INPUT AND INTERACTION IN DEAF FAMILIES

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1 THE ROLE OF LANGUAGE INPUT IN ACQUISITION THEORIES

1.1 Introduction

Input cannot be considered separately from the interactive situation in which it is provided. In the literature on language acquisition language input and the interaction between adult and child have been assigned roles of varying importance. Input is considered inconsequential in some language acquisition theories, in others it plays a crucial role. In all theories of child development interaction is considered important for the cognitive, emotional and social development of the child. In language acquisition its role is judged as minimal in some theories and all-important in others, besides being very much culturally defined (e.g. Ochs 1983; Schieffelin 1985).

That children need to be at least exposed to a language in some sort of interaction in order to be able to acquire language is, however, beyond dispute (see for an overview Skuze 1988; Mayberry and Eichen 1991). A well-known example of the consequences of the deprivation of language in a child is the description of Genie by Curtiss (1977). Another case was presented by Emmorey, Grant and Ewan (1994) who describe the linguistic isolation of a 16-year old Guatemalan deaf girl, Anna, and the first steps towards the acquisition of American Sign Language (ASL) after her arrival in the United States. Not much is known, however, about *how much* language children must be exposed to, to be able to acquire a language. Is there a minimum amount of language a child needs to encounter, in other words does a minimum-exposure threshold exist? Hearing children of signing deaf parents often receive little input in a spoken language, being exposed primarily to a sign language. They provide evidence on this issue. From a study by Sachs and Johnson (1976) we know for example, that a hearing child of deaf parents who received only spoken English from television did not acquire that spoken language. Apparently just having access to a language is not sufficient for acquiring it. This is supported by findings of Schiff (1979), who concluded that hearing children of deaf parents can develop a spoken language normally, provided they are in contact with hearing speakers for a minimum of 5-10 hours a week, and watch some television (Schiff-Myers 1988:54). Recent research in spoken languages also indicates that the amount of language in the input *is* indeed relevant for the acquisition of language (Hart and Risley 1995). For bilingual or trilingual input this is also true (De Houwer 1999).

There are also circumstances where a child does have daily and full access to input but where the input language itself is 'poorly structured'. Even if the quantity of input apparently is sufficient, the quality of the input may be inadequate. The same

question arises – what quality must the input have for the child to be able to acquire that language? Is there a minimal quality threshold?
Within the group of children receiving 'poorly structured input', hearing children of deaf parents form again a special group. The parents usually produce speech which has been described as having "[...] limited syntax, abnormal phonology and atypical intonation patterns" (Mogford and Bishop 1988:242). The robust character of the language acquisition process is shown by the fact that most hearing children of deaf parents do not show these same restrictions in their language production. They do not simply 'imitate' the spoken language of their deaf parents, they add to it. Granted, they usually have access to normally spoken language through other sources like hearing relatives, neighbors, peers, etc., but the first language contact will be with their parents. It is therefore important to describe qualitative aspects of language input, in order to be able to examine its influences on structural aspects in the output of the children.
Besides being offered spoken language many hearing children of deaf parents also receive sign language input. They are thus often raised in a bilingual situation. This is also true for deaf children of deaf parents. Even if their home language is a sign language, all deaf children necessarily have to become bilingual. They will have to acquire the spoken language of their environment within the limits of their (hearing) abilities in its spoken form, or at least in its written form.

By comparing the language acquisition process under various conditions it should be possible to identify those factors that are necessary for normal language development, and identify those that are not. Mogford and Bishop (1988) stated this as follows.

> These variations in the conditions in which language is acquired can be regarded as natural experiments that would not be feasible or ethical under normal experimental conditions, but which allow us to dissociate factors that are usually associated in normal development. (Mogford and Bishop 1988:24)

It is the aim of this thesis to study the bilingual language input of deaf mothers to their deaf and hearing children and to describe the role that the quantity and the quality of their language input plays in the language acquisition process of their children.

1.2 Input and interaction in theories of language acquisition

As mentioned above, in the last decades there has been a controversy in the field of language acquisition between those theories that attribute a small (or no) role to language input or interaction (nature), and those attributing it a more important role (nurture).

The earliest studies on child language in our times are the so-called diary studies (e.g. Stern and Stern 1907). Parents described the language development of their children. In general the idea (often implicit) was that the child was the learner. Little attention was paid to the environment as an influence. Later Chomsky (1965) expressed this in a much stronger form. He believed that the input children receive was degenerate and an insufficient basis for language learning. In this theory language acquisition is explained on the basis of assuming that children have innate language learning capacities that enable them to acquire language *despite* the impoverished input. Working in this same framework Pinker in his 1994 publication proposed that language is an instinct, that has evolved out of adaptation throughout the evolution of man. The innate linguistic capacities contain universal grammatical principles that are subsequently set according to the language-specific characteristics in the input. Another advocate of this theory is Bickerton (1981) who proposed that children with incomplete and 'simple' input (a Pidgin) themselves create a fully-fledged language (a Creole) based on their innate language capacities.
Other nativist researchers like Borer and Wexler (1987) and Pinker (1994) believe that at a genetically predetermined time the principles of language become available to the child.
The quantity and quality of the language input has little weight in all of the above theories, since children construe regularities themselves from their innate capacities. They must however have some input on which the innate capacities can work.

Since the 1920's there has existed a school of thought in psychology called behaviorism. These psychologists believe that the environment was all-important in the (language) learning process of the child. They attributed very little internal structure to the child except general abilities (Ingram 1989). According to this theory (e.g. Skinner 1957) the child learns all behavior through stimulus, response, associations and reinforcement and in the same way the meaning of words and the grammar of the language is learned. Quantity and quality of input are not unimportant, but the main focus lies on the behavior of the parent (environment). In the more recent connectionist theories (e.g. McClelland and Rumelhart 1986) which are frequently linked to behaviorism, input to the neural network is certainly crucial.[1]

From the field of child psychology there have been those (for example Piaget 1955; 1971; Slobin 1977; Bates, Bretherton and Snyder 1988) who view language as one of the many cognitive capacities or skills the child has to acquire, like memory or attention. The linguistic system is build up by the child in interaction with his/her caretakers and this language development goes hand in hand with the development of general forms of knowledge. Linguistic input and communicative interaction both play an important role in these views. The child and the adult can both

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1 See Adema (1999) for a full description of the comparison between behaviorism and connectionism.

contribute to the process of language acquisition. Vygotski as a social interactionist also acknowledged the important role of language and communication in the general development of the child (see Zaitseva, Pursglove and Gregory 1999 for a recent overview of his theory). Often it is not clear what part innate capacities might play in learning but they are not ruled out.

Other researchers are explicit that innate capacities as well as input and interaction play a role in the acquisition process. Wells (1985) was of the following opinion.

> If we now return to the question of the relative contribution of child and adult to the process of language learning, it is clear that the answer must be stated in terms of an interaction. Interaction, first, between the child's predisposition to learn to communicate and the model of language provided by those who communicate with him. Interaction, also, in the form of the specific conversations that provide the evidence from which the child learns and feedback on how his own communications are interpreted by others. (Wells 1985:415)

Cross-linguistic studies (e.g., Slobin 1985 and later) have indicated that no one form of input or interaction is responsible for language acquisition. In different linguistic communities language is offered to children in significantly different ways, and yet the children acquire their mother tongue more or less at the same age along the same route.

In this study we take the combined point of view, that is that the child acquires a language through interaction with caretakers, that the linguistic input serves the child as a model on which to build up assumptions about the grammatical structure of that language, and that innate capacities are involved. In an account of language acquisition it is of great importance to describe the (quality of) the grammatical structure of the language model that the child has access to. This is the aim of this thesis for one particular language situation.

1.3 Quantity and quality of input

1.3.1 Quantity of language input

Not much is known about the actual quantity of language input during the different phases of language development. Although many studies have concentrated on the amount of language produced by children, not much research has been done on the amount of input and its role in language acquisition (but see Hart and Risley 1995; 1999).

In Table 1.1 we present an overview of data on the quantity of language, expressed in number of utterances, offered to children in several studies in different

languages. The number of utterances is corrected in each case for 10 minutes of interaction.

Table 1.1 Overview of number of utterances in10 minutes of input in Dutch, German, English, American Sign Language (ASL), British Sign Language (BSL) and English and signing combined

Language and Source	Age of children	(Range of) no. of utterances corrected for 10 minutes
DUTCH		
van der Stelt (1993)		
6 mothers	1;0	68 - 198
6 mothers	1;6	158 - 194
4 mothers	2;0	170 - 200
Wijnands (forthcoming)		
2 mothers	1;11 - 2;1	188 - 300
2 mothers	2;5 - 2;8	196 - 306
2 mothers	2;11 - 3;1	144 - 227
Jansonius-Schultheiss (1999)	2;0	117 - 290
9 mothers		
GERMAN		
Wagner (1985)	1;5	41 - 131
ENGLISH		
Kaye (1980)	infants	
36 mothers	(≤26 wks)	210 (mean)
	2;0	145 (mean)
Snow (1977)	1;0	84 - 200
Hampson and Nelson (1993)	1;1	89 - 305
45 mothers	1;1 - 2;0	182 (mean)
Bernstein-Ratner (pc)	1;6 - 2;2	47
Moerk (1983)		
Wells (1985)	2;0 and 3;0	±44 (mean)
125 parents		
Hart and Risley (1999)	1;0	52 (mean)
42 mothers	2;0	67 (mean)
	3;0	54 (mean)
ASL		
Kantor [a] (1982)		
Mother of Mich	1;0 -1;8	±12 - ±28
Mother of Erin	1;8 - 2;6	±16 - ±71
(only selected utterances!)		
BSL		
Harris et al. (1988)	1;4	20 - 51
	1;8	45 - 74
Harris (1992)		
three mothers	0;10	21 - 60
four mothers	1;4	7 - 50
four mothers	1;8	22 - 73
English + signing		
Woll et al. (1988)		
three mothers	0;9	±141 - 190

[a] *These sessions were between 45 and 60 minutes; correction is approximate.*

From Table 1.1 it is clear that huge individual differences may occur in the number of utterances that children receive at different ages, in different languages. In general we see an increase in amount of input as the children grow older, up to age 2;6-3;0 (Wijnands in Table 1.1). Wijnands' study of Dutch suggests that at age three there is a slight decrease. The smaller amount of language around age three agrees with findings of Hart and Risley (1999) who observed that after age 2;4 the American parents in their longitudinal study show a strong decrease in the number of utterances addressed to their children (1999:121). They explain this fact that by this age the parents consider the children to be turning into fluent enough talkers. They are also ready to acknowledge the growing maturity of the children with regard to communication and interaction (1999:124). The children are broadening their horizon, and begin playing outside with other children etc. They could now be treated the same as the 'other' children in the family and not as the baby who needed special (linguistic) attention. The amount of language directly addressed to the child decreased between the ages of 2;4 and 3;0. Barton and Tomasello (1994) found that in dyadic interaction children usually contribute half of the conversation, but it was not specified at what age this could be expected. If the children's participation increases over time, it is to be expected that the mother's contribution decreases.

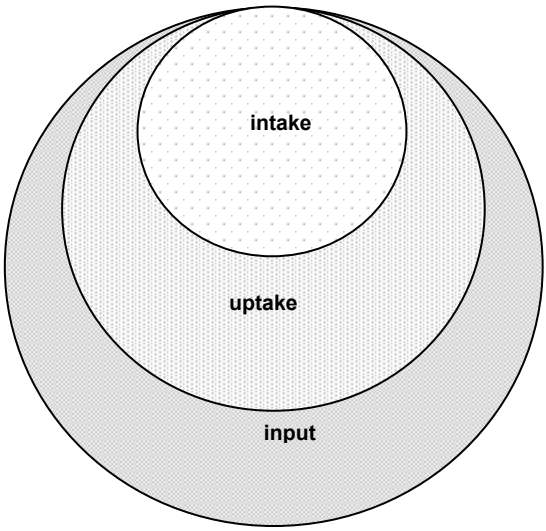
In the signed languages ASL and BSL the range of the number of utterances in 10 minutes seems a little less than in the spoken languages. This could have implications since the amount of language offered is considered to be facilitative to the acquisition of language in general (Hart and Risley 1999). Snow (1994) considers quantity relevant for vocabulary. She makes the following observation.

> One of the more sophisticated analyses of input effects on language acquisition so far reported, that by Huttenlocher, Haight, Bryk, Sletzer and Lyons (1991), utilizing Hierarchical Linear Modeling, found that *amount* of maternal talk during the observation was the best predictor of children's growth in vocabulary (Snow 1994:9).

If this is the case, then the smaller amount of signed language during the early years might have its influence on the rate of language acquisition or at least vocabulary learning.

Thus far we have talked about input with little discussion of the term. The quantity of input can be viewed from the perspective of the adult but also from the perspective of the child. The accessibility of the input is important. If input is being offered but not perceived by the child, no input can actually take place. This will not occur very often in the case of spoken input, although television background noise has been reported as distracting from input (Ward and Birkett 1994; Cooper and Clibbens 1999). However, in the case of sign input accessibility is a clear issue. In sign language interaction it is imperative that the partners in conversation can see each other (Siple 1978). If the mother is signing but the child is not looking, no

actual input can occur. This aspect has already been discussed by, amongst others, Harris, Clibbens, Tibbitts and Chasin (for BSL 1987), Kyle, Ackerman and Woll (for BSL 1987), Woll, Kyle and Ackerman (BSL 1988) and Swisher (for ASL 1991). They make a link between the amount of input offered and accessibility and claim that during the early stages of language acquisition deaf mothers offer their children less language than hearing mothers do to their hearing children, because they assume that the children are still learning to pay visual attention to the mothers. Establishing the amount of sign or spoken input offered is not enough. We must also establish how much of the input is actually accessible to the child. Harris (1992) uses the term 'uptake' for this accessible input and defines this as "that part of the input that is actually attended to by the child" (1992:44). Uptake is clearly less than input. Uptake itself however has to be processed by the child. Since child production is less than the adult model, researchers have introduced a level of 'intake'. This intake is defined as "the features attended to and processed by the child (Richards and Gallaway 1994:262). Figure 1.I depicts the relation between input, uptake and intake.



Input*: language offered to the child*
Uptake*: part of the input that is attended to by the child (Harris 1992)*
Intake*: features attended to and processed by the child*
(Richards and Gallaway 1994)

Figure 1.I Relation between input, uptake and intake

We have already mentioned that children of deaf parents are often raised bilingually. It is important to realize that children who are offered more than one language during the initial years of language acquisition necessarily receive less

input *per language* than monolingual children do. De Houwer (1999) found that input in a language X does not automatically imply the use of that language X in the production of the children (1999:2). Whether or not a language is used by a child is related, amongst other things, to the proportion of the different languages that are offered and to the number of family members that use the languages with the children or amongst themselves. What we need to establish then is the amount of input of each language the child has access to over time, and compare that amount to the amounts of that same language offered to monolingual children. These data would give us more insight whether or not a 'minimum exposure threshold' exists (see section 1.1) in the context of bilingual language acquisition, and help establish where the threshold lies.

In our study we will look at the input (quantity and quality), uptake (accessibility) and intake (through the output of the children) in the bilingual language situation of deaf and hearing children of deaf parents.

1.3.2 Quality of language input

The quantity of input/uptake is important but, as mentioned above, the quality is probably also relevant. The structures that are offered, the vocabulary and language functions may all have an influence on what the children can learn.

Classic studies like Snow and Ferguson (1977) have made it clear that the language addressed to children (motherese or Child Directed Speech, CDS) is different from language addressed to adults, such as exaggerated intonation, specific vocabulary items and even specific grammatical structures. CDS is claimed to be facilitative for language acquisition, and even necessary in some frameworks. However, the relationship between CDS and the child's acquisition is not as straightforward as some studies would like us to believe (Pine 1994:15). Pine summarizes why CDS is used and concludes, with others, that mothers are primarily trying to engage their child in conversation, not to teach the child the language (Snow 1986). In this section some of the research done on input will be discussed in relationship to the main areas of language (see Gallaway and Richards 1994 for a review). Richards (1994) warns that the effects and non-effects of CDS are to be interpreted with care, because the methodology and interpretation of results in many studies often pose problems. No aspect in CDS has been actually proven to be necessary for the acquisition of language. He argues that much more research is needed in order to inventorize the different circumstances of language acquisition, and the exact role of language input.

Vocalizations are the earliest phonological productions of children – initially they make sounds that can occur in all languages, but as they grow older their vocalizations consist only of those sounds found in their input. Later vocalizations become babbles, rhythmic alternations of vowels and consonants, which carry no linguistic meaning yet. Interactive play with vocalizations has been studied

amongst others by van der Stelt (1993) working within a Vygotskyan framework. The alternate production by mother and child of vocalizations, where mutual imitation plays a role, is considered by van der Stelt as early turn-taking behavior, and as such plays an important role in early interaction. Do the equivalents of vocalizations in sign language, called movements by Caselli and Volterra (1990), play a similar role in sign language acquisition?

The next stage in the child's linguistic production are the first words. To quote Eve Clark: "Words make a language. […] Words come first in language acquisition." (1993:1). It is therefore of importance to describe the lexicon that mothers offer their children at the different stages of language acquisition, and also to describe the development of the vocabulary of the children. The first meaningful or representational words are generally produced around the child's first birthday. Usually combinations begin to occur once the child has acquired about 50 words (Ingram 1989). We also know that there may be a period when the vocabulary increases at a fast rate (vocabulary spurt, amongst others Clark 1993). How the vocabulary develops and at what rate in relation to input is an important issue.
For instance, research has shown that children seem to acquire more nouns than verbs in their early vocabularies (Gentner (1982); Goldfield (1993) and Shatz (1994) for English, and Caselli, Bates, Casadio, Fenson, Fenson, Sanderl and Weir (1995) for Italian). One explanation for a preponderance of nouns in children's output could be that the input they receive contains more nouns than verbs. This was indeed found by Gillis and Verlinden (1988), who studied both the Dutch input to and the language production of a Dutch boy between the ages of 0;11 and 2;0. They conclude that Dutch children learn more nouns than verbs because 1) they hear nouns more frequently, 2) nouns occur more frequently in salient positions in adult sentences and 3) pragmatic aspects of child-directed speech predict a noun-predominance in the child's vocabulary (1988:65). The frequencies for Dutch are higher than for English and Italian (see Table 1.2). However, not all languages have such a clear 'noun bias'. Tardif, Shatz and Naigles (1996:7; 1997) compared the input from English, Italian and Mandarin speaking parents and found that there were more verbs than nouns in Mandarin input even more so than in the English and Italian input (see Table 1.2).

Table 1.2 Noun ratios found by Gillis & Verlinden (1988) [2] *and Tardif et al. (1996) in the input and the output of Dutch, English, Italian and Mandarin speaking parents and their children at approximately age 2;0*

2 Gillis and Verlinden (1998) give the raw data for the parent on page 30, Table 4 (noun tokens: 422, verb tokens: 221), and for the child on page 24, Table 2 (noun tokens: 273, verb tokens: 67).

	Dutch	English	Italian	Mandarin
Input of parents N/(N+V) tokens	.66	.32	.32	.20
Output of children N/(N+V) tokens	.80	.63	.53	.39

(Children acquiring Mandarin as their first language also had more verbs than nouns in their early vocabulary). Their conclusion was that differences in noun-emphasis in the input explain differences in noun biases of the children (1996:11). The lexical richness in the input to children of course influences their acquisition of the vocabulary of their language(s) (see also Hart and Risley (1995).

Many researchers assume that different syntactic structures in input must be clearly identifiable in terms of form in order for children to be able to acquire them and to identify their function. Others assume the opposite, that is function leads to the acquisition of form (Bates et al. 1988), so the functions must be clear in the input.
It is not always easy to identify functions reliably; the context plays an important role here (e.g., Ninio, Snow, Pan and Rollins 1994). For instance, questions may be put in the form of a declarative, or vice versa. Pragmatic aspects always play a role in the interpretation of the meaning of an utterance, independent of its form. The child has to learn to distinguish these different functions and the form they may take, and to interpret deviations from the standard form according to accepted pragmatic rules.
Pine (1994) points out that declaratives are less common in CDS than in adult conversations, and that they increase in frequency as the child grows older. The high proportion of questions in the spoken input is interpreted by some researchers as a way of passing the conversational turn to the child. As the child becomes a more able partner in conversation, questions become less manifest in the input. If the presence of many interrogatives in the input serves different functions in the input, these functions must be described. Also it must be established whether or not the role of interrogatives is the same or different in varying input situations, both for grammatical and for pragmatic reasons. A description of the functional framework of the input can give us insights in how function and form mapping takes place during the early stages of language acquisition.
During the early period of language development the Mean Length of Utterances (MLU) of the mothers' speech appears to slowly increase. It always seems to be slightly larger (2 morphemes ahead) than the child's MLU, and is said to more or less 'pull' the child along (Cross and Morris 1980). The relation between the mother's and the child's MLU's at different points in time thus needs to be explored.
The acquisition of the verbal system of a language is generally seen as the basic framework on which word order acquisition and morpho-syntactic development are based. Studies like Newport, Gleitman and Gleitman (1977), Furrow, Nelson and Benedict (1979) and Gleitman, Newport and Gleitman (1984) provide contradictory

evidence for the facilitative effect of input on the language acquisition of children. The high percentage of *yes-no* questions in English input, for example, was claimed (and disclaimed) to be facilitative for the acquisition of auxiliary verbs by the children. Form (auxiliary verb fronted) and function (*yes-no* question) mapping is an important aspect in the acquisition of syntax in English, or other input languages, for that matter. Children have to learn whether or not their language is a pro-drop language, and which arguments need to be realized in which position of the sentence. Can subjects or objects be left out, and if so, under what conditions? For instance, studies of Dutch and German input have shown the use of fewer finite verbs with young children, and a different word order (SOV). In this period the children themselves produce this order and many infinitival forms (Mills 1985; Gillis and De Houwer 1998:72). Krämer (1995) and Schlichting (1996) have described the occurrence of topic drop in Dutch by adults and in the language production of hearing children. The causal relationship between the input and output is nevertheless not clearly established.
As Richards (1994) stated, there is as yet little hard evidence for the relationship between qualitative aspects of input and the output.

1.4 Input in the bilingual situation

The various issues touched upon above (quantity and quality of input; exposure and access to language input, and functional and formal aspects) can also be considered in a situation where two (or more) languages are offered to a child. We do not mean here the situation where a child has already acquired a first language and subsequently learns a second one in school at a later point in life (*second language acquisition*). We are talking about *bilingual development*, of which Genesee (1988) gives the following definition.

> The simultaneous acquisition of more than one language during the period of primary language development. (Genesee 1988:62)

Some researchers define this period as the first *three* years of life and others during the first *five* years. Bilingual development can occur under different circumstances, for instance when two languages are used within the home by the two parents (one person - one language) or when one language is used at home and another outside the home. Bilingualism usually entails biculturalism, which means that a person or a child has the ability "[...] to act here and now according to the requirements and rules of the cultures" (Oksaar 1983:20).
Bilingualism is more often the norm than people realize (Appel and Muysken 1987); many children are raised in a bilingual or multilingual environment. How does this affect the language acquisition process? Genesee (1988) adequately summarizes the question.

> [...] are there interactions between the two language systems that result in the pattern of language acquisition being different in comparison with monolingual development? (Genesee 1988:63)

1.4.1 Quantity and quality of bilingual input

In many studies the simultaneous acquisition of two spoken languages in early childhood has been described. Hoffman (1991:50ff) presents a comprehensive overview of such studies. From the literature it becomes clear that children raised bilingually from birth in general do not lag behind monolingual children. The simultaneous acquisition of two languages does not affect the eventual proficiency in either language, all this provided, of course, that the children have frequent contact with both languages. Data provided by for example Zurer Pearson, Fernández and Oller (1995) for Spanish and English bilingual input show proportions of 60-40% or 40-60% for the two languages, depending on the specific language situation of the child. The children acquired both languages with this division. If the child is exposed to one language almost to the exclusion of the second, then there is a good chance that this second language will not be fully acquired or perhaps be lost (De Houwer 1999). We briefly mention 'semilingualism' here. Skutnabb-Kangas (1984) used this term to indicate the language proficiency of children who had a low proficiency in their home language Finnish and lagged behind their monolingual peers in acquiring the school language Swedish; ultimately the children did not attain full competence in either language. However, Hoffman (1991:127-128) and Romaine (1989) criticize this concept and they warn against a linguistic interpretation of imperfect language production where cognitive and social factors may play an important role.
It is always of importance in bilingual situations to look at the actual amount of input that the children receive. In the case of deaf and hearing children of deaf parents, where a spoken and a signed language can be offered in the input, it is also important to establish what *access* the children have to the two languages. As described in section 1.3.1 the difference between language input by the parents and the intake by the children is of course influenced by the actual amount of input that can be processed (or accessed) by the children (uptake).

The quality of the various languages in the input may also vary. There are many descriptions in the literature of parents using a language with their children that is not their first language (Bickerton 1981; Grosjean 1982). In those cases the language offered may not be native-like. Does this influence the acquisition of that language by the children? As yet there is no clear answer to this question. It is clearly important to look at the bilingual input that is being offered. The quantitative, lexical, functional, and structural aspects of each of the languages that comprise the linguistic input to the children should be described and related to their output.

1.4.2 Language input and separation of languages

As we have seen there is very little work on the quality and quantity of the input in the bilingual situation. An additional issue in bilingual development is how children manage to acquire the two separate linguistic systems; or put differently, on the basis of what information do children decide that a word or a syntactic rule belongs to this one particular language or to the other? De Houwer (1987) suggested the following.

> Obviously, the more distinct the two languages are that the pre-bilingual child is exposed to, the more chance there is for investigating early separate development. (De Houwer 1987:109)

It is well documented that when children raised bilingually start to speak they often use words from one language mixed together with words from the other. However, usually as more complex utterances occur, they seem to be able to keep the languages apart. This led many researchers to the hypothesis that in the initial stage of language acquisition children have one lexicon for the two languages (Leopold 1939-1949; Grosjean 1982; Saunders 1982). Volterra and Taeschner (1978) proposed three stages in the bilingual acquisition process. Stage one, where bilingual children have one lexical system, consisting of lexical items from both systems. Stage 2, where the child has two lexicons but one structural system; and stage 3, when the two systems are separated on all levels. Taeschner confirmed these stages empirically in her 1983 study of two children. She used lexical equivalence as indicator of one system in the child. By this is meant that if a child has a label for a concept in language A, initially there would be no label for that same concept in language B. This conformed to what Slobin (1973) called the principle of unifunctionality, that is a (monolingual) child accepts only one form for one function during the one-word stage. However, Hoffmann (1991) criticized Taeschner's work methodologically.

> […] more comprehensive lists taken from the first stage (lexical mixing) are needed to ascertain whether the absence of equivalents is observable in all children or whether it is largely determined by the linguistic input. (Hoffmann 1991: 64)

This means that if the input contains mixed utterances we cannot attribute the mixed output of the children to their having initially one lexicon. But if the child only receives certain lexical items in one language, then no lexical equivalents can be learned. The input determines the output in this aspect, and therefore needs to be studied thoroughly and compared to the output.
Bergman (1976) believes that in a situation of a one person-one language environment the child will not mix its languages, thus establishing that the single-language system does not exist. But if parents do mix words from two languages in the input, so will the child in his/her language production. She proposed an Independent Development Hypothesis:

> In case of simultaneous language acquisition, each language will develop independently of the other, reflecting the acquisition of that language by monolingual children, unless it is the case that the lines between the two languages are not clearly drawn in the linguistic environment of the child. In such a case, which may be caused by code-switching patterns in the bilingual community or by deviations [sic] in the adult language of the child's environment from the norm in the monolingual community, the child will sort out the two systems according to the input that he receives. (Bergman 1976:94 in De Houwer 1987:82)

Goodz (1989) and Quay (1995) found supporting evidence for this hypothesis in their data.

In this study the use of sign language and spoken language in the input of deaf mothers is described. Besides aspects of bilingual input, we have the added difference in modality. Sign languages are perceived and produced in the visual-gestural modality, while spoken languages use the auditive-oral modality. Unlike two spoken languages, there is the possibility of producing signs and words at the same time. This sometimes leads to a special form of cross-modal language contact (Vonen 1999) which needs to be studied in its own right (Lucas and Valli 1992; Romaine 1989). Romaine (1995) claims that mixed input can produce a 'third system'.

> In situations of intense language contact it is possible for a third language system to emerge which shows properties not found in either of the input languages. Thus, through the merger or convergence of two systems, a new one can be created. (Romaine 1995:4)

If indeed the mixing of signs and words in the input leads to a third system as described by Romaine (1995), this form of input will of course influence the acquisition of the languages by the children in an important way.

1.5 Summary

In this chapter we have outlined the role of input and interaction in the language acquisition process in various theories of language acquisition. In every framework input has some role and so it is important to describe in any study. It is assumed that is has a clear role along with innate principles. We have established that a child must have access to a language to be able to acquire that language. The quantity and quality of this input may also play a role, although there is as yet no firm

quantitative evidence on lower limits or necessary features. An important distinction was made between input, uptake and intake. In the case of bilingual development, where a child is in contact with more than one language before the age of five, input can be of additional importance, amongst other things contributing to the separation of the two (or more) languages. Where mixed input is provided, a third system may develop.

In describing the language input of deaf mothers and the language development of their children in this study we hope to present a clear picture how two factors influence the acquisition process. These factors are a hearing impairment in one or both of the partners in conversation, and bilingual language input and output in two modalities. In this study we will describe the language input offered by four deaf mothers to three deaf and three hearing children, as well as the language production of the children at the ages of 1;0, 1;6, 2;0, 2;6 and 3;0. We shall give a description of the quantitative and qualitative input and output, as well as a functional and structural description. With this research we hope to contribute to greater insight into the role of input in the complex process of language acquisition in deaf and hearing children in deaf families.

In Chapter 2 we give background information on the interaction in deaf families in the Netherlands, and the literature on language input, both spoken and signed, to deaf and hearing children in deaf families, and on the language acquisition of these children.
The research questions are formulated in Chapter 3, and Chapter 4 describes the design of the study. Questions of quantity of language are discussed in Chapter 5, where we will describe the amount of language input and output produced by the deaf mothers and the children, and their language choices. Chapter 6 deals with the accessibility of the input of the deaf mothers and the output of the children. Qualitative aspects are dealt with in the following chapters. Lexical issues in input and output are described in Chapter 7, including lexical equivalents. Chapter 8 concentrates on functional and formal aspects in input and output and in Chapter 9 we will describe the grammatical structure of the input and output in the different languages used. A summary and conclusions will be presented in Chapter 10.

2 LANGUAGE IN DEAF FAMILIES

2.1 What is a deaf family?

In describing the languages used in a deaf family, we should first establish what we understand a deaf family to be. Lane (1984), Padden and Humphries (1988), Kyle (1990) and Lucas and Valli (1992) amongst others have studied the deaf communities in the USA and England. These authors suggested that not the degree of audiological deafness decides whether or not a person considers him/herself to be deaf, but the degree of identification with the deaf community. A distinction was found between audiological deafness and cultural deafness and they used the terms 'deaf' (audiological) and 'Deaf' (cultural) to describe the two concepts. One of the deciding characteristics of a deaf person appears to be his/her use of and competence in a sign language. In turn this is influenced by factors such as onset of deafness (pre- or post-lingual deafness), degree of deafness (e.g. ≥90 decibel (dB) hearing loss), having a relationship with another deaf person, identification with and participation in the deaf community, etc. Baker-Shenk (1983) describes the deaf community as an ethnic community.

> membership in the ethnic, deaf community is primarily a function of attitude rather than audiology; that is, members are persons who identify themselves with the ethnic group [...] and are accepted as members by other members. This had been called 'attitudinal deafness' (Padden and Markowicz 1976). The actual degree of hearing loss ('audiometric deafness') is relatively unimportant. Thus, some audiologically deaf persons are not members of the ethnic group, and many audiologically hard-of-hearing persons are members. (Baker-Shenk 1983:35)

In the Netherlands the estimated number of persons with a severe hearing impairment is ± 290.000 (see Méér dan een gebaar 1997).[1] The number of prelingually deaf persons at any one point is estimated to be between 4.000 (Breed and Swaans-Joha 1986) and 14.000 (Schermer 1990), depending on how narrow or broad a definition of prelingual is used. We will follow Schermer who used 'deaf from birth or before three years of age'. A part of the prelingually deaf population can be considered to belong to the deaf community, i.e. they use Sign Language of

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1 'Méér dan een gebaar' is the final report of the Commission Sign Language of the Netherlands, which was instituted in 1996 by the State Secretary of Education and the State Secretary of Welfare to investigate the best way to recognize Sign Language of the Netherlands as an official language in the Netherlands. This is expected to be realized in 2002.

the Netherlands (SLN)[2], they have a deaf partner and consider themselves to be active members of the deaf community. From 1980 onward the deaf community has been slowly organizing itself into a (heterogeneous) cultural minority. Only a few socio-linguistic studies of this process have been done and so unfortunately not much information is available on the Dutch situation (but see Breed and Swaans-Joha 1986; Méér dan een gebaar 1997; Rodenburg 1986; Tervoort 1983; Voorhoeve 1989). For this reason it is not possible to make a clear distinction between deaf versus Deaf in the Dutch situation, and we will use the term deaf without it having further social or cultural implications.
The number of deaf children that have two deaf parents is estimated to be between 3 and 5% of all deaf children, and 10% have one deaf parent (Quigly and Paul 1984; Schermer 1990). Mallory, Zingle and Schein (1993) explain this low percentage.

> […] deaf parented families are not likely to be uniformly deaf, given the 90% rule; deaf children are born to hearing parents approximately 90% of the time; deaf adults marry deaf spouses 90% of the time; deaf couples tend to bear hearing children approximately 90% of the time. (Schein 1989, Schein and Delk 1974). (Mallory et al. 1993:73)

There are few families where both parents and children are deaf but they form the core of any deaf community. Despite their small number they pass on their language together with the cultural and social values to their own and the next generation in a natural environment.
As stated above, we know that approximately 90% of all deaf children have hearing parents. Hearing parents normally have no competence in sign language and generally know very little of deafness and all it entails for a young child, at the time when deafness is confirmed in their child. The socialization and enculturation processes into the deaf community of most deaf children of hearing parents starts therefore not at birth, but at a later age, usually between two or three, when the child begins to attend a school for the deaf. Here, often for the first time, the children come into contact with deaf children of deaf parents, other deaf children with hearing parents and deaf adults.
Most deaf parents have hearing children (Mallory et al. 1993). Padden (1980) discussed whether or not hearing children of deaf parents belong to the deaf community. If the family uses a sign language and the parents identify with the deaf community and are also identified as such by others, the hearing children may achieve native competence in their sign language, and will be able to distinguish 'hearing culture behavior' from 'deaf culture behavior' (Schermer 1990:9). Usually these hearing children are called CODA's (Children Of Deaf Adults).
According to Mallory et al. (1993) 10% of the deaf marry a hearing person. If this hearing person is a CODA, the family language most probably will be a sign

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2 See Crasborn, Coerts, van der Kooij, Baker and van der Hulst (1999) for an overview of research in SLN.

language. Mixed deaf and hearing parentage of this nature would still mean that the children in such a family are raised in a deaf environment. However, if the hearing person is not a CODA, there is more chance that the family language will *not* be a sign language.
Based on the above we can now decide that a deaf family is a family where the deaf parents (or one deaf and one CODA parent) use sign language with their deaf and/or hearing children and where the children are in contact with 'deaf culture behavior'. On the basis of this definition we will exclude families with hearing parents and deaf children from our discussion of deaf families. Below we shall briefly describe the different combinations of hearing status in persons that are possible in a deaf family together with the various linguistic possibilities. There are two main combinations:

a) The parent(s) are deaf and the child is deaf (DPDC).
b) The parent(s) are deaf and the child is hearing (DPHC)

In families with one or two deaf parents the children are predominantly hearing. Only 5-10% of the children of deaf parents is also deaf. As we mentioned before, it is families such as these that may play an important role in the deaf community. The study of the interaction and the communication between deaf parents and their deaf children can teach us about linguistic, social and cultural values that prevail in the deaf community. More insight in the development of these second or third generation deaf children may help us to improve counseling guidelines for the majority of deaf children who have hearing parents.

In the next sections we will discuss the situations where the parents are deaf with either deaf or hearing children. This will be done separately since the language input can or will be different in each case.

2.2 Language input in deaf families

2.2.1 The problem of multilingual input

Deaf parents use different languages in different contexts. In the study by Mallory et al. (1993) on intergenerational communication modes in deaf-parented families, the interaction pattern between hearing grandparents, deaf parents and their hearing children (mean age 12;6) is described. Of 14 deaf parents 11 report using ASL with each other, but only 4 (29%) say that they use ASL with their hearing children. The other deaf parents do use some form of signing (Signed English (SE) mixed with ASL). The children themselves were described as using a 'generic' form of sign, which appeared to follow English word order and included much fingerspelling, lacked SE detail, and included little ASL redundancy." (1993:78). These children did not distinguish between ASL and SE. Only 4 out of 15 children used distinct linguistic modes, meaning that they used SE with fingerspelling or ASL and English. Mallory et al. (1993) concluded that "parents and children typically modified their usual language mode to effect dyadic communication." (1993:80).

For the Netherlands, Breed and Swaans-Joha (1986:117) described how many Dutch deaf adults use spoken language with hearing friends or relatives (73%), sign language with deaf friends or extended family (65%) and 41% use sign language at home, which included deaf or hearing partners and deaf or hearing children. 14% of the children of these deaf adults were deaf or hard of hearing (o.c.:114), but unfortunately it was not made explicit which language was used with the hearing or with the deaf children. The percentage of 41% sign language at home is higher than that found by Mallory et al. (1993) in the United States.
Most deaf persons are assumed to be bilinguals (Grosjean 1992). Dufour (1997) considers there to be three types of bilingualism associated with sign language:

a) sign-sign bilinguals: individuals who know a sign language as a first language and learn another sign language as a second language
b) speech-sign bilinguals: individuals who primarily use a spoken language and who learn a sign language sometime in their lifetime
c) sign-text bilinguals: deaf individuals who acquire a sign language as a first language and, because of their deafness, can only learn the written form of the spoken language of the community they live in.

The main distinction between the last two types of bilinguals lies in their access to the full aspects of the spoken language. According to Dufour speech-sign bilinguals have no constraints in acquiring language in either modality, whereas sign-text bilinguals have a limited access to the oral aspects of spoken languages (1997:306). However in his category of speech-sign bilinguals he disregards those deaf people who are raised orally, that is with a spoken language. This spoken language is then their first language, but because of their hearing impairment the ultimate level of that language may not be comparable to that of hearing native speakers. Category c), the sign-text bilinguals does not include those deaf people who do manage to acquire the spoken language to (near-) native level. Clearly the competence in the spoken and sign language of the parent is important in considering input as discussed earlier in section 1.4.1.

The two different modalities of sign and speech offer the possibility to sign and speak at the same time. Bernstein, Maxwell and Matthews (1985) and Maxwell, Bernstein and Mears (1990) found that such simultaneous sign and speech production usually follows the grammar of the spoken language, whereas the signing is incomplete and often abbreviated. Speech-sign bilinguals would often use this variety. However, sign-text bilinguals, whose first language is a sign language, are also reported to use a simultaneous mode where the sign grammar is used, and spoken words (usually produced without voice) are inserted in the utterances (Lucas and Valli 1992). The role of mouthed words is important in deciding the status of the languages in the input. They can be structurally part of the sign language, in which case the input will be monolingual although signed and spoken. They can be the result of interference or be used as loan words in which case the input is mixed and consists of two languages (see Boyes-Braem forthcoming; Ebbinghaus and Hessmann 1990; 1996; Schermer 1990). It could also be the case that the

combination of simultaneously produced signs and words together form a third system as defined by Romaine (1995) (see section 1.4.1). It is also possible that different versions of this simultaneous mode exist, comparable to newly developing mixed languages (see for instance Bakker 1992 on spoken languages). To what extent the subjects in the studies of Mallory et al. (1993) or Breed and Swaans-Joha (1986) were using the different structures of ASL and English and SLN and Dutch as separate languages or mixed is not known. The exact structure of the languages used was not described.

In her dissertation Schermer (1990) demonstrated that oral and spoken components play an important role in SLN, as in many sign languages investigated thus far (for instance Ebbinghaus (GSL) 1990; Pimiä (FSL) 1990. Coerts (1992) pursues this further for SLN. Schermer defines oral components as "lip/mouth movements, often together with head and face movements, that are not related to the spoken language, that are either optional or required as part of the sign" (1990:17). Spoken components were defined as "lip/mouth movements that refer to a lexical item from a spoken language" (1990:17).
She found that the majority of spoken components could be categorized as follows:

1) sign plus spoken component that represents part of a Dutch lexical item
2) sign plus spoken component that specifies, disambiguates or complements a sign; the spoken component can either represent a complete or a part of a Dutch lexical item
3) sign plus a spoken component that does not have one of the functions of 2) and that represents a complete Dutch lexical item

She describes language use in two situations: a structured situation, where deaf adults were asked to read a written story in Dutch, to memorize the content and to convey the story in their own 'words' to their deaf partners. The second, spontaneous situation consisted of free or spontaneous language between two informants (1990:74).
The deaf adults used signed and spoken components simultaneously in 79.8% of their language production in the structured situation and in the spontaneous situation in 74.4% (1990:77). She concludes that

> [...] the structured language samples show a strong influence from the Dutch syntax which can be inferred from the word/sign order that is used, the continuous presence of spoken components; the absence of syntactic uses of the signing space [...] and the absence of [...] nonmanual signals such as the oral component. [1990:82]
>
> The spontaneous language setting elicited a type of communication system that differs from the spoken Dutch and demonstrates features of the grammar of known sign languages such as topic comment word order and the use of syntactic signing space to express relationships between parts of a sentence. (Schermer 1990:87)

Spoken components can have several functions within sign interaction. They can be redundant (i.e. they add no lexical or morphological information). But they can also be used to disambiguate a sign, or to add to or specify the meaning of a sign. Or they can be used to indicate time and person of verbs. Schermer maintains that it is the type of spoken component that occurs that indicates the type of language that is used, rather than the frequency of occurrence of spoken components (see also section 6.3 and Chapter 9). Redundant spoken components in the signed language production would suggest more Dutch influence, and they would not be intrinsic to the sign language.
Ebbinghaus and Hessmann (1996) argue against a sign-centered perspective such as taken by Schermer and propose a comprehensive approach to the problem of dealing with spoken elements in sign languages. They say that spoken words (voiced or mouthed) "may be a natural ingredient of signed utterances even without contributing to their meanings in any obvious way" (1996:27). These would include words called 'redundant' by Schermer (1990) and others (e.g. Bergman 1984; Boyes-Braem 1984; Coerts 1992). Also there are other cases where words cannot be considered redundant, so they think it is more natural to assume that words are used because they are functional (Ebbinghaus and Hessmann 1996:41; Bos 1998). So the presence of spoken or mouthed words in signed utterances would not necessarily indicate that a third, mixed system is being used – the syntactic structure of the mixed utterance as a whole must be considered to gain insights into the functions of the signed and spoken parts. Redundancy of spoken words in a signed context in itself has proven to be no criterion on the basis of which one can establish whether only a sign language is used or a mixed mode.

In the Netherlands the linguistic input to deaf or hearing children has not yet been described. Some research has been done on the influence of SLN input or input of Sign Supported Dutch (SSD) immediately preceding the language production of deaf children (± age 8;0) in a school situation (Keppels and Jansma 1994).[3]

Until the 1980's sign language was not used in the schools for the deaf in the Netherlands. This means that many deaf people were raised with spoken Dutch as their first language. They sometimes did not learn to sign until after they left school and began to participate in the deaf community. Dufour would consider these deaf people to be speech-sign bilinguals, but their grasp of and fluency in the spoken language would not be native-like. Some Dutch deaf people who have deaf parents can be considered sign-text bilinguals with varying degrees of fluency of speech. As described in section 1.4.1, Romaine (1995) discusses the possibility of a third type of input in bilingual situations, where the two languages of the parents are mixed. This would seem possible in the situation of deaf parents using SLN and Dutch with their children. A mixed form of signs and words could be considered to be such a third

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3 Current work (Fortgens in prep.) is examining the language production of deaf children with a hearing teacher and deaf teacher, assuming differences in input as described in Keppels and Jansma (1994).

system, and has been described as contact signing by Lucas and Valli (1992) for parents using ASL and English. We do not know whether parents use mixed input. In particular if speaking and signing is combined in one utterance in such a way that both channels are necessary for the complete proposition, then there is evidence that the third system exists.
Considering the different language backgrounds of deaf people in the Netherlands, and the different possibilities for language choice, it is imperative that the language input offered by deaf parents in deaf-parented families is described in detail. We cannot simply assume that the input will be spoken Dutch, or Sign Language of the Netherlands. Since the two modalities allow for simultaneous use of signs and words, the exact nature of the input needs to be established in order to properly evaluate the role of this input in the acquisition process of the children. In the light of the discussion by Romaine of a third system it is plausible to consider utterances in which words and signs are produced together, as forming a separate system, separate from 'pure' spoken utterances or 'pure' sign utterances. This discussion will be returned to in section 5.3.

2.2.2 Deaf parents with deaf children (DPDC)

When deaf parents use a sign language in the interaction with their infant, the child has potentially full access to the language, just as a hearing child of hearing parents has full access to the spoken language. The sign language is used in all situations, with different people and on a range of subjects, and in this way the child comes into contact with the language in a natural way. Several researchers have described the sign language acquisition process of deaf children of deaf parents. They found that the developmental process is similar to that of hearing children of hearing parents (for ASL Newport and Meier 1985; Bonvillian and Folven 1993; Petitto and Marentette 1993; for BSL Carter 1983; for Italian Sign Language (LIS) Caselli 1983; Caselli and Volterra 1990; Volterra and Caselli 1985). In sign language acquisition the same global stages are found as in spoken language acquisition, that is, babbling, one-sign utterances, then two or more sign utterances, and the beginning of the use of syntactic rules.

However, several studies on the interaction between deaf mothers and their deaf children revealed that the quantity of sign language during the first year of the child's life was very small (Britain: Kyle et al. 1987; USA: Maestas y Moores 1980). The deaf mothers (all native signers in these studies) used mainly spoken language. Only around the child's first birthday did they start signing as expected (Kyle et al. 1987). Harris, Clibbens, Chasin and Tibbitts (1989) additionally found that British deaf mothers offer their deaf infants *less* language than hearing mothers offer hearing children at several points in time (see Gallaway and Woll 1994).
Kyle et al. (1987), Harris et al. (1989) and Harris (1992) attribute the smaller amount of language use during the first year of the child's life to the fact that deaf mothers appear to 'train' their children in visual attention behavior. Harris summarizes as follows.

> One reason why the amount of signing that the deaf children received was considerably less than the least amount of speech received by a hearing child stemmed from the requirements of visual attention. [...] the majority of signed utterances were made by the mother while the child was looking at her. [...] the proportion of utterances seen by the child increased with age - suggesting that it gradually became easier for mothers to make signs visible. [...] These data suggest that a deaf mother typically signs only when there is a good chance that her child will be able to see what she is signing. The hearing mother, of course, does not operate under the same constraint of visual attention, and so there are potentially many more opportunities to talk than to sign because a child does not have to look at the mother in order to hear what she is saying. (Harris 1992:101)

The most striking difference between hearing mother-child interaction and deaf mother-child interaction is that deaf mothers using a sign language cannot both hold their deaf baby and communicate in sign language at the same time. Several mothers have told us that even if their hands are free to sign, they feel uncomfortable signing to very young children. From an Italian study of two hearing babies and their mothers by D'Odorico and Levorato (1990:13) we know that "at about 8/9 months of age communicative exchanges by eye contact undergo an important change of strategy". They and many others, found that at this age children begin taking a greater interest in the surrounding environment and that the child has to learn to divide its visual attention between what it is observing and its mother. Hearing mothers, when playing with their baby, can monitor the eye-gaze direction of the child and comment on whatever it is looking at. The deaf mother, however, must first follow the eye-gaze of her child to establish what it is interested in, then attract the child's visual attention before she can comment (in sign) on what the child is seeing. Masur (1990) reports on a study by Murphy and Messer (1977).

> 9 month-olds were capable of following a point and looking at the object only when the mother's hand and the object were in the same visual field; however, the infants could not follow points directed across their midlines. [...] The majority of the sample of 14 month-old infants, however, had developed the ability to follow such points. (Masur 1990:19)

These facts more or less coincide with the increased use of sign language by the deaf mothers in the Kyle and Harris' data studies. Harris (1992) observes that by 1;4 the deaf children of deaf parents in her study could perceive 80% of all utterances offered to them (uptake, see section 1.3.1). This means that 80% of the input could serve as possible intake for the child. The child's intake can only be measured by looking at his/her language production.

There is a clear development in the accessibility of input. Harris claims that deaf mothers find it easier to make signs visible as the children grow older. This supports the idea that mother and child both contribute to the accessibility of the conversation. In fact, all mothers can be said to train their children to react to certain signals used to gain their attention. Hearing children must also learn, for instance, that, if their mothers call their name, they are supposed to respond to her. But within the special requirements of sign language communication we might expect different strategies from the deaf mothers. The quantity of the signed and spoken input of deaf parents to their deaf children must be described, together with the accessibility of the input to the child. The next step is then to describe the linguistic output of the child and compare it to the input.

Not much is known about the quality of the sign language input to deaf children. We know of only a few studies that look into vocabulary input (e.g. ASL: Launer 1982). Some American studies have described the sign language acquisition of deaf children, but do not cover the exact nature of the input, which is implicitly taken to be adult-like ASL (e.g. Newport and Meier 1985). Usually no reference is made at all as to whether or not spoken language is used, or even mouthing, and if so to what extent. A few studies (USA: Kantor 1980; Launer 1982; Swisher 1992; Britain: Gregory 1985a/b; Harris et al. 1988; Kyle, Woll and Ackerman 1989) describe signing adapted to the linguistic or cognitive developmental level of the child, or describe aspects related to visual attention within the interaction of deaf mother-child dyads.
Kyle et al. (1987:222) found that deaf mothers used "[...] fewer questions, and more report-type utterances" in the interaction with their children compared to hearing mothers (see 1.3.2). Initially the sign language input is rather simple, with a high proportion of naming utterances. Kyle et al. related this to the 'training' of visual attention by the mothers during the first year(s) of life, which is essential to sign interaction (see Chapter 6).
Pine's reference to these aspects seems to be relevant.

> For example, if the task in the earlier stages is to learn a basic vocabulary and effective ways of expressing simple semantic forms and pragmatic functions, then very simple CDS may well be the most facilitative. On the other hand, as the child's task shifts to the acquisition of morphological and syntactic rules, it will probably be the case that more complex input is required. (Pine 1994:25)

If this is especially true for the mothers using signs (while training the attention-giving behavior), we can expect many labeling utterances during the early years. More complex language will be used once the visual attention-giving behavior of the children is adequate (see Chapter 6). Moores and Moores (USA 1982) and Mills and Coerts (Netherlands 1990) describe a few functional differences in the use of signed and spoken language of deaf mothers to their infants (age $\leq$ 1;6). They found that emotional and affective utterances seem to be linked to spoken language in the input

to young deaf or hearing children, while utterances pertaining to objects are produced in signs.
Gregory and Barlow (1986) (children aged 2;0 and 3;0) and Woll and Kyle (1989) found that the utterances of deaf mothers consisted mainly of one sign. Gallaway and Woll (1994) attribute this to the dominant function of naming.

> Utterance function also showed striking differences. Hearing mothers asked many more questions than did the deaf mothers, whose most frequent utterance function was naming. (Gallaway and Woll 1994:210)

Jamieson (USA: 1994) studied the different instructional strategies used by deaf mothers with children aged 4;9 up to 5;5 compared to hearing mothers. She found that deaf mothers concentrated their instructions at the levels of comments and directives. These deaf mothers also made less use of questions than the hearing mothers did. Jamieson suggests that this may be because the continuation of visual contact is at some time more important than asking questions on the task at hand.

General structural descriptions of the input to deaf children of deaf parents have not been found, but there are some articles that focus on a single aspect of sign grammar. For instance, Reilly and colleagues have been studying the use of non-manual grammatical markers of parents in the ASL input to young children (Reilly, McIntire and Bellugi 1990; Snitzer-Reilly and Bellugi 1996). Since both affective feelings and grammatical markers are expressed on the face, they examined how children learned to distinguish between these two functions. They found that mothers did not start using non-manual markers in ASL in a grammatical way with their children from the age of 2;0 on.

2.2.3 Deaf parents with hearing children (DPHC)

Not much is known about the actual language situation during the early years of hearing children in deaf families. Some information has become available over the last few years. Schiff-Myers (1988) gives a comprehensive overview of research on the spoken language production of hearing children of deaf parents.
Mallory et al. (1993) give information on the language mode that deaf parents report using with their hearing children.

> The results of this study indicate that although deaf parents did report ASL as the preferred language mode with spouse, over two-thirds use some form of language mixture involving English structure in communicating with hearing offspring. That means that for at least part of the time they move away from the structure and inflection patterns of ASL to a mode of language with English sentence order (SE). To this, some parents add an approximate speech component, mouthing key words, with or without voice. For their part, the children tend not to rely on ASL but on a "generic" form of sign-plus-

> fingerspelling, roughly paralleling their spoken English. (Mallory et al. 1993:80)

These interview data suggest that, also depending on age and/or birth order, hearing children acquire quite different aspects of sign language. The descriptions by the parents and the children of their language use revealed widely differing degrees of sign language fluency among siblings, and of deaf and hearing siblings' differential use of language modes (1993:87). From the studies described by Schiff-Myers it is unclear whether these deaf parents sometimes were using sign language (ASL), spoken language (English), deaf speech without signs, or mixed signing and speaking at the same time. It is possible that we can speak of a 'third system' (Romaine 1995) in the case of simultaneous signing and speaking. The interesting question remains what effect such a mixed input would have on the production of the hearing children. Unfortunately, nowhere in these studies have the structural aspects of the input been described.
Schiff-Myers writes that the spoken language of the deaf adults is often "unintelligible because of hyponasal speech with numerous omissions and inappropriate stress patterns [...] and has limited syntax" (Schiff-Myers 1988:56), but what is meant by limited syntax is not specified. There is no detailed information on the quantity of input.

2.3 Language production of children in deaf families

2.3.1 Language production of deaf children of deaf parents

As mentioned in 2.2.2, an early study in this area from Newport and Meier (ASL 1985) showed that deaf children that acquire a sign language as their first language follow more or less the same path of language development as do hearing children of hearing parents acquiring a spoken language.
Boyes-Braem (USA 1974/1990) and Bonvillian and his colleagues (for instance Bonvillian, Richards and Ibrahim Saah (USA 1996)) amongst others have done phonological acquisition studies. As with spoken language, the phonological forms used by deaf children differ greatly from that of adult signers in the early years of language acquisition.
Other researchers have demonstrated that deaf children start to 'babble' in sign around the age of 8 months (USA: Petitto and Marentette 1991). We use the term *movements* for these babbles, following Caselli and Volterra (1990); these movements carry no symbolic meaning (see for a further description Chapter 4).
Petitto and Marentette (1991) claim that only deaf or hearing children who receive structured (i.e. syntactic) input, either in the visual-gestural or in the oral-auditory modality, will produce appropriate 'babbling' behavior in that modality. Others claim that no sign language input is necessary for children to produce movements (Meier and Willerman 1995) (see also section 2.3.2). It is thus of importance to determine

whether syntax is present in the input and compare the use of movements in the output of deaf and hearing children with the input they received.

The first symbolic (or representational) signs appear around the first birthday (USA: Bonvillian and Folven 1993; Italy: Caselli and Volterra 1990). Caselli and Volterra (1990:277) maintain that the emerging ability of children to combine two representational signs or words "crucially depend[s] on exposure to a linguistic input", namely input of combinations of (at least) two representational signs for the acquisition of a sign language, and combinations of (at least) two representational words for the acquisition of a spoken language. Children start with combinations of Points and representational signs and around the age of 1;8 they begin to combine representational signs – the beginning of the application of grammatical rules in their output. Caselli and Volterra claim that the combination of a deictic sign (or Point) and a representational symbol is not evidence that a linguistic system is being used - only the combination of two or more representational symbols indicates the presence of syntax. Goldin-Meadow and her colleagues (Goldin-Meadow and Mylander 1983; Goldin-Meadow, Mylander and Butcher 1993; Wang, Mylander and Goldin-Meadow 1995) found that deaf children of hearing parents with no sign language input seemed to construct a sign language system of their own (including combinations of deictic signs and a representational sign. However, Volterra (1983) and Volterra and Caselli (1985) state that the gesture production of these deaf children should be analyzed according to criteria also applied to the gestures of hearing children of hearing parents and of deaf children of deaf parents. In a study similar to Goldin-Meadow and her colleagues they found that all children combine deictic gestures with referential words or signs, but that only children exposed to a sign language combine referential gestures or signs with referential gestures/signs. After reanalyses of the data of Goldin-Meadows and her colleagues they established that deaf children who have had no sign input combined deictic gestures with referential gestures, but never a referential gesture with a referential gesture. Gallaway and Woll (1994) summarize:

> Since children both exposed and not exposed to adult models of sign can use symbolic gestures and combinations of gestures to communicate, these do not depend on exposure to a linguistic model. What does depend on exposure is the ability to combine symbols (referential gestures) with each other. This indicates that the symbolic capacity (meaning) and combinatorial capacity (syntax) are separate, that both are necessary to the development of language, and that the ability to use the two together depends on adult input. (Gallaway and Woll 1994:217)

These differences in input, and their subsequent influence on the language production of the children make it all the more important to give a full description of combinations of representational signs or words that occur in the input.

The study of pronominal reference in sign languages is complicated by the overlap in form between non-linguistic pointing and linguistic pointing. This aspect in ASL has been studied by Petitto (1987) and Pizzuto (1990). Around age 0;10 non-linguistic pointing to self, to other people and objects appears. Petitto maintains that between 1;0 and 1;5 pointing to persons stops, although pointing to objects is maintained. However, these findings were not supported by Pizzuto. Around 1;6 linguistic pointing to other people begins, and pointing to addressee between 2;0 and 2;5. By 2;5 1st, 2nd and 3rd person are correctly distinguished. Lexical compounds begin to appear between 3;6 and 3;11, and innovative compounds between 4;0 and 4;11, although they are not adult-like either in phonology or in meaning.

There have also been several studies on the acquisition of morphology and syntax. Meier (ASL 1982), Bellugi (ASL 1988) and Reilly et al. (ASL 1990) studied the acquisition of verb-agreement, the acquisition of syntax and space, and conditionals respectively. Verbs (in citation form)[4] appear in the lexicon between 1;6 and 1;11 but there is no verb morphology. This does not begin to appear until between 2;0 and 2;5, and then usually as unanalyzed rote forms. There is some over-generalization of the verb inflection rule, with plain verbs inflected where this is not grammatical in adult sign language (BSL Woll 1998). So far not many studies have focused on the acquisition of the rules for the (non-)realization of subjects and/or objects (but see Coerts and Mills 1994; Coerts 1999, SLN).

Sign languages are classifier languages, that is they include morphemes called 'classifiers' whose function it is to classify nouns according to inherent characteristics of their referents (Allen 1977 in Siple 1997:34). Between 2;6 and 2;11 classifiers begin to appear in spatial verbs.[5] There is no morphological marking of manner on verbs yet.
The first productive use of verb agreement occurs at the beginning of this period. Between 3;6 and 3;11 movement and manner can be observed in certain verbs, but produced sequentially rather than simultaneously towards the end of this period (Woll 1998). Not until 5;11 is the mastery of most morphology completed, although polymorphemic forms still cause difficulty (Woll 1998) and are not acquired fully until the end of the 9th year.

Although the speech production and comprehension of hearing-impaired or deaf children has received a fair amount of attention only little research has been done on the functional spoken language development of deaf children of deaf parents. Maxwell (1989) describes a deaf girl's (Alice) speech from 1;6 to 7;5. Her parents did use speech with Alice, although ASL was the dominant mode in the family.

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4 The citation form of a sign is understood to be the least complex form that represents the whole paradigm and from which the other forms can most directly be derived (Appel et al. 1992:78).

5 For a description of the verbal system in ASL see Padden 1983/1988.

> Alice paid attention to speech around her and could occasionally use speech to repair communicative failure in sign. Up to age 3 there was very little vocal production [...]; but by age 3 Alice produced short segments of speech and began to speechread with some understanding. Nevertheless, she hardly used speech at all until after 4;3; it was not a major productive mode for her until 5;5. By 7;5 she had sorted out the associations between different manual modes (sign, fingerspelling) and speech, and switched appropriately. (Maxwell 1989:39)

Mogford (1988) summarizes research done on the acquisition of spoken language for severely hearing impaired or deaf children in general. It is both deviant and severely delayed.

Several studies have been done on the attentional behavior of deaf children of deaf parents. As we already discussed in section 2.2.2, deaf parents appear to train their young deaf children in visual attention, especially so during their first years of life. Deaf children raised with a sign language learn at an early age to check back with their conversational partner to see whether or not linguistic information may be offered (Harris et al. 1987; Harris and Mohay 1997). A few studies have been done on the development of this skill after the first year (Siple, Akamatsu and Loew 1990; Swisher 1992; Baker and van den Bogaerde 1996; Richmond-Welty and Siple 1999; van den Bogaerde 1999). The major characteristics of behavior of visual attention in sign language communication are apparently acquired before the age of 3;0.

2.3.2 Language production of hearing children of deaf parents

Several studies have been carried out on these groups of children. Some of the earliest descriptions of the language production of hearing children of deaf parents come from Critchley (1967) and Brejle (1971) (both mentioned in Schiff-Meyers 1988:48/49). More research has been done by Schiff and Ventry (1976), Mayberry (1976), Murphy and Slorach (1983), Todd (1975), Todd and Aitchison (1980), Sachs and Johnson (1976) and Sachs, Bard and Johnson (1981). Only four studies reported on language or communicative problems in these children (Critchley 1967; Brejle 1971; Sachs et al. 1972 and Todd 1972). But these problems referred to the acquisition of the spoken language. Mayberry (1976) also reports a focus on spoken language. Not much attention has been paid to the sign language development of these children.

Meier and Willerman (1995) argue that sign babbles can be expected in hearing children anyway. They claim that hearing children may produce babbles because:

1) the rhythmical organization of speech may trigger rhythmically-organized gestures
2) sighted children of hearing parents receive visual feedback from their own gesturing, unlike deaf children who receive little or no auditory feedback from their own vocalizations

3) even the children of non-signing parents receive some nonlinguistic gestural input. Based on their findings we could thus expect similar movement production by deaf and hearing children.
Further it is not clear what to expect in the sign language production of these children. The hearing children of deaf parents are usually exposed to two languages from an early age.
Schiff-Myers (1988) describes the early sensitivity of these children to their linguistic environment.

> Schiff (1976, 1978) found that five 2-year-olds used proportionally more signs, more exaggerated and whispered speech and shorter utterances with their deaf mothers than they did with the normal speaking investigator. Therefore [...] the children were already making modifications in their utterances seemingly based upon the linguistic differences of the listener. In addition, these children showed some awareness that their parents did not hear [...] Older hearing children of deaf parents become bilingual and use two systems to communicate, one with the deaf and one with the hearing (Lenneberg 1967; Schiff and Ventry 1976). Perhaps children who learn Standard English without any problems are those who realize early in development that they are learning two languages. Like the bilingual child who learns two languages simultaneously, the hearing child of deaf parents might need to identify one language (deaf speech +/- ASL) with their parents, and the second language (Standard English) with others. If the children perceive their parents' oral language as different, then they should not be confused by the seeming 'irregularities' in input in the oral language they hear. (Schiff-Myers 1988:61)

The use of voice is an aspect, which clearly reflects awareness of the mother's deafness.
Prinz and Prinz (1979; 1981) and Griffith (1985; 1990) describe the linguistic behavior of hearing children with one deaf and one hearing parent. At a very young age (≤ 2;0) the two children in these studies seem to be aware of the hearing status of their parents and other conversational partners. They try to adjust their language production accordingly. At one point Griffith (1990) maintains that hearing children who are raised with two languages in two channels (i.e. ASL and English) have the advantage that through combinations of the two channels, these children can express even more complex utterances than if they use one channel at the time (1990:241).
No information is available at all about children in the Dutch context.

2.4 Summary

In this chapter the language use in deaf families has been discussed. We established that deaf families are families where both the parents are deaf (or one hearing CODA), who use sign language as their main means of communication with their

deaf or hearing children, and who pass on the social and cultural values of the 'deaf cultural world' in a natural way. Hearing parents with deaf children do not fall in this category although they are the larger group.
The languages used by deaf parents within the family may vary according to their educational background, their identification with the deaf culture and also the hearing status of their partner and their children. They use both a sign language and a spoken language in different context. They also use a combined system of signing and speaking. The status of this is unclear but may form a third mixed system.

From the relatively few studies of input it appears that during the early years deaf and hearing children who receive sign language input may receive less language than do hearing children of deaf parents. This is probably linked to the accessibility of the input: mothers spend time 'training' their young children to pay visual attention to their signing.

There appear to be fewer questions in the input compared to hearing parents with hearing children. Naming is a predominant function, expressed in one-sign utterances between ages 2;0 and 3;0. Affective function is expressed in spoken utterances at an early age. Non-manual markers (for affective markers and grammatical markers) are not present in the input prior to age 2;0.
Hearing children of deaf parents also receive a mixed language input – signing and speaking. Since there are no good descriptions of the input, it is not clear if it is the same as to deaf children of deaf parents.

From studies of sign languages other than SLN we know that deaf children acquire the sign language used in their family more or less in the same way that hearing children acquire the spoken language of their parents. There are of course some differences in the interaction. Within sign language communication settings it is of the highest importance that children learn to pay appropriate visual attention to the sign language that is offered. We know that children begin their language production with (prelinguistic) babbles and then proceed to their first signs. We know very little of the content of their vocabulary, or of the proportional relation between nouns and verbs, for instance. The acquisition of the verbal system starts fairly late (around 2;0 – 2;6) and is not finished until the children are much older, around 9;0 in ASL or BSL. For Sign Language of the Netherlands no description exists yet of the acquisition of the morpho-syntactic system. Spoken language acquisition is severely delayed.
Hearing children of deaf parents usually seem to acquire the spoken language effortlessly and to communicate on the whole without problems with their deaf parents. In what language is not clear.

This study will address these areas in the Dutch situation. A description of the input offered by the deaf mothers, and the output of the children will be made. In all areas we will look at the development over time and consider the relation between the

input and the output. We will also study the influence of the hearing status of the child in the interaction between the mothers and the children.

3 RESEARCH QUESTIONS

In Chapters 1 and 2 we discussed the role of linguistic input and interaction in situations of normal and exceptional language acquisition and the language use in deaf families. From the literature it is clear that quantity and quality of input can be relevant for the child's acquisition. In a bilingual situation there are additional aspects of input that are relevant. In deaf families the situation is again a special one and raises many interesting questions. This study will examine the situation for deaf families in the Netherlands.
The research questions can be divided in five main areas which will all be examined in the input of the deaf mothers and in the production of the deaf and hearing children:

1 The amount of language produced in total, and which languages are produced (section 3.1)
2 The accessibility of the language production for the conversational partner (section 3.2)
3 The vocabulary and the separation of languages (section 3.3)
4 The functions expressed (section 3.4)
5 The structures that occur (section 3.5)

The analyses related to these areas were carried out with data collected over a two year period at half year intervals (ages 1;0, 1;6, 2;0, 2;6 and 3;0 of the children). Individual development will be traced (intra-subject comparison) as well as group development. This developmental aspect is not explicitly formulated in each research question to avoid being repetitive. Furthermore comparisons will be made between the deaf mothers in interaction with their deaf children and with their hearing children and also between the deaf and hearing children (inter-subject comparisons). Further general aspects of design are addressed in Chapter 4. Specific aspects of methodology are presented in the relevant sections in Chapters 5 to 9.

3.1 Quantity of language and language choice

Question 1A

Do the mothers offer a total amount of language input to their child that is comparable with the average amount offered to deaf and hearing children as established in other research?

We expect that the deaf mothers will offer their children input comparable to the amount of language offered by deaf mothers to deaf or hearing children.

Question 1B

How much language is produced by the children?

Question 2

What is the contribution to the conversation of the deaf mother on the one hand and her child on the other? In other words is the conversation carried equally by both conversation partners?

We might expect that the children contribute half of the conversation, but it is not exactly clear at what age this might be expected.

Question 3A

What are the proportions of different language modes in the total input?

Although there is little information on the exact input to deaf and hearing children, we might expect the deaf mothers to mainly offer SLN to their deaf children and SLN and NL to their hearing children. However, some mixed signed and spoken input is also to be expected.

Question 3B

What are the proportions of different languages in the output of the children?

Question 4

Do the deaf and hearing children reflect their mother's language choice in their language production?

We expect the deaf children to use mainly SLN; for the hearing children we predict a focus on spoken language (Mayberry 1976).

The results related to these questions are presented in Chapter 5.

3.2 Language accessibility

Question 5

Is the linguistic input offered to the children actually accessible, i.e. can signs and words be seen by the deaf children or seen or heard by the hearing children?

We assume that the deaf children will have visual access to most of the mothers' utterances; we have no information on which we can base a prediction as to how accessible the input (whether spoken or signed) is to the hearing children.

We also want to find out in what way(s) the deaf mothers ensure that the deaf and hearing children actually have access to the linguistic input that is offered to them, and formulated the following questions.

Question 6

What strategies are used by the deaf mothers to gain or hold the attention of their deaf or hearing child?

We could expect that as the children grow older the mothers will need to attract their children's attention explicitly less often as the children develop appropriate attention-giving behavior.

Question 7

Is there a relation between strategy used and consecutive language choice of the deaf mothers?

Question 8

Is there a relationship between the attentional strategies used by the deaf mothers and the attention-giving behavior of their deaf or hearing child?

As deaf mothers are reported to 'train' the visual attention of their children, we might expect that the children's visual behavior changes over time, which in turn will influence the use of attentional strategies by the mothers.

Do the deaf and hearing children show awareness of the fact that their mother is deaf and therefore has to pay visual attention both for signed and spoken utterances in order to be able to perceive them?

Question 9

Is the linguistic production of the deaf and hearing children accessible to their deaf mother?

Question 10

Do the children take care that their mother can see their signs and/or words, and if so, how do they ensure visibility?

We can make no prediction for the visibility of the children's utterances to the mothers. We expect the children to show awareness for the necessity of visibility of their language production from 2;6 on.

Question 11

Do the hearing and deaf children produce words with or without voice?

This aspect reflects the children's awareness of accessibility of speech for the mothers.

Question12

To what extent is it necessary for the mothers and the children to focus on one or more channels (signing/speaking)), in other words how are propositions in the input and output distributed over the two channels?

If propositions are distributed over two channels in one utterance, then this is evidence for simultaneously signed and spoken utterances functioning as a third system.

Question 13

Is there a relationship between the quantity of input of the deaf mothers and the development of the attention-giving behavior of the children?

The results related to these questions are presented in Chapter 6.

3.3 Lexical issues

In order to obtain a general view of the vocabulary produced by the deaf mothers and the children we looked at the following aspects.

Question 14A

How are deictic and representational symbols used and combined in the input?

Question 14B

When do deictic and representational symbols appear and when are they combined in the output of the children?

Question 15

How often are nouns used relative to verbs in the different languages in the input of the deaf mothers and in the output of the children?

Question 16

What is the variability in vocabulary in signs and words measured in proportion of different types in the input of the mothers and in the output of the children?

Question 17

Is there lexical evidence in the input of the deaf mothers and in the output of the children for the use of separate languages?

The results related to these questions are presented in Chapter 7.

3.4 Functional aspects

It has been observed in earlier studies by amongst others Kyle et al. (1987) and Gregory and Barlow (1989) that functionally the language offered by deaf mothers to

their children seems to differ from the language offered by hearing mothers to their hearing children. This may have its influence on the language acquisition of the children. In order to see whether this is true for our subjects we formulated the following questions.

Question 18

What is the proportion of utterances with a declarative, interrogative and imperative function in the input of the deaf mothers and in the output of the children?

Question 19

How are affective propositions expressed by the deaf mothers? Are they expressed by the children and if so, how?

Question 20

Is there functional evidence for the separation of languages in the input and the output?

The results related to these questions are presented in Chapter 8.

3.5 Structural aspects

A description of the linguistic structures used in the input and output is an important source of information on the possible relation between the input and the language development of the children.

Question 21

What is the length of the language input of the deaf mothers and the output of the children, measured in Mean Length of Utterance (MLU) and MLUL10 (Mean Length of 10 Longest Utterances) in signs and/or words in the different languages?

Question 22

How many verbs are produced in the input and the output in the different languages?

Question 23

What arguments are realized in the different languages in the input and in the output?

Question 24

What is the position of the verbs in the different languages, both in the input and in the output?

Question 25

Are the verbs that are produced inflected and if so, are they inflected as expected in the different languages, both in the input and in the output?

Question 26

Are non-manual grammatical sentence markers 'q, 'wh-q' and 'neg' used in the input and the output?

Question 27

Are plural and diminutive markers, and markers on adjectives (correctly) used in the input and the output?

Question 28

What sign and word types are used besides nominals, verbs and adjectives/, both in the input and the output?

The results related to these questions will be presented in Chapter 9.

4 GENERAL DESIGN

4.1 Subjects

As described in section 2.1, approximately 5-10% of deaf children have deaf parents. This means in the context of the Netherlands that less than 500 deaf people have deaf parents. In the Netherlands there is also no registration of deafness except within the medical consultancy offices. These two facts made it difficult to trace subjects that were suitable for our longitudinal research project, which covered approximately 10 years. In 1988, when the project started, we were looking for subjects that met the following conditions (see also Mills and Coerts 1989:26).

1 The mothers must be prelingually deaf. A prelingually deaf person is defined as someone who is born deaf, or became deaf before spoken language was acquired, so that language could not be acquired on the basis of auditory information
2 The mothers have to be members of the deaf community.
3 The mothers must be fluent in SLN and SLN should be the primary language used in the family
4 The children must be in the prelinguistic stage, that is to say a considerable time before the first word (or sign) or one-word stage (or one-sign stage). The description of the input and language development needs to begin as early as possible in order to show any possible influence of input and interaction on the language acquisition of the child.
5 The children must have no known cognitive, motor or visual impairment.

Thanks to the help of the Dutch Foundation for the Deaf and Hard of Hearing Child (NSDSK) and the Dutch Foundation for the Deaf (Stichting Nederlandse Dovenraad, now Dovenschap) we initially found three families with deaf parents and hearing children who met these criteria, and who were willing to participate in our study. In 1988 we began filming in these families when the (hearing) children were 1;0 (Jonas), 0;6 (Alex) and 0;3 (Sander) respectively. We still had not found deaf families with deaf children at this time. In 1989 twins were born into Jonas' family, and at 0;11 both children (Laura and Mark) were diagnosed to be severely hearing impaired. Graciously the parents granted us permission to include the deaf twins in our project. Approximately 6 months later we found a deaf mother and father with two deaf children who were willing to participate with their youngest child (Carla) who was 1;6 at the time and not prelingual.
For the longitudinal study we initially filmed the children and their mothers every month for about one hour. As the children grew older and language development slowed down (around age 4;0) we filmed then once every 4 months. After age 6;0

we filmed them twice a year until they reached the age of 8;0. For this study we used the session at ages 1;0, 1;6, 2;0, 2;6 and 3;0 (see Table 4.1 in section 4.3 for an overview of the exact ages of the children).

The mothers participating in this study are all prelingually deaf (see section 2.1). Two of the fathers are deaf, one is severely hearing impaired and one father is a CODA and a native signer. The three deaf children are Carla, Laura and Mark and the three hearing children Jonas, Sander and Alex. More relevant information on each child, mother and its family is given below.

4.1.1 The deaf children

Carla

Carla was diagnosed deaf at the age of 0;9 and at 1;1 showed no reaction in hearing tests (see Appendix to Chapter 4 for further audiometric information). She was 1;6 when she started participating in the longitudinal study. Around the age of 2;6 she started attending the pre-school (*voorschool*) at Effatha, the Christian Institute for the Deaf in Voorburg.

Carla's mother usually wears a hearing aid, with the help of which she can pick up some sounds; her degree of hearing loss is unknown. It is also unknown whether her hearing impairment was present from birth, although she suffered from no illness known to cause deafness in her youth. Her parents are deaf, and there are no known deaf relatives. She has used Sign Supported Dutch and SLN since the age of 3;0 when she came into contact with other deaf children at the school for the deaf. She works at home, and at the time of the study is not very active in the deaf community since in the town where the family lives there is no club for the deaf.

Carla's father is a deaf (cause unknown) child of hearing parents and he works outside the home.

Carla has one deaf brother (hearing loss unknown), who is nearly two years older than Carla.

Laura

Laura was probably born deaf, and at 0;11 was diagnosed to be profoundly hearing impaired (≥ 80 dB hearing loss in her best ear). Over the years however it appeared that she showed only little reaction to the standard hearing tests, so her loss of hearing may be greater. Laura was 11 months old when she started participating in this study, and in the prelingual stage. When she was 2;6, she started attending the pre-school in Voorburg twice a week, together with her twin brother *Mark* (see below).

Laura's mother has a hearing loss of ≥70 dB in the best ear, and usually wears a hearing aid, which enables her to pick up some sounds, for instance a passing motorcycle. However, she cannot hear spoken language. She was born deaf, and she has hearing parents and one deaf sister. Before the children were born she worked as a psychological assistant at the Christian Institute for the Deaf Effatha in Voorburg.

She considers herself to be a member of the deaf community and has many contacts with other deaf people.
Laura's hearing father has deaf parents and is a native signer (CODA). He is an active member of the deaf community, and he has been working with deaf and hearing parents of deaf children, but he also develops sign language courses and is an interpreter .
Laura has one deaf twin brother, Mark and a hearing brother Jonas who is 14 months older than the twins. Mark and Jonas also participate in our study (see below).

Mark
Mark was born profoundly hearing impaired (≥ 90 dB hearing loss in best ear). He also joined the study at age 0;11. Mark is the twin brother of Laura and younger brother of Jonas.

The three deaf children Carla, Laura and Mark started going to kindergarten at the Christian Institute for the Deaf Effatha in Voorburg when they were approximately 2;6. At the time the teachers in this school were using Sign Supported Dutch with the children (see Knoors 1992; 1994). The children were in a class of 5 to 7 children once or twice a week. More details on their hearing status and results of audiometric tests of the deaf children can be found in the Appendix to Chapter 4.
The three deaf children do not form a homogeneous group, even though the twins Laura and Mark of course share the same mother. Carla's parents were not much involved with the deaf community at the time of the filming, and this may have its influence on the way they interact with their children (see section 2.2.1).

4.1.2 The hearing children

Jonas
He is the hearing older brother of Mark and Laura (see Laura for family details). He joined the project at age 0;11 and attended regular pre-school from approximately age 2;6.

Sander
Sander is the hearing child of two deaf parents. He joined the project at age 0;3. He has two hearing brothers (twins), who are six years older. Sander's mother is born deaf of deaf parents and does not wear a hearing aid. Her hearing loss is unknown. She worked part-time as an assistant at a bookbinder's at the time of the filming. She considers herself an active member of the deaf community.
The father of Sander is deaf of deaf parents, with deaf brothers and sisters. He is an active member of the Dutch deaf community, and works as a representative of the deaf community. Sander also went to pre-school from about age 2;6.

Alex

He has a deaf mother and a severely hearing impaired father (exact hearing loss unknown for both). He has one hearing sister, who is eight years older, and one hearing brother six years his senior. His mother became deaf after meningitis at the age of 2;6; she has a hearing aid, which she wears inconsistently There are no other deaf members in her family. She worked at home during the early stages of the study, and later worked in an administrative function. The father always wears an hearing aid and works outside the home. Alex attended pre-school from age 2;6.

The hearing children all three started attending 'peuterspeelzaal' (pre-kindergarten) once or twice a week for a couple of hours at the age of approximately 2;6, in the neighborhood of their home.
The hearing children form a homogeneous group, in that their parents share characteristics related to the deaf community. In two respects the children differ. Jonas is the oldest child in his family, and Alex and Sander both are the youngest of three. Jonas has two deaf siblings, while Alex and Sander have hearing siblings. These two factors can influence the input and interaction between parents and children.

In Figure 4.I the different mother-child relations are presented.

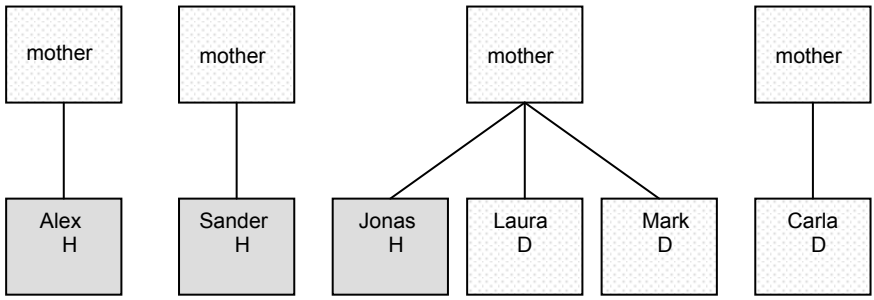

Figure 4.I The four deaf mothers and their six children in this study

4.2 Data collection

The mothers and their children were filmed at home monthly in a free play situation, with toys and books of their own choice. Usually the (hearing) author[1], together[2]

[1] We are aware of reservations amongst sign linguists of deaf people being filmed by hearing researchers for a language study. However, we feel that very soon, even during the initial stages of the study, a relaxed atmosphere was established with the deaf families. This was a result of the high frequency of the filming sessions. We feel that the language used by the mothers was representative of their everyday communication. This was supported by the mothers who judged the video tapes at a later point.

with a colleague or a student made the video-recordings. Most recordings were made with only the mother and one child present, together with the person behind the camera. The first two sessions of the deaf twins Laura and Mark were an exception. They were both present while the mother was filmed playing with one of them.
The mother and child would most often sit at a low table, or on a couch next to each other or on the floor. The toys chosen were balls, books, puzzles, plastic tea cups, tennis rackets, the suitcase of the camera, wooden or plastic construction blocks, square boxes in different sizes, dolls and Duplo or Lego. Bacchini, Kuiken and Schoonen (1995) discuss the generalizability of spontaneous speech data collected at home and in a clinic. They studied four children aged about 3;8. They concluded that the difference in time, place and toys result in the use of different morphosyntactic structures. For our study this means that variation in the data could be partly attributed to the use of different toys or books.
Usually we filmed the interaction of mother and child for about 20 to 30 minutes; sometimes, however, the children were irritable or not feeling well and filming had to be stopped early. This was the case in one of the samples that was chosen for this study, where filming was terminated after approximately six minutes (Mother and Mark at 3;0).
The filming was done with a Panasonic Camcorder M7 CCD with a JVC monitor. The tapes were transcribed using a JVC monitor (TM 150 PSN) and a Panasonic (AG-6200) video recorder.

4.3 Data Selection

Five recordings were selected per mother-child dyad over a two-year period so that development could be studied. The exact ages of the children for the recordings between 1;0 and 3;0 are presented in Table 4.1. The number of the session is given between brackets after the age.

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2 At this point I would like to thank Lies Alons, Anne Baker, Hellen van Berlo, Claudia Blankenstijn, Heleen Bos, Jane Coerts, Sonja Jansma and Machiel de Zoete. Over the years they either helped me film the children or were willing to take care of other children in the family while filming was taking place.

Table 4.1 Exact ages of the children at the different filming sessions grouped per age as referred to in this study. Number of sessions in brackets

Children	1;0	1;6	2;0	2;6	3;0
Carla (D)	-	1;06:16 (1)	1;11:27 (6)	2;06:29 (13)	2;10:29 (15)
Laura (D)	1;00:11 (2)	1;05;22 (8)	2;00:02 (14)	2;06:15 (19)	2;11:11 (22)
Mark (D)	1;00:11 (2)	1;05:22 (8)	2;00:02 (14)	2;06:15 (19)	2;11:11 (22)*
Jonas (H)	1;00:03 (1)	1;05:30 (7)	2;00:10 (13)	2;06:05 (19)	2;11:25 (25)
Alex (H)	0;11:12 (4)	1;05:29 (10)	1;11:19 (16)	2;05:20 (22)	3;00:04 (29)
Sander (H)	0;11:14 (8)	1;06:03 (14)	2;00:05 (19)	2;06:09 (25)	2;11:12 (29)

** This session lasted 6 minutes and 6 seconds.*

Ten minutes of interaction from each session were selected and transcribed. Each transcript starts 5 minutes after the start of a particular session on a videotape, except when this was not possible due to a session lasting shorter than 15 minutes (as in the case of session 3;0 for Mark and his mother). This session was cut short when Mark proved to be very uncooperative and mainly cried.
Whenever the mother or the child is out of range of the camera, transcription is continued for another 10 seconds; transcription is then stopped until that person reappears on the screen. The interaction should always be between two persons (mother and child), except for the above mentioned incidental periods of 10 seconds.

4.4 Transcription

4.4.1 The transcription form

A transcription form was designed for this project, the following features are noted on each separate sheet: the project number, name of the researcher, the session number, which copy of the session-tape is used, the name and the age of the child, the page-number and the time (of the time code) with which that page starts (see for an example of the transcription form the Appendix to Chapter 4). The page is divided in two: the upper part for the transcription of the deaf mothers' language (with 8 rows); the lower part for the children (8 rows). Below we will give an explanation of the rows in the transcription form relevant for this study.

MOTHER and CHILD Fields:

row		*transcription of:*
1	time	each session has a time-code on the videotape, which states hour, minute, second and 1/4 second or frame (24). In this row the time-code indicated on the tape is noted, so far as this is

		needed as a reference point for non-linguistic and linguistic behavior.
2	nvb	non-verbal behavior of the mother that is not a gesture, a movement, a vocalization, a sign or word is written down here (see below). Vegetative sounds (e.g. mother coughs) and body-movements are registered in this row (see below for definitions) **NB**: also contextual information like 'mother turns page', 'taps child' or 'moves toy to attract attention' is noted in this row.
3	morph	in this row relevant phono-morphological aspects of signs that deviate from the usual 'adult' sign are written.
4	gest	all movements or gestures that carry non-linguistic, communicative meaning are listed here. A plus (+) or minus (-) next to the gesture indicates whether or not it is *seen* or *not seen* by the partner (see below for definitions).
5	expr	eye-gaze direction and facial expression (see below)
6	gloss	all signs produced by the mother are glossed in Dutch. In a second viewing, every sign-gloss is coded with (+) or (-), to indicate whether the Addressee has *seen* or *not seen* the sign. Also noted in this row are those movements that can be considered 'proto-signs' - these were glossed as 'MOV' (see below).
7	oral	in this row all spoken (with voice) or mouthed (without voice) words or oral components are noted as such, as well as all vocalizations, which were written down as 'voc' (see below Row 7).

Non-verbal behavior (nvb, row 2)

Vegetative sounds and body-movements that are not communicative and not linguistic are written down when relevant. Vegetative sounds are usually ignored unless they give rise to interaction, for instance when a mother coughs and a hearing child looks up and asks whether or not she said anything. Other vegetative sounds are for example burping, exhalations due to bodily exertion, but also sounds like *brr* e.g. while imitating driving a car. Body-movements are transcribed if they are relevant for the context or if they give rise to interaction, for example when a mother scratches her nose and her child, perceiving the motion, looks up possibly expecting a sign.

Gesticulations (gest, row 4)

All movements of the subjects that have a (non-linguistic) communicative function are written down in row 4. These gesticulations are used by signing and non-signing people in the Netherlands as 'cultural' or 'natural' communicative gestures (see Bos 1989 for definitions). Also noted here are all deictic gestures (Point or Index), since

their linguistic status is not always clear (see section 2.3.1). The following gestures occurred:

head nod — head moves up and down, once or several times. General meaning is 'affirmative'. Can occur by itself or co-occur with signs and words

head shake — head moves from side to side, once or more. General meaning is 'negation'. Can occur by itself or co-occur with lexical realization of negation (signs and words)

NB: Both for head nods (nod) and head shakes (neg) a line indicates the period during which those signals are present (Coerts 1992:13):

nod
TAKE (yes, take it)

neg
TAKE (don't take it)

Point — main characteristics are: stretched/bowed arm with index finger extended, other fingers/thumb are closed (1-handform), with or without touching the person/object the finger is pointing at. A second form occurred, with the thumb extended and the other fingers curled inward (A handform).

give-to-me — one or two-handed movement towards the person speaking or signing or gesticulating. Distinct from the sign GIVE by its more relaxed movements and no clearly marked beginning or end point.

come-to-me — one-handed movement towards the person speaking or signing or gesticulating produced farther away from the body and usually higher than give-to-me. Distinct from the sign COME by its more relaxed movements, no distinct beginning or endpoint, and more repetitions of the shorter movement.

surprise/fear — eyes are opened wide, eyebrows are up, mouth is open, sometimes
shoulders are raised. Without accompaniment of 'hand before mouth', which is glossed as *OH* and counts as a sign.

clap hands — to attract attention, or to express admiration.

Expression (expr, row 5)

The eye gaze direction of the deaf mother (DM) or the child is noted in the following manner:

- DM looks at face of child, (e.g. A=Alex) A
- DM looks towards child ∏A
- DM looks at toy toy

-	DM looks in the direction of the toy	∏toy
-	DM looks at nothing in particular, stares	0, or neutral
-	DM looks away, focus unclear	looks away/right/left

Movements/signs and vocalizations/words (gloss, row 6 and oral, row 7 respectively)

Movements (MOV) and vocalizations (VOC) are defined as those movements or sounds of the mother or child that are (possibly) intended as a word or sign, but to which no meaning could be attached. Movements are distinguished from 'gesticulations' (see row 4) by the fact that they are not accepted cultural or natural gestures.

> Although our categories are largely based on Volterra and Caselli (1985; 1990) there are some differences. We consider a sound or a movement of a child to have linguistic status (i.e. it is a word or a sign) if meaning can be attached to that sound or movement, either because the mother repeats it in the adult form, or if she does not because the sound or movement is consistently made within the same context. By this we mean that if a certain sound is always uttered simultaneously with the same sign which is (approaching) the adult form, or a movement is consistently made with a recognizable word, we consider the sound or the movement to be a word or a sign. Since we are not studying phonological development, we do not make a distinction between unsystematic (i.e. sounds, cries etc.) and systematic (i.e. babbling) vocalizing or moving (Petitto and Marentette 1991; see also Meier and Willerman 1995). Because, in the interaction of the child with the deaf mother, intelligibility of words or signs is relevant for the negotiation of meaning, intelligibility was one of the main criteria in case of doubtful forms (see section 4.4.3).

All SLN signs are given a Dutch translation (gloss) written in capital letters e.g. the sign for *paard* 'horse' is written as PAARD 'HORSE'. This gloss gives only information about the meaning of a particular sign and says nothing about its form. Morpho-phonological information (when relevant) is given in row 3 (morph, see above).

The transcription of inflected verbs follows sign linguistics conventions. For example the sentence 'I give you a book', where the direction of the movement of the verb GIVE is from the signer to the addressee, is transcribed as: 'BOOK 1GIVE2'. If a classifier is incorporated into the verb, this is glossed as follows: '1GIVE(Q5-CL)2', where Q5-CL specifies the classifier handform.

All Dutch words are written down in row 7, including vocalizations. If a spoken Dutch word had a different or deviant pronunciation, a phonetic rendition was given as well as the target word. Unintelligible words were written down as 'onverstaanbaar' 'unintelligible'.

If a sign and a word are uttered simultaneously this can be seen immediately on the transcript, because that particular sign and word are written parallel to each other as in example (1).

(1)

_____q	row 5
WIE ----- PAP-- OP-------- AV [3]	row 6
wie heeft de pap opgegeten	row 7
_____q	row 5
WHO--- PORRIDGE GONE PU	row 6
who has the porridge eaten	row 7

(Who has eaten the porridge?)

explanation of example (1):

row 5 the line indicates the scope of a particular facial marker, *q* stands for 'question': raised eyebrows, lift of chin etc.

row 6 glosses of SLN signs; the dotted line (--) indicates which signs go together with which word(s)

row 7 the words that are spoken or mouthed while the signs are made. NB: in the example above, under the sign PU (Palm Up) there is no spoken/mouthed word, this indicates that this sign was produced by itself.

As in example (1) all examples in this text will be translated into English in the linguistic structure and as an idiomatic translation.

4.4.2 Segmentation

Vocalizations and movements are units of analysis, but are not linguistic. Signs and words have conventionalized meaning. A string of signs and/or words that form a unit on a syntactic, semantic and pragmatic level is considered an utterance. For signed utterances the utterance boundary was further established by noting when the hands went to a rest-position, for instance the lap, or in front of the body on an object or on a person (see also Bos et al. 1988). For spoken utterances pause-length and (rarely) intonation were further indicators. For complex utterances we followed the definition of Hunt (1970:4) *one main clause plus any subordinate clause or nonclausal structure that is attached to or embedded in it.*

The linguistic utterances are subdivided into four types:

a) Point(s) alone

A 'Point alone' is an indicative gesture uttered without an accompanying sign and/or word. All utterances consisting of only one or more Points are coded as such. We decided to make 'Points alone' a special category, as it is as yet uncertain at what

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3 AV stands for ‘Algemeen Vraaggebaar’ (general questionsign, usually transcribed as ‘palms up’)

point in acquisition indicative gestures, also used in hearing mother-hearing child interaction with a spoken language, become integrated in the grammatical system of Sign Language of the Netherlands and thus gain linguistic status. We will discuss this aspect further in sections 7.1 and 9.7.

b) Minors

Minors are described as follows by Bol and Kuiken (1988): With regard to minors no productive morphosyntactic structure can be presumed and therefore they are to be considered unanalysable.[4] Minors are utterances like *yes, no, hallo, bye bye, daddy, thank you*, or phrases used in a ritual such as *peekaboo*.

c) Unintelligible / incomprehensible utterances

Utterances are considered unintelligible when

1) the sign(s) cannot be perceived by the camera (e.g. because a child is standing in front of the mother's signing)

2) the word(s) cannot be heard, e.g. because of background noise, or not be registered by the camera if produced facing away from the camera and without voice

3) the camera cannot pick up both signs and words. Incomprehensible utterances of which the meaning is not clear are also included in this category, as well as utterances that are a false start.

d) Analyzable utterances

This category is formed by all linguistic utterances not falling within categories a, b or c. These utterances can consist of one or more lexical signs and/or words, possibly in combination with one or more Points.

Figure 4.II shows a schematic presentation of the different categories of communicative units.

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4 "Met betrekking tot **Minors** kan geen produktieve morfosyntactische structuur verondersteld worden en daarom worden ze als niet te analyseren beschouwd." (Bol and Kuiken 1988:26)

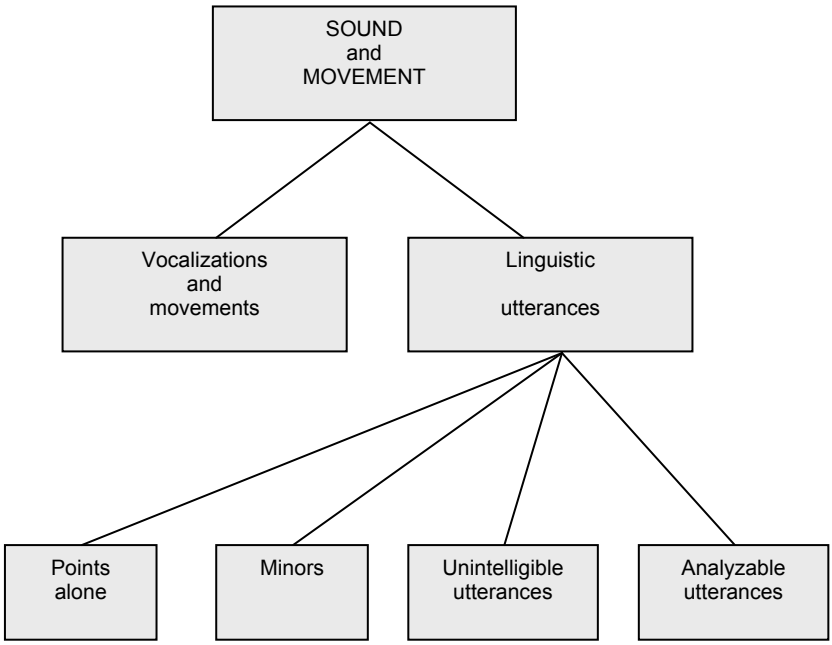

Figure 4.II Schematic presentation of units of analysis

4.4.3 Interrater reliability for transcription and segmentation

The author made the original transcripts, with the invaluable help of our deaf co-researcher Wim Emmerik for the transcription of the SLN utterances. To establish consistency of transcription and segmentation, about 8% of all 29 transcriptions of the mother-child dyads which were done by the author were again transcribed by a second transcriber[5], and segmented into utterances. For the following transcription categories percentages of agreement were calculated: nonverbal-behavior, gestures, signs (glosses) and movements, words and vocalizations and (segmentation into) utterances. Over all points in time the following percentages of agreement were found for the deaf mothers and for the children (see Table 4.2).

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5 I would like to express my gratitude to Carola Rooijmans for her time and effort in establishing the interrater reliability.

Table 4.2 Averaged percentages of agreement on transcription measures for the deaf mothers and the children

	deaf mothers	deaf and hearing children
non-verbal behavior	93	80
gestures	76	56
MOVs/SIGNS	92	79
vocs/words	88	84
utterances	81	75

For the segmentation into linguistic utterances the general interrater reliability on the whole was satisfactory. The percentage of agreement for gestures made by the children however was very low (56%); 29 out of 52 gestures were interpreted differently by the two transcribers. Since gestures were not further analyzed in this study, this low percentage has no effects on the data that will be examined and discussed.
However, we also had some problems with establishing utterance boundaries. Especially the repetitive use of Points at the end of sentences appeared to give rise to mismatches between the two transcribers. For instance, in labeling sequences like *POINT CHURCH POINT* [pause] *CHURCH* the two transcribers were often not in agreement whether the utterance boundary was after the second Point or after the second CHURCH.
In the end it was decided that utterances such as these would be taken very literally according to our semantic cohesion criteria (see section 4.3.2) and thus segmented into two utterances, segmentation point being between the first lexical sign and the second Point. The more complex utterances proved to pose few problems. There was almost no disagreement in establishing utterance boundaries for Dutch utterances.

Within the categories 'signs' and 'words' we also looked at the interrater reliability for the *content* of the glosses and the words, i.e. the intelligibility of the linguistic items. This was only calculated for uttered signs which both transcribers glossed. The cases where one transcriber glossed a sign and the other transcriber interpreted this particular movement as for instance non-verbal behavior, thus in another category, were already calculated in the data presented in Table 4.2.
If the meaning of a sign fell into the same semantic category the two glosses would be considered to be in agreement. For instance a mother used a sign which was glossed as 'HOUSE' by the author and by the second transcriber as 'BUILDING'. The same procedure was followed for spoken and mouthed words. If a sign/word was glossed within the same semantic field, but in a different syntactic category, for instance by one transcriber as a verb ('AIRPLANE-FLY') and by the other as a noun ('AIRPLANE') (see also section 7.2.1) the two glosses were scored for non-

agreement (e.g. Carla (D) at 2;0). Table 4.3 gives the percentages of agreement for intelligibility of signs and words.

Table 4.3 Averaged percentages of agreement on intelligibility of signs and words for the deaf mothers and the children

		1;0	1;6	2;0	2;6	3;0
Signs						
	mothers	100	96	95	95	98
	children	100	69	80	93	89
Words						
	mothers	95	88	97	90	97
	children	100	94	84	91	93

The one score that is not satisfactory (signs for children at 1;6: 69%) is caused by the second transcriber's not recognizing a sign made by Jonas (*VIS* 'FISH') as 'fish', but transcribing it as the verb 'ZAGEN' (SAW). This is how his deaf mother also incorrectly interpreted the sign. Jonas co-articulated *dis* in stead of *vis* 'fish' with the sign, which was not seen by the mother and misinterpreted by the second transcriber; however, the context indicated that Jonas meant *vis* 'fish' and in the end it was decided that the gloss for the sign should be 'VIS' 'FISH'. As he repeated this particular sign/word combinations about 11 times this had quite an influence on our score.

The liberal Kappa was calculated for agreement on transcription for signs seen or not seen[6], words seen or not seen, and words voiced or not voiced (see Tables 4.4, 4.5 and 4.6).

Table 4.4 Liberal Kappa for transcription of whether or not signs are seen (+) or not (-) at the different points in time

Sign seen	1;0	1;6	2;0	2;6	3;0
by children	.56	.86	.77	.62	.88
by mothers	1.	.94	.96	.86	1.

At age 1;0 the score for signs seen/not seen by the children was not satisfactory and at age 2;6 very low. We will have to bear this in mind when we interpret the results in Chapter 6.

6 I would like to gratefully acknowledge here the help of Sonja Jansma, in establishing working definitions for when a sign or a word could be considered seen or not. It was greatly appreciated.

Table 4.5 Liberal Kappa for transcription of whether or not words are seen (+) or not (-) at the different points in time

Words seen	1;0	1;6	2;0	2;6	3;0
by children	.82	.88	.73	.88	.86
by mothers	.88	.80	.82	.80	.78

Across time the transcription of whether words were seen or not was reasonably dependable.

Table 4.6 Liberal Kappa for transcription of whether or not words are voiced (+) or not (-) at the different points in time

Words voiced	1;0	1;6	2;0	2;6	3;0
by mothers	.92	.87	.98	.90	.94
by children	1.	.88	.86	.98	.70

The interrater reliability for the use of voice was quite high, even though some uncertainties occurred in the occasion of whispered words. In the end we decided to score these as unvoiced.

4.5 Handling the data

Due to the small number of subjects we decided to not use statistic measures other than Chi-square (Hatch and Farhady 1982) for the analyses in Chapters 5 through 9. Most data will be presented in numbers and percentages or proportions.
In general we will present individual results, or per mother-child dyad. In some analyses, when the amount of item(s) under analysis was very small per person, results are grouped. For instance the mothers of the deaf children together are compared to the mothers of the hearing children, or the deaf children are compared to the hearing children for developmental aspects. Whenever results are grouped, this will be indicated. The emphasis of the discussion of the data will firstly lay on development, where if possible statistics will be used, or results will be inspected. Secondly, the relation between input and output will be explored by description. And thirdly, we will examine the effect of hearing status of the child either by statistical analysis or by inspection.

5 QUANTITY OF INPUT AND LANGUAGE CHOICE

In this chapter we firstly present the results of the research questions about the quantity of the language input of the deaf mothers and of the language output of the children in section 5.1. Section 5.2 reports on the relation between quantities of input and output. In section 5.3 we present the language choice of the mothers and the children and section 5.4 is a summary of this chapter.

5.1 Quantity of input and output

As described in Chapter 2 deaf adults produce both spoken and signed language, as do the children in deaf families. We have considered here both non-linguistic and linguistic input and output. Before describing the linguistic input and output in section 5.1.3, we will briefly focus on the input and output of vocalizations and movements in the following sections.

5.1.1 Vocalizations and Movements in the input

The definitions of vocalizations and movements were given in Chapter 4 (sections 4.4.1 and 4.4.2).

Results

Firstly we look at the number of vocalizations produced by the deaf mothers to see whether or not these occur to the same extent as found by, for instance van der Stelt (1993) in the interaction between hearing mother - hearing child dyads (see also sections 1.3.2 and 6.1.1). The data are presented in Table 5.1.

Table 5.1 shows that the deaf mothers produce very few vocalizations. The exception is the mother of Jonas who produces many vocalizations at age 1;0 compared to when he is older and also compared to the other mothers. This higher number of vocalizations can be attributed to the play situation: mother and child play peekaboo together and the mother vocalizes (e.g. *boo*) whenever her face appears from behind the chair where she is hiding. Typical vocal turn-taking behavior as found by van der Stelt (1993) (section 1.3.2) is not seen with the deaf mothers at the ages described above. This might be due to the age of the children, but earlier studies of the deaf mothers with the hearing children (Mills and Coerts 1989; Blankenstijn and Van den Bogaerde 1989), of the same subjects but at ages ranging from 0;3 to 1;0, showed no such interaction either.

Table 5.1 INPUT DC+HC: Number of vocalizations by the deaf mothers

No. of vocs.	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf Children	Mother of Carla	-	1	0	0	0
	Mother of Laura	0	0	0	0	0
	Mother of Mark	0	0	0	0	0
Hearing Children	Mother of Jonas	14	0	1	0	0
	Mother of Alex	2	1	1	0	0
	Mother of Sander	0	0	0	0	0

The mothers do not produce any movements during the filming sessions. These did not occur in the recordings where the children were under 1;0 either. We therefore assume that turn-taking practice is done by means other than imitation of vocalizations or movements (see also Chapter 6).

5.1.2 Types of prelinguistic utterances of the children

In the literature first signs and first words are usually described as occurring around the first birthday of a child (see section 2.3). Assuming that movements and vocalizations are (as yet unrecognizable) protosigns and protowords of the children, we expect to find a decreasing number of movements and vocalizations by all children as their linguistic skills increase. In particular, we expect for the hearing children that during the first sessions they will either produce movements and vocalizations only or movements and vocalizations together with signs and words. Ultimately movements and vocalizations will decrease if not disappear altogether. For the deaf children we can predict that as their production of signs increases, their production of movements will decrease. We expect a similar, but delayed development for their spoken development.

Results

Table 5.2 presents the results for the number of movements and vocalizations produced by the children. It happened occasionally that within one utterance a movement and a vocalization were produced simultaneously; in these cases the movement and vocalization were counted separately.

Table 5.2 OUTPUT DC+HC: Number of movements and vocalizations produced by the deaf and hearing children

OUTPUT		Movements					Vocalizations				
		1;0	1;6	2;0	2;6	3;0	1;0	1;6	2;0	2;6	3;0
Deaf Children	Carla	-	9	0	0	0	-	42	20	33	1
	Laura	2	1	0	0	0	10	7	18	6	3
	Mark	0	0	0	0	0	2	34	0	7	3*
Hearing Children	Jonas	0	1	1	0	0	20	7	1	6	7
	Alex	0	0	0	0	0	25	13	12	14	2
	Sander	1	7	0	0	0	16	0	3	0	5

** corrected for 10 minutes*

Movements
The deaf and hearing children produce a few movements mainly at ages 1;0 and 1;6 (as expected). We find no difference in the production of movements between the deaf and hearing children. In fact, only Carla (D) and Sander (H) at 1;6 produce some movements. The other children produce hardly any. We feel that the period between 0;6 and 1;6 should be studied more extensively with shorter intervals between recordings for this aspect, to reveal more information on the development of movements. According to Petitto and Marentette (1991) we should expect no difference in their output if their input is the same. However, according to Meier and Willerman (1995) hearing children need no structural sign input before producing movements (see section 2.3.2). The paucity of data makes it impossible for us to interpret these figures with respect to the input-output relation.

Vocalizations
We find that almost all children produce vocalizations at all ages. Carla (D) produces many vocalizations up to the age of 2;6, after which there is a sharp decrease. She produces significantly more vocalizations than Laura and Mark (D) up to age 2;6[1]. The hearing children vocalize substantially at 1;0, more so than the deaf children. This is a different picture than other researchers might suggest. Clement and Koopmans-van Beinum (1995) found that hearing-impaired children vocalize more often than hearing children do during the first eight months of life, but the children are younger. Gregory (1985a: 7-8) found that at age 1;3 deaf children in interaction with their hearing mothers made on average twice as many expressive vocalizations as hearing children did (68 vs. 28 in 10 minutes).[2] The fact that the hearing children in our study have deaf mothers might be the explanation for the different findings. A phonological study of the use of vocalizations by deaf mothers and their hearing children before the age of 1;0 would perhaps shed more light on the reason for these findings.
We find that the number of vocalizations of the hearing children decreases after age 1;0, especially with Jonas and Sander. We predicted that this should happen together with an increase in the production of linguistic utterances, which we will further discuss below. Alex (H) produces more vocalizations than Jonas and Sander at all times, and also until a later age (2;6). This fits together with the fact that his production of spoken (recognizable) words begins later (see section 7.3.2). He stays longer in the pre-lingual stage.
At 1;0 the hearing children vocalize more than the deaf children, but at 1;6 the reverse is the case, at least for Carla and Mark. These vocalizations are all isolated vocalizations, produced without an accompanying sign. But we also find that Laura and Carla vocalize regularly while signing; in the majority of these cases the meaning of the signs is clear, but no meaning can be attached to the vocalizations.

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1 1;6: χ^2=24.31; 2;0: χ^2=19.15; 2;6: χ^2=29.17; df=2, $p \leq 0.001$ for all ages

2 'Expressive vocalizations' is not clearly defined

Utterances such as these were coded as 'SLN with vocalization'. We will discuss these utterances further in section 6.2.3.

In summary we can say that movements do not occur very often in the language production of Carla, Laura (D), Jonas and Sander (H), and are not produced at all by Mark (D) and Alex (H). Vocalizations are produced at most ages and decreasingly so, both by the deaf and by the hearing children. Carla (D) and Alex (H) appear to produce them more often and for a longer period than the other children do. We saw that vocalizations and movements are scarcely present in the input of the mothers and thus are not (any longer) performing a function in interaction (turntaking). In section 7.1.2 we will discuss the transition from movements to signs and from vocalizations to words in more detail.
In the next section we shall discuss the language choice of the mothers and children at the different points in time.

5.1.3 Quantity of linguistic input and output

Research question 1A (see section 3.1) is formulated as follows: "Do the mothers offer a total amount of language input to their child which is comparable with the average amount offered to deaf and hearing children as established in other research?" Question 1B is "How much language is produced by the children?"

Results for the input

In several studies with very young children (Gregory 1985b; Gregory and Barlow 1986; Kyle et al. 1987; Harris, Clibbens, Chaisin and Tibbitts 1988; Woll and Kyle 1989; Harris 1992) discussed in section 2.2 it was found that deaf mothers offer less language to their children than hearing mothers offer their hearing children. These authors suggest that this is due to the fact that during the first few years of their child's life the deaf mothers seem to be 'training' the visual attention of the children to prepare them for interaction in which sign language is used. As the children grow older, it is suggested, the language quantity will become more similar to that offered to hearing children.
In order to see whether it is also true that the mothers in our study produce less language, we present the total number of linguistic utterances produced at the different points in time in Table 5.3.

Table 5.3 INPUT DC+HC: Total number of linguistic utterances produced by the deaf mothers

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf Children	MCarla	-	118	131	135	174
	MLaura	71	84	114	121	182
	MMark	44	102	156	140	128*
Hearing Children	MJonas	61	152	146	174	115
	MAlex	164	196	164	193	175
	MSander	111	152	142	150	131

** this session is corrected for 10 minutes (no. of utterances in 6.06 minutes is 78)*

The first thing to notice is that there is considerable individual variation. But overall we see an increase over time in the number of utterances offered to the children. We have no explanation as to why the mothers of Mark (D), Jonas, Alex and Sander (H) produce significantly fewer utterances at age 3;0 - this is not caused by a much larger contribution of the children, except perhaps in the case of Jonas. We think that a more intense concentration on the toys by the children, which perhaps holds back the mothers from interfering too much, is a more plausible explanation. This is supported by findings from a study done by Hart and Risley (1999). They found the same decrease in parental input around the age of 3;0 (see section 1.3.1). They explained this by the fact that the increasing fluency of the children led them to pay less explicit linguistic attention to the children, and to consider them to be the same as the 'other' (older) children.

We now compare these figures with those for the input offered by hearing Dutch mothers to their hearing children. van der Stelt (1993), Jansonius-Schultheiss (1999) and Wijnands (personal communication) found the following number of Dutch utterances offered by hearing mothers to their hearing children all around age 2;0 (Table 5.4).

Table 5.4 Number of utterances in studies on Dutch input by hearing mothers to hearing children

Source	in 10 minutes range of number of utterances
van der Stelt (1993) ± 2;0 4 mothers	170 - 200
Jansonius-Schultheiss (1999) 2;0 9 mothers	117 - 290
Wijnands (pc) ± 2;0 2 mothers	188 - 300

The range of number of utterances found in these studies is 117-300. With the deaf mothers we find a range of 114-164 at the age of 2;0 (see Table 5.3). The quantity of input of deaf and hearing mothers is thus comparable, although the deaf mothers stay on the low side of the range.

We also compared the input of the deaf mothers to ASL input offered by two deaf mothers in a study by Kantor (1982:139) (see also section 1.3.1). The one deaf mother offers between 53 and 125 utterances between ages 1;0 and 1;8 and the other mother between 71 and 321 utterances between ages 1;8 and 2;6 in sessions of approximately 45 minutes. Corrected for 10 minutes of interaction this means between 12-28 utterances for the younger child, and between 16-71 utterances for the older child. We see a low amount of input before age 1;8, which we also see in the input to the deaf children in our study. The ASL input for the older child is much less than the amount of input we found.

We find that the total quantity of language offered by the deaf mothers to their children is similar to that offered by other mothers, deaf or hearing, although more is offered than found by Kantor for two deaf mothers. Should we find differences between the output of the children in our study and the output of hearing children in hearing families, then these cannot directly be attributed to the total quantity of input.

Results for the output
In Table 5.5 we present the number of linguistic utterances produced by the deaf and hearing children at the five points in time.

Table 5.5 OUTPUT DC+HC: Total number of linguistic utterances produced by the deaf and hearing children in 10 minutes of interaction

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	43	91	63	103
Children	Laura	1	11	19	83	93
	Mark	3	26	46	97	75*
Hearing	Jonas	5	108	88	86	96
Children	Alex	9	26	95	68	79
	Sander	8	41	95	122	93

** corrected for 10 minutes*

As with the mothers, we see much individual variation at the different points in time. But all children produce significantly more utterances, as they grow older.[3] There are significant differences between the children[4] at age 1;6 (Jonas and Laura), 2;0 (Laura and Mark) and 2;6 (Sander, Alex and Carla). These differences become less marked at age 3;0. Mark (D) and Sander (H) produce fewer utterances at age 3;0 than at the previous session - we will come back to this aspect later in section 5.2.

While realizing that we cannot fully compare the output of the children in our study to the language production of monolingual Dutch children, we still like to present in Table 5.6 some data of Dutch hearing children at age 2;0. In studies by van der Stelt (1993), Jansonius-Schultheiss (1999) and Wijnands (p.c.) hearing children produce the following number of NL utterances.

3 see Appendix to Chapter 5, Table A5.1 for Chi-square values, page 259

4 see Table A5.2 in Appendix to Chapter 5, page 259

Table 5.6 Number of Dutch utterances produced in 10 minutes by hearing children around 2 years of age.

Source	range of number of utterances in 10 minutes
Van der Stelt (1994) 2;0 (n=2)	65 - 177
Jansonius-Schultheiss (1999) 2;0 (n=9)	62 - 175
Wijnands (pc) ± 2;0 (n=2)	125 - 219

At age 2;0 Jonas, Alex, Sander (H) and Carla (D) produce a number of utterances comparable to the number found by van der Stelt and Jansonius-Schultheiss, while Laura and Mark (D) produce fewer utterances. In general then there appear to be no great differences in the number of utterances produced by four of the children in our study compared to other Dutch children. The two exceptions Laura and Mark also produced less language than the other children prior to age 2;0. These differences are possibly related tot the amount of input. This relationship is explored in the next section.

5.2 Relation between quantity of input and quantity of output

We have seen that there is considerable individual variation both in the quantity of input that the children receive as well as in the quantity of their own language production. In section 5.1 we described how the input of the mothers and the children in general increased with time. We want to see whether or not the relation between the increase of the input and the increase of the output, i.e. the contribution to the interaction of the mothers and the children, changes over time. We analyzed the relation as follows: per mother-child pair we looked at the total number of utterances per session of each mother and each child. We performed a Chi-square analysis to see whether or not the proportional contribution shifted over time (for instance, mother's input decreased, child's output increased).

We find significant changes[5] in the relation between quantity of input and quantity of output for Laura and Mark (D), and Alex and Sander (H). For Laura, Mark (D) and Sander (H) a shift is observed at age 2;6, and for Alex (H) at age 2;0. This shift means that while the mother's input increases compared to the last session, the output of the children increases more than the input of their mothers' does.

Carla (D) and Jonas (H) and their mothers also show an increase in the total number of utterances, but there is no significant change in the relation between input and output over time - they both increase to the same extent. We will look at the contribution of the children to the interaction process to see whether or not these

5 see Table A5.3 in Appendix to Chapter 5 for Chi-square values, page 259

shifts mean that they participate increasingly and at what moment they also carry responsibility for the conversation (research question 2).

Barton and Tomasello (1994:130) maintain that in mother-child conversation the children should take half of the conversational turns, but they do not specify the age of the child. Since we have not made an analysis based on turns, we cannot match our data to theirs. However, we will look at the participation of the children and the mothers in the 10 minutes of interaction in terms of utterances. Since both input and output increase, we need to establish whether or not the children carry approximately half of the conversation (in utterances). This will enable us to see whether or not the shifts found above in the interaction between mother and child means a greater participation of the children.

Method
We calculated the proportional contribution to the conversation of the children by dividing the number of linguistic utterances of the children (Table 5.5) by the total number of linguistic utterances of the children *plus* the total number of utterances of the mothers (in Table 5.3) per session.

Results
We present the proportional contribution to the conversation of linguistic utterances of the deaf and hearing children in Table 5.7.

Table 5.7 OUTPUT DC+HC: Proportional contribution to the conversation in linguistic utterances by the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	.31	.41	.32	.47
Children	Laura	.01	.12	.14	.10	.34
	Mark	.06	.20	.23	.41	.37
Hearing	Jonas	.08	.42	.38	.33	.46
Children	Alex	.05	.12	.37	.26	.31
	Sander	.08	.21	.40	.45	.42

We can see that all children proportionally increase their contribution to the conversation over time, although at no point in time do the children dominate the conversation (i.e. produce more utterances than their mother). We emphasize here that we did not make an analysis in turns like Barton and Tomasello (1994).
We find that Carla, Mark (D), Jonas, Alex and Sander (H) all proportionally participate more at the same age that their output increases quantitatively. For Carla this occurs at age 2;0 and 3;0, for Mark at age 2;6, for Jonas at age 1;6 and for Alex and Sander at age 2;0. Although the input of all mothers increases, the children can contribute more to the conversation, as they grow older. Only for Laura this is not

true: Laura's output increases significantly at age 2;6, but not until age 3;0 does she begin to participate more actively in the conversation with her mother.
Overall we find that at 3;0 the children carry about 40% of the conversation - the same percentage can be found for the children in the Wijnands study (p.c.), also counted in utterances.

5.3 Language choice of the mothers and children

Until now the total language input and output has been considered but it is to be expected that different languages are involved, Dutch and SLN, and also possibly a mixed simultaneous code as suggested by Mallory et al. (1993) and Romaine (1995) (see section 2.2.1). The languages used in the input can be expected to influence the output of the children.

Method
As discussed in detail in section 2.2.1, we do not know exactly what the function of spoken words is when accompanying signs. Are they part of SLN, Dutch together with SLN or a third system? We decided to consider all utterances with simultaneous signing and speaking as a separate system (SC). In this way differences in this form of input or output can become more easily manifest and lead to insight into whether this does function as a third system. Strict definitions were adhered to for this study. We will return to the question of the status of SC in Chapter 10.
Thus all linguistic utterances are coded in the following way:

NL If an utterance consists of one or more spoken words (with or without voice) with no co-occurring signs, it is coded as a Dutch utterance. If a word is produced simultaneously with a movement (MOV) (see section 4.4.1) to which no meaning can be attached the utterance is coded NL.

SLN If an utterance consists of one or more signs, with no co-occurring spoken words (with or without voice) it is coded as a SLN utterance. If a sign is produced simultaneously with a vocalization (voc) (see section 4.4.1) or an oral component (see section 2.2) (e.g. the sign *WIND* with 'shhhh') the utterance is coded as SLN.

SC If an utterance consists of one or more words, produced simultaneously with one or more signs, it is coded as a SC utterance. This definition is applied very strictly. For instance, if a complex sign-utterance (i.e. two or more signs) is produced with only one mouthed word or vice versa a complex word-utterance with one sign, this utterance is coded as SC. The strict adherence to this definition may thus cause the number of SLN, and possibly NL utterances to be smaller than it should be.

5.3.1 Language choice of the mothers

In this section we will look at the proportions of the different languages as defined above in the input of the deaf mothers (research question 3A, section 3.1).

Results

Figures 5.Ia-f show the language choice of the deaf mothers in interaction with the deaf children and the hearing children.[6] These figures are presented individually for purpose of comparison.

Figure 5.Ia Mother of Carla (D)

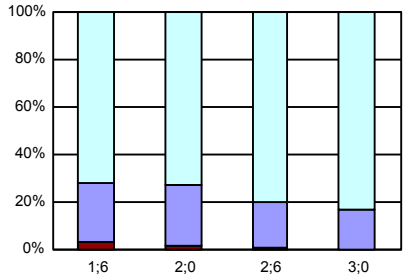


Figure 5.Ib Mother of Laura (D)

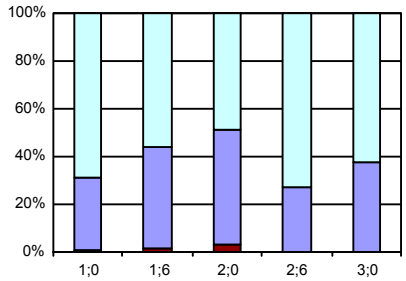


Figure 5.Ic Mother of Mark (D)

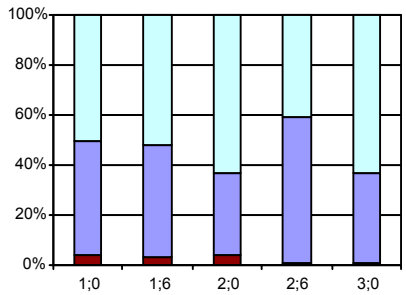


Figure 5.Id Mother of Jonas (H)

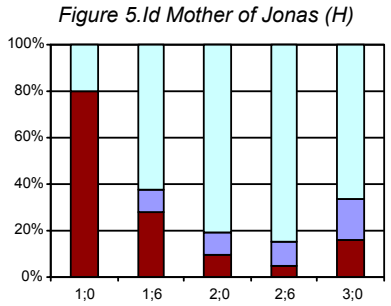


Figure 5.Ie Mother of Alex (H)

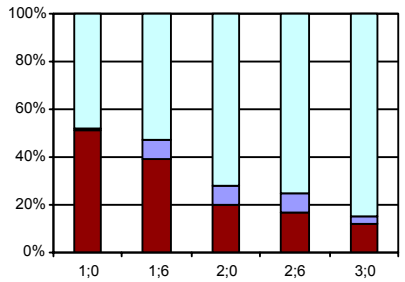
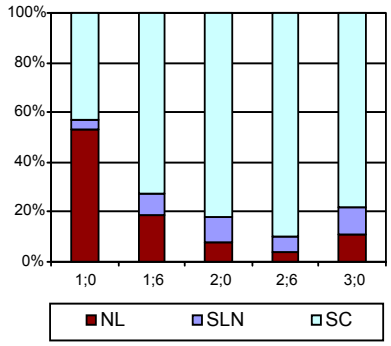


Figure 5.If Mother of Sander (H)



Figures 5.Ia-f INPUT DC+HC:
Language choice of the deaf mothers

6 see also Appendix to Chapter 5, Table A5.4, page 260

With Carla, Laura and Mark (D) the mothers clearly prefer SC and, in second place, SLN, and a few NL utterances are produced at different times. On average across time the deaf children are offered 34% SLN, 65% SC, and a mere 2% of NL. With Jonas, Alex and Sander (H) SC is also preferred, but NL is in second place. Some SLN is offered to the hearing children in most of the sessions. The hearing children receive on average 8% SLN, 70% SC and 22% NL.

Data provided by for example Zurer Pearson et al. (1995) for Spanish and English bilingual input show proportions of 60-40% or 40-60% for the two languages, depending on the specific language situation of the child. The children acquired both languages with this division. But is does indicate that the proportions for SC with the deaf children and with the hearing children clearly fall within a range necessary to be able to acquire a language. The languages which are in second place with the deaf children (SLN) and with the hearing children (NL) are proportionally smaller than the 40% found by Zurer Pearson et al. (1995). And the proportions of NL with the deaf children and SLN with the hearing children are even smaller. On the basis of the percentages found for NL in the input to the deaf children (mean 2%) and SLN to the hearing children (mean 8%) it is questionable whether or not this input forms a basis sufficient for the children to be able to acquire these languages.

Another factor is that in the situation described by Zurer Pearson et al. (1995) the children were offered one language by one person, and the other language by another person (and usually on separate occasions). This is not the case in our study where one person offers both languages in a mixed context.

The hearing status of the children has an effect on the input. The mothers produce more Dutch with the hearing children. SC was not, however, expected to such a large extent with the deaf children since they have little access to the spoken mode. Spoken languages can often be distinguished from one another even in mixed utterances. Spanish and English for example are very different structurally; German and Dutch are close however. Van de Weijer (in press) found that of the input to a child aged between 2;6 - 2;9, 59% could be distinguished as German, 11 % as Dutch, and 31% as either, e.g. the child's name or small words used as discourse markers (see also Quay 1995). SLN and Dutch can be distinguished easily from each other, but in our study we encounter signs and words offered simultaneously.

SC is the bulk of the input for both the deaf and hearing children but the question remains whether it is a separate system. It is possible that differences will emerge between the SC offered to the deaf children compared to the hearing children. This question will return throughout the remaining chapters.

5.3.2 Language choice of the children

All linguistic utterances of the children were analyzed in the same way as the utterances produced by the deaf mothers to see which languages they produced (research question 3B). Each linguistic utterance was coded as either SLN (Sign Language of the Netherlands), NL (Dutch) or SC (Simultaneous Communication) following the definitions described in section 5.3.1.

Results

There were a limited number of linguistic utterances produced at age 1;0 (see Table 5.4) The proportions of SLN, NL and SC utterances were therefore considered from the age of 1;6 on. Figures 5.IIa-f present these data.[7]

As can be seen from Figure 5.IIa-c the deaf children clearly prefer SLN at all ages, but there is variation among them across time in the amount of NL and SC used. Carla has more SC than Laura and Mark. She uses SC and some Dutch utterances at all ages. Laura produces hardly any NL utterances, and only a few in SC. Mark produces only a little NL and even less SC than his sister.

Amongst the hearing children there is even more variation (Figure 5.IId-f). Jonas and Alex clearly prefer Dutch in the beginning but shift their preference to SC. Sander has a preference for SLN at 1;6, but later also shifts to SC. He produces considerably fewer NL utterances than Jonas and Alex.

It might be thought that movements would become SLN and vocalizations Dutch utterances (see section 5.1.2). This does not appear to be the case, however. Carla's productions of movements almost ceased after age 1;6 so we would expect an increase in SLN utterances, which we do not see. Although Carla vocalizes a great deal until age 3;0, her production of NL utterances does not increase significantly at this age; apparently her vocalizations are not replaced by Dutch words. In Laura's production there is no apparent relation between the disappearance of movements (after age 1;6) and an increase in sign language production (age 2;6). Mark produced no movements between 1;0 and 3;0 and his vocalizations decrease after age 1;6 – but there is no increase in spoken words. With Jonas (H) there is no clear relation between his use of movements (n=2) and his sign language production. His production of vocalizations decreases after age 1;0 and this goes together with an increase in linguistic utterances. Alex' vocalizations steadily decrease over time. Sander uses movements and vocalizations at ages 1;0 and 1;6 after which they almost disappear, and there is no relation with an increase in linguistic utterances.

When we compare the data of the mothers in Figures 5Ia-f to the data of the children presented in Figures 5.IIa-f we see that the language choice of the children does clearly reflect the language choice of their mothers (research question 4).

Carla, Laura and Mark (D) are offered mainly SC and SLN, but they obviously prefer SLN, although Carla and Laura also produce some SC utterances. The hearing children are offered mainly SC input but also Dutch, and a little SLN. Jonas' mother offers him mainly Dutch at 1;0, but from then on shows a preference for SC: a choice that Jonas does not reflect until the age of 3;0. Alex' mother also uses SC most often, but Alex clearly prefers Dutch up to the age of 3;0, when his SC utterances increase. Sander's mother prefers SC at all ages, except at 1;0. Sander reflects his mother's choice of language after the age of 1;6, but he uses a larger

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7 see Appendix to Chapter 5, Table A5.5, page 260

proportion of SLN than his mother does, and also a higher percentage of NL utterances.

Figure 5.IIa Carla (D)

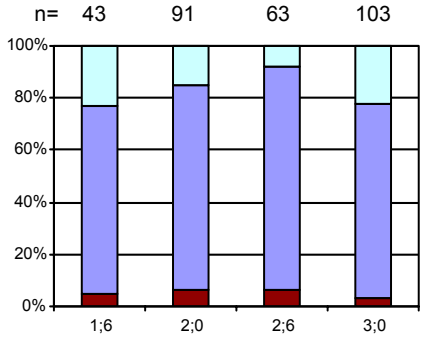


Figure 5.IIb Laura (D)

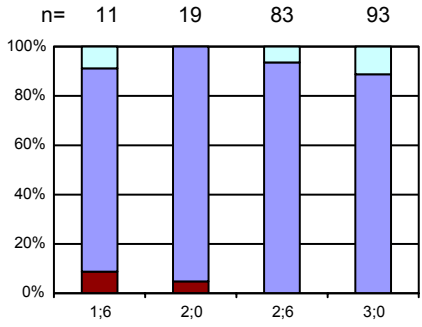


Figure 5.IIc Mark (D)

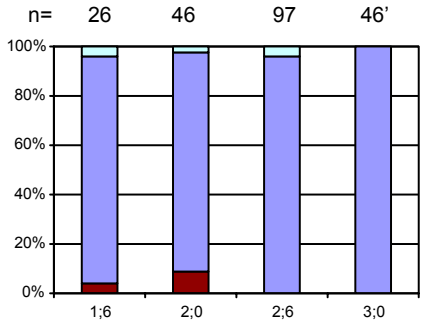


Figure 5.IId Jonas (H)

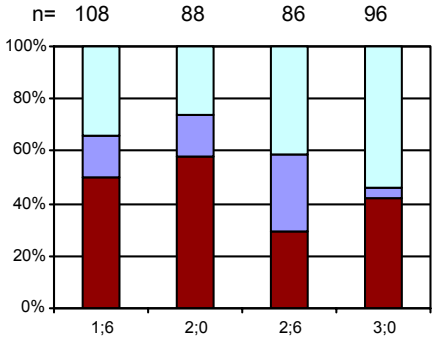


Figure 5.IIe Alex (H)

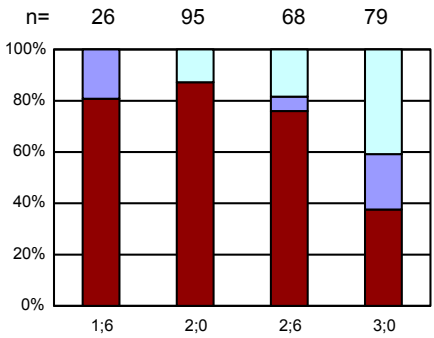
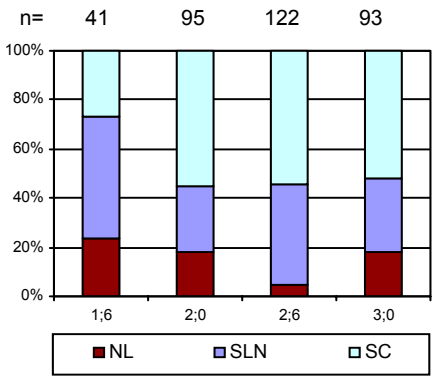


Figure 5.IIf Sander (H)



Figures 5.IIa-f OUTPUT DC+HC: Language choice of the deaf and hearing children

Multilingual children make a choice for a particular language not only under the influence of the input they receive, but also due to other factors such as subject of conversation, partner in conversation etc. (Grosjean 1982). If in our study the hearing status of the speaker/signer is a decisive factor in choosing a language, this would explain the choice for SLN of the deaf children; however, Carla uses more SC than Laura and Mark, which could be related to the fact that her mother offers her more SC input than Laura and Mark's mother does. Carla also uses some Dutch, which her mother hardly offers to her. However, these will prove to be all one-word utterances (see also section 7.1.3). Their own hearing status seems to be the most important factor for the deaf children, but they also show some influence from the hearing status, and the language choice, of the partner.

We might expect the hearing children to use mainly Dutch under the influence of hearing family members (see section 4.1); however this is only the case with Alex. He prefers Dutch and SC but also uses some SLN, particularly at 1;6 and 3;0. Jonas uses SLN also at all ages, and in general produces a higher percentage of SLN utterances than his mother, as does Sander. From their language choice we can thus see that the hearing children seem to adapt to the fact that their mother is deaf from quite an early age.

This interpretation is supported by the linguistic behavior of the hearing children with the hearing researcher. Before and after the filming sessions the hearing children would talk with the researcher, and all three of the hearing children would use Dutch. Sander at 1;2 already made a distinction in his language production between his mother and the researcher. With his mother he would drop his voice, but with the researcher he would speak with volume. Use of voice appears also to be an indication of awareness of hearing status (see sections 6.1.1 and 6.2.3).

5.4 Summary

The deaf mothers in this study provide their children with as much language input in total as hearing mothers of hearing children do. The input increases in time as might be expected, with some individual variation. The children also produce total amounts of language comparable to hearing children in hearing families. They also increasingly take part in the conversation. At age 3;0 this amounts to 40% of the utterances, again comparable to hearing children in hearing families.

The input is clearly multilingual as is the output of the children. We defined three language modes: SLN, Dutch and a simultaneous mode in which signing and spoken words are combined, Simultaneous Communication or SC. All three language modes are offered to all children but the dominant mode is SC for both the deaf and hearing children (65-70%). The use of SC increases over time with the hearing children. The deaf children produce mainly SLN and this stays relatively constant over time. Only Carla produces a little SC. The hearing children produce all three language modes, although Alex prefers Dutch, Jonas Dutch and SC and Sander SC and SLN. All children show an increase in their use of SC across time.

The children increase their output along with the mothers' increased input. It is not clear what the relationship is between the two. We should get more insight into this relationship by considering the structural changes in Chapter 9. The influence of the mothers' language choice is also not directly obvious. Although SC is the dominant mode of the mothers, the children do not generally reflect that. The deaf children use predominantly SLN. They are offered very little Dutch and scarcely produce any either. However it is likely that their own hearing status affects their language choice as much as the input. The hearing children show variation in their language choice, even though their input is very similar. They do increasingly produce SC as do the mothers with them. They receive very little SLN but they often produce proportionately more SLN utterances than their mothers, in particular Sander. The input of SLN and SC appears to be enough for acquisition to take place. The hearing children receive very little Dutch in their mother's input but they do produce it. Clearly the other sources of Dutch are sufficient for acquisition to take place. Their language choice appears to be affected by the input but also by the hearing status of their conversation partner. Their awareness of hearing status in language choice is obvious from their behavior with other hearing adults, since there they do not sign.

The hearing status of the children does not affect the total amount of language they are offered or the total output. It does affect the language choice of the mothers since the hearing children receive very little SLN whereas the deaf children receive very little Dutch. The children's output reflects their own hearing status in that the deaf children acquire SLN although they are mainly offered SC. In Chapter 6 we shall see whether accessibility could be an explanation for this. The hearing children use more SLN than might be expected from the input, which seems to reflect some awareness of the mothers' hearing status. Two of the children, Jonas and Alex, use a considerable amount of Dutch, which is clearly a reflection of their own hearing status. This is not the case with Sander who clearly makes a different language choice, namely predominantly SC and SLN. But the output of the two groups of children is quite different in terms of language choice.

6 LANGUAGE ACCESSIBILITY

In section 6.1 we show how accessible the input offered by the deaf mothers is. In section 6.2 we look at the accessibility of the language production of the children for their mothers. This analysis will indicate whether or not the children are aware of the fact that their mother is deaf and therefore needs to have visual access both to the signed and to the spoken utterances. In section 6.3 we discuss how the mothers and children use the two modalities in terms of semantic content and the effect thereof on the accessibility of the content of the language production. We look at the relationship of the quantity of input and the attention-giving development of the children in section 6.4. Section 6.5 is a summary of this chapter.

6.1 Input and accessibility

In Chapter 5 we showed that the mothers offer their children SLN, NL and SC. However, as described in section 2.2, offering a language is not enough. That language must be accessible for the child in order for the child to be able to acquire it. This means for the deaf children that they must have visual access, both to signed and to spoken input. The hearing children can hear the spoken language, at least if it is produced with voice, but must also have visual access to sign language. Research question 5 was formulated to see how much of the input is accessible to the children (see section 3.2). Furthermore we want to establish who is responsible for the accessibility of the input, in other words how do the mothers take care that the children have access to their signed and spoken input? Do the children contribute as well? (research questions 6, 7 and 8 in section 3.2).

Method
All signs and words are coded as 'seen' (+) or 'not seen' (-). Signs and words are coded as 'seen' when the signer and the addressee are looking at each other. Signs made by the signer within the visual field of the addressee are also coded (+); words produced with voice (+v) are not coded for visibility when addressed to a hearing child. All words addressed to a hearing child without voice (-v) are coded as + or - seen. When there was doubt as to the visibility of a sign or a word, it was coded as not seen (-). This conservative coding may have inflated the percentage of signs and words that were not seen. The interrater reliability between the two transcribers was satisfactory for these aspects at all ages, except at 1;0 and 2;6 for signs, and for words at 2;0 (see section 4.3.3). At 1;0 the liberal Kappa for signs seen was .56. Disagreement was mainly due to the lack of feedback from the children (e.g. not responding in any way to indicate that a sign was seen). All signs produced by the mothers at 1;0 were checked a third time and, in case of doubt, coded as not seen. At

the age of 2;6 the low Kappa (.62) was caused by a low reliability in scoring signs as 'seen" by Carla (D), who was much preoccupied with attracting the attention of the person behind the camera. She gave little attention and feedback to her mother, which influenced the interpretation of the visibility of signs made in her peripheral vision. Her mother's signs were checked a third time, and in case of doubt coded as not seen. The low Kappa for words seen at 2;0 (.73) was caused by 3 words produced by Carla's mother, which were coded differently by the two transcribers.

To answer the questions on attentional strategies (research questions 6, 7 and 8) we chose the following procedures.
Based on studies by Harris et al. (1987; 1989; 1992), Kyle and his colleagues (1987, 1988) and van der Stelt and Jansonius-Schultheiss (1990) (see also section 2.2.1) we categorized the different strategies for attention in two main categories. We distinguish **non-explicit** strategies, where the mother does not actively manipulate the child's attention, and **explicit** strategies where the mother actively seeks the attention or the eye-gaze of the child before producing an utterance (see *Procedures* for details).
Per session all linguistic utterances produced by the deaf mothers are coded for a strategy for attention.

Procedures
S Signer or Speaker
Ad Addressee

Non-explicit strategies for attention

A S is looking at Ad and produces a sign, or a string of signs, in the normal location and/or starts speaking while Ad is looking at her. S waits, as it were, for Ad to look at her spontaneously before producing an utterance (NL, SLN or SC).
There is one subcategory within category A:

A' All second (or subsequent) utterances that are uttered after S *already* has the attention of Ad (via whatever strategy employed for the first utterance) are coded with A'. S takes advantage of the fact that Ad is already looking at her to produce a second (or subsequent) utterance. It is of no importance whether or not Ad produces an utterance in-between two A' utterances, because what matters is continuous eye contact or visual attention to S.

B S starts signing in the usual place for that particular sign, or speaking or signing and speaking simultaneously, while Ad is *not* looking at her.
The basic assumption here is that when S is the mother, it is her intention to induce the child to look up at her when she is signing. This is either caused by a perception of motion within the periphery of the child's vision or, in case of the hearing children when she is speaking, because they hear her voice.
When S is a child we assume that there is *no* intention on his/her part to induce the mother to look up, since children have no native knowledge of

attention-giving and turn-taking behavior (Siple et al. 1990; Swisher 1992). There is no evidence in the use of this strategy that they have acquired this behavior.

AB Ad is looking at S, S is not looking at Ad, and S starts signing and/or speaking.

If S is the mother we assume that she is aware that the child is looking at her and that she takes advantage of this fact to produce an utterance. However, if S is a child, we assume that the child has no such awareness (i.e. that the mother is looking at him/her), and thus does not take into account the need for visual attention of the mother.

Explicit strategies for attention

C S displaces her sign(s) in such a way that Ad need not look at or towards her in order to perceive the sign(s). So S takes responsibility for the visibility of the sign(s). This strategy can of course only be used with SLN and the signed part of SC utterances. The following subcategories are distinguished:

C1 A lexical sign of an utterance, which usually would be made on or near the body or the head of S is instead made *on the body or head of Ad.* Ad can thus perceive the sign(s) in a tactile way.

C2 A lexical sign of an utterance can be displaced *into the signing space of Ad.*

For instance, when the child is sitting on the mother's lap while reading a book. The mother can reach her arms around the child, and produce the signs thus in his/her signing space.

C3 A lexical sign of an utterance can be displaced *within the visual field of Ad.*

For instance, if a child is looking at an object, the deaf mother may choose to make the sign near the object, while the child is looking at it. Any first (and subsequent) lexical sign that is displaced, i.e. not made in its regular place, causes the utterance to be coded with C3.

D1 S is looking at Ad, and manipulates an object to *gain* the attention of Ad *for an utterance.*

This can be done in the following ways:

D1.1 S moves an object within the visual field of Ad

D1.2 S makes a sound with an object (e.g., squeaky noise in a toy-bear or sounding a bell)

D1.3 S moves a toy and simultaneously makes a sound with it, e.g. banging a toy on the floor.

D2 S manipulates (the body of) Ad, to indicate that attention should be paid to S.

This is scored in two ways:

D2.1 S adjusts the position of Ad

D2.2 S taps or touches Ad somewhere on the body

D3 S manipulates attention of Ad:

D3.1 S attracts attention of Ad by the use of *voice* (e.g. name-calling or shouting)
D3.2 S waves an arm/hand within the visual field or periphery of Ad
D3.3 S makes noise or vibrations by means of, for instance, banging a fist on a table, or stamping on the floor

Exceptional cases
A special category is formed by those linguistic utterances that consist of a pointing gesture with one spoken word or with one lexical sign, in particular those cases where the mother points on or near an object or a picture in a book whilst the child is already looking at it. These utterances (naming or labeling utterances) are coded separately in the following way for later analysis (see Chapter 7)
If a single Point is produced together with *one* spoken word, or a *dislocated* sign, the utterance is coded C3. Note, however, that if Ad is looking at an object, and S points on or to this object while producing *more than one* word, or one or more word(s) simultaneously with a sign in the normal location, the utterance is coded B. Some examples follow below, where the child is looking at the book and the mother is signing/speaking:

(1)	sign	POINTonbook
	spoken	rabbit
	code	C3
(2)	sign	POINTonbook
	spoken	that's a little rabbit
	code	B
(3)	sign	POINTonbook RABBIT (dislocated near book)
	spoken	that rabbit
	code	C3
(4)	sign	POINTonbook RABBIT (on right side head of S)
	spoken	that rabbit
	code	B

Per session we looked at how the mothers tried to attract the attention of their child for all SLN, NL and SC linguistic utterances. Per strategy (A, B, C and D) we totaled the number of linguistic utterances in each language. Some utterances could not be coded for a strategy. For example, it should be clear that those utterances consisting only of a vocative (e.g. Mother calls son: *Alex*!) are considered to be a strategy for attention and these utterances should be deducted from the total number of utterances. Some utterances could not be coded with a strategy for attention because the child was out of range of the camera; these utterances were coded as 'rest'. An example should make the coding and analysis clear:

At age 1;6 of Jonas (H) his mother produced 152 linguistic utterances in total (see also Table 5.3). Strategy A was used with 18 utterances, B with 77, C with 54 and D with 2.[1] Table 6.1 shows how these strategies were distributed over the three language systems:

Table 6.1 INPUT HC: Strategies for attention used by Jonas' mother at 1;6

Mother of Jonas	NL	SLN	SC	Total
Strategy A	1	4	13	18
Strategy B	39	0	38	77
Strategy C	0	11	43	54
Strategy D	1	0	1	2
rest	1	0	0	1
Total no. of utterances	42	15	95	**152**

In this example 72% of strategy A is used with SC utterances (13 out of 18), 51% of strategy B with NL (39 out of 77), 80% of strategy C with SC (43 out of 54) and strategy D equally with one NL and one SC utterance. If more than 50% of the use of a particular strategy is linked to a particular language. then that language is noted for that session and strategy.

6.1.1. Accessibility of the input to the children

Here we are interested whether the signs are seen by the deaf and hearing children and whether the deaf children can see the mouthed words (research question 5).
In Figure 6.I we present the percentages of signs that are seen by the deaf and hearing children.[2]

1 see also Table A6.5d in Appendix to Chapter 6, page 262

2 see Appendix to Chapter 6, Table A6.1 for the raw figures, page 261

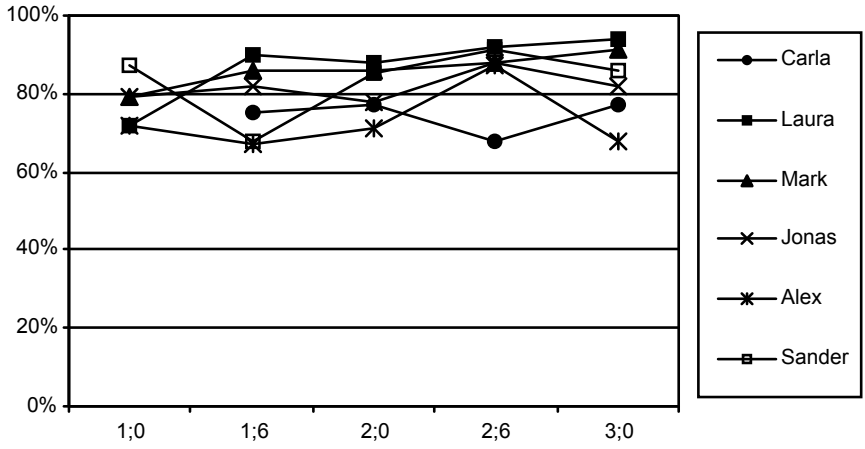


Figure 6.I INPUT: Percentages of signs seen by the deaf and hearing children

Harris (1992) found 80% of the input as an average percentage for signed and spoken utterances to serve as intake (see also section 2.2.2). We see that for sign input the percentages vary to a certain extent with the individual children in our study. Carla (D) and Alex (H) seem to differ slightly from the other children in that they have somewhat less access to the signed input. However, on average the deaf children can see 83% of the signs and the hearing children 79%, which is comparable to what Harris found for deaf children in England.
If initially during interaction the mothers focus on training the attention-giving behavior of the children, we would expect that as the children grow older and acquire the necessary attention-giving skills, they would see increasingly more signs. There is a slight increase over time, but this is not significant for all children (chi-square test). The deaf and hearing children see the signs offered to them equally well from age 1;0 on, with a peak at 2;6 for all children except Carla (D). We will discuss in sections 6.1.2 and 6.1.4 how the high percentage of visibility of the signs can be explained.

In Figure 6.II we present the percentages of words seen by the deaf children.[3]

3 see Table A6.2 in Appendix to Chapter 6, page 261

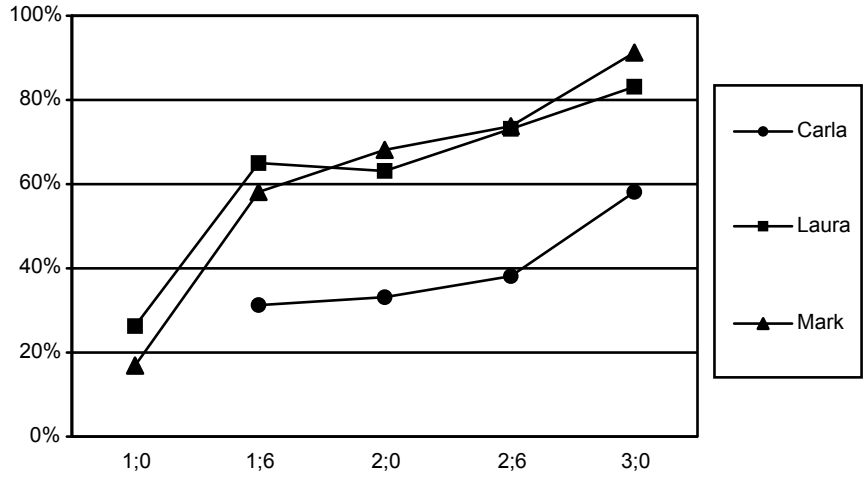


Figure 6.II INPUT: Percentages of words seen by the deaf children

On average the deaf children see only 55% of the words spoken or mouthed by their mother, although individually there are great differences (range is 17-91%). Carla's mother does not succeed in getting visual attention for more than 38% of her mouthed or spoken words until Carla is 3;0, when we see an increase to 58%. Laura and Mark seem to be able to access the mouthed or spoken input increasingly better, but only at 3;0 do they see more than 80% of the words in the input.
Most of the spoken input to the deaf children forms part of SC utterances (see Figures 5.Ia-c). Therefore the effect of missing the spoken or mouthed is not necessarily equivalent to missing all or part of the semantic content of the utterance. We will discuss how the SC proposition as a whole is distributed over the two channels in section 6.3.

For the hearing children only the mouthed words produced by the mothers (i.e. words produced without voice) require visual attention. When we take into consideration the total number of vocalizations and words produced by the deaf mothers with their hearing children[4], which is 4677 in total, only 4% (163) are uttered without voice; half of these are not seen by the hearing children. In comparison, the mother of Laura and Mark (D) offers her children 703 and 534 words respectively, 85% of which are produced without voice. Carla's mother produces 733 words, and 94% is produced *with* voice. We will come back to this fact in Chapter 9, where we will discuss structural aspects of the input. Information on the use of voice by the children is presented in section 6.2.3.

4 see Appendix to Chapter 6, Table A6.3, page 261

The hearing children will have no access to NL utterances in which these (unseen) mouthed words are used. If the mouthed words are used in a SC utterance of which the children see the signed part, it will depend on the propositional structure of the SC utterances whether or not the child has access to the full linguistic message or not (see section 6.3). Since the percentage of unseen mouthed words is so small, we decided not to make this analysis at this point. We conclude that the majority of the words offered to the hearing children can serve as uptake since they are heard (see section 1.3.1). Here we assume that the speech of the mothers is intelligible to the children, even though it often (but not always) has characteristics that distinguish it from standard Dutch (see also section 2.2.3).

As discussed in Chapter 5, for all children at most points in time SC is the language mode preferred by the mothers. Although the hearing children have access to the spoken part of SC through their hearing, Laura and Mark (D) seem to miss a substantial part of the spoken or mouthed linguistic information up to 2;6, and Carla (D) even more at all times. Carla has only access to less than 58% of her mother's spoken language production. Her output in fact does resemble what her mother offers, since she has access to most of her mother's signing but fails to see the majority of the spoken or mouthed words (see section 5.3.2). Her output thus seems to reflect what her uptake may have been. However, even though Laura and Mark have better access to their mother's spoken input, they do not reflect her choice of SC in their output, so hearing status seems to be more important.
In section 6.3 we will discuss the effect of the accessibility for the different modalities in more detail.

In the next section we will describe how the deaf mothers achieve accessibility of their input.

6.1.2 Strategies for attention used by the deaf mothers

We saw in the previous section that the input is accessible to the children more or less to the same extent over the years. As we mentioned before (section 2.2.2), it has been shown that deaf mothers seem to train their deaf and/or hearing children to look at or towards her, at least during their first year of life (Gregory and Barlow 1986; Kyle et al. 1987; Harris 1992). If there is no change in accessibility of the input to the children, as they grow older, we may well wonder if there is a change in the way the mothers make the input accessible and if there is a change in the attention-giving behavior of the children. We would expect that the children increasingly pay attention spontaneously so that the mothers need to employ explicit strategies to get their attention less and less often. Here we examine which strategies are employed by the Dutch deaf mothers. Firstly we will look at the relation between non-explicit - explicit strategy use for all mothers over time, and secondly at the distribution of the four main subcategories over the different language modes.

Non-explicit versus explicit strategies

Figures 6.IIIa and 6.IIIb show the use of explicit strategies (C and D), expressed as a percentage of the total use of all strategies by the deaf mothers with the deaf and hearing children respectively.[5]

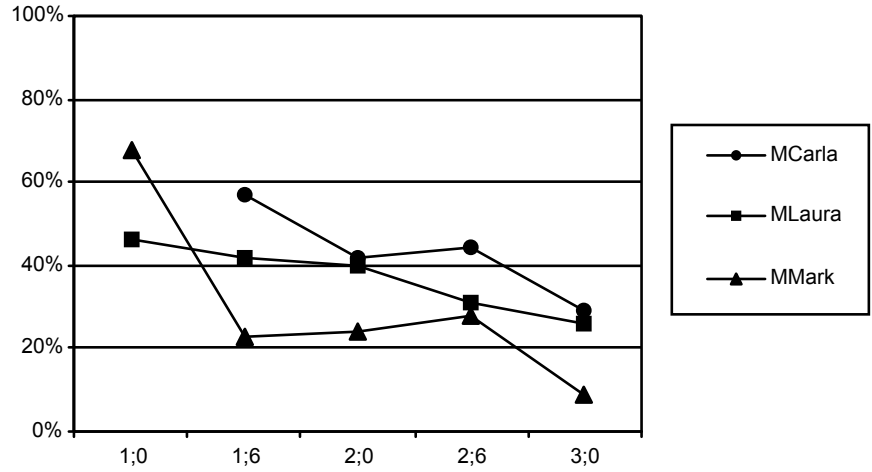


Figure 6.IIIa INPUT DC: Percentages of explicit strategies over all strategies used by the deaf mothers with the deaf children

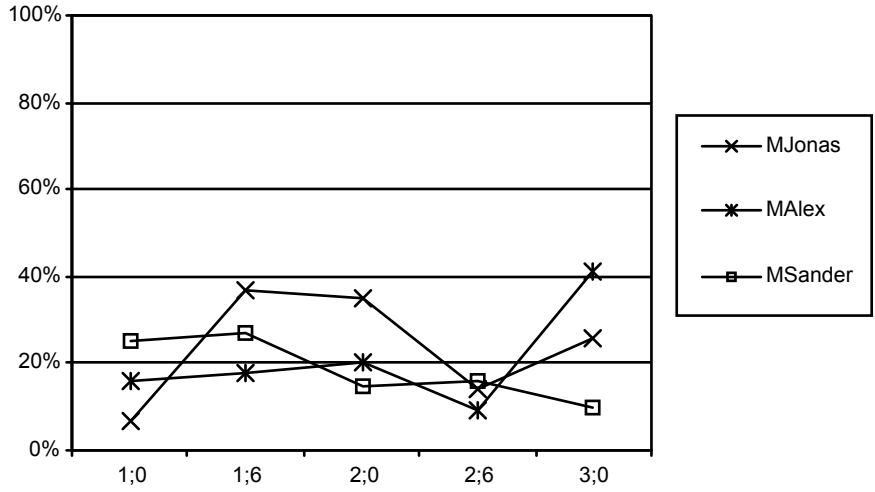


Figure 6.IIIb INPUT HC: Percentages of explicit strategies over all strategies used by the deaf mothers with the hearing children

5 see Appendix to Chapter 6, Table A6.4 for the raw data, page 261

As was expected, strategies C and D are used decreasingly over time with most children (see also Waxman and Spencer 1997). Exceptions are the mothers of Jonas and Alex (H) at age 3;0. A very plausible explanation for the increase in the use of explicit strategies seems to be that in these sessions both boys were very busy with their toys and not inclined to pay attention to their mother. Comparing the use of explicit strategies with the deaf children and with the hearing children there is a clear difference at age 1;0. The deaf mothers use explicit strategies proportionally more with the deaf children than with the hearing children, especially with Carla and Laura (D). We will come back to this point in the next section.
In general we can say that our prediction that explicit strategies will be used less as the children grow older is correct. We will next look at which strategies are used specifically with the deaf and the hearing children.

Preferred strategy for attention by the mothers
Looking at the strategies for attention in more detail (see Table 6.2) we see different patterns for the strategy preferred by the deaf mothers at different points in time.[6] A strategy is called 'preferred' when it has *the highest percentage of use in one session*. Preference for more than one strategy (as for Mother of Carla at 1;6: C/B/D) means that these strategies have the same percentage, plus or minus a difference of 3 %.

Table 6.2 INPUT DC+HC: Preferred strategy for attention by the deaf mothers

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla	-	C/B/D	B	D	A
Children	MLaura	C	A/C	A	A	A
	MMark	C	A	A	A	A
Hearing	MJonas	B	B	B	A/B	B
Children	MAlex	B	B	A/B	A	B
	MSander	B	B	B	A/B	A

With the deaf children we can see variation. The mother of Laura and Mark shifts from C (explicit) to A (non-explicit) whereas Carla's mother shows great variation. With the hearing children there is a different pattern. The mothers at first use strategy B, but they all shift at some point to A/B or A. From age 2;0 - 2;6 on the mothers mainly sign and/or speak after the child has looked up, or while the child is not looking (but expected to look up).
Strategy B is a strategy which accommodates most to the fact that the children are hearing. Because the mothers predominantly use SC and NL with voice with the hearing children (see also Rea, Bonvillian and Richards 1988), there is really no need for the hearing children to pay visual attention to their mother (see also section 6.3). We point out here that we coded the *first sign or word* in each utterance for use

6 see also Appendix to Chapter 6, Tables A6.5a-f, page 262-263

of a certain strategy. We did not analyze here how successful each strategy was in terms of obtaining visual attention at the level of signs and/or words. As will be seen in later analyses (section 6.1.4) the frequent use of a stategy does not imply that it is successful in getting visual attention. The response to different strategies will be discussed in section 6.1.4.

We predicted that if the mothers do need to actively attract their child's attention, they would use different strategies with the deaf and with the hearing children. This is indeed what we found. The mothers attract the deaf children's attention through dislocating signs or by tapping them or waving (substrategies C, D2.2 and D3.2). With the hearing children these strategies also occur but to a much lesser extent, and often accompanied by a vocative (substrategy D3.1). These results confirm findings by Waxman and Spencer (1997) for ASL. Overall we find that until the children are around 2;6 the mothers take responsibility for the visibility of their linguistic input. They adapt to the hearing status of their child in the use of their strategies.
As we already know (see section 5.3), the language choice of the mothers is different with the deaf and hearing children (i.e. SC and SLN with the deaf children, and SC and NL with the hearing children). It is possible that a certain strategy is linked to a particular language. We will discuss this aspect in the next section.

6.1.3 Relationship between strategies for attention and consecutive language input

In the previous section we have shown that the deaf mothers prefer different strategies for attention with the deaf and with the hearing children. Are the strategies that are used by the deaf mothers linked to one particular language? For instance, is it the case that strategy C is only used with SLN and not with SC utterances? (see research question 7 in section 3.2).

We find that strategies A and D are mainly linked to SC at all times for all mothers.[7] Strategy B is also used most with SC utterances although not as consistently. Strategy C seems to be used often with SLN with the deaf children, but with SC with the hearing children. Of course we must take into consideration here that the hearing children were not offered much SLN anyway.
We can draw the conclusion that all of the strategies are used most frequently with SC utterances with the hearing children and with Carla (D). Since with all children SC is used predominantly in the input, we cannot say that we found a preference for a strategy with one particular language as we expected. However, strategy C is used predominantly with SLN with Laura and Mark (D), while with the other children mainly with SC. The choice for a particular strategy seems to be driven more by the focus of the child's attention or by the activity mother and child are engaged in, than by the language choice of the deaf mother.

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7 see for full details Appendix to Chapter 6, Tables A6.6a-f and Table A6.6g, pages 263-265

In the next section we will consider what effect the use of the different strategies has on the attention-giving behavior of the children.

6.1.4 Relationship strategies for attention and attention-giving behavior of the children

Firstly, we would like to know how the children react to the strategies for attention used by their mother. Are these strategies successful? Do the mothers actually manage to attract the visual attention of their child? Secondly, is there a connection between strategy A and the spontaneous visual attention-giving of the children? If all mothers show an increase in the use of strategy A, we can deduce that the children must be looking up at them more often as they grow older. We formulated question 8 in section 3.2 so that these two aspects are covered: "Is there a relationship between the strategies for attention used by the deaf mothers and the attention-giving behavior of their deaf or hearing child?"

Response of the children to strategies B and D

We will first discuss the need for a reaction of the deaf and hearing children to their mother's different strategies. For strategy A no response is expected, since the mother already has the visual attention of her child. If the mother employs strategy B, the child may either respond by looking up (+) or not (-). For strategy C no response is required of the child, since the mother takes care that the child can see the sign(s). Strategy D, however, requires a response of the child, measured in change of eye-gaze direction. So it is the response of the children to strategy B and D that we will discuss next.

In Figures 6.IVa and 6.IVb we present the percentages of positive responses to their mothers' use of strategy B of the deaf and hearing children respectively.[8]

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8 see Appendix to Chapter 6, Table A6.7 for the raw data, page 265

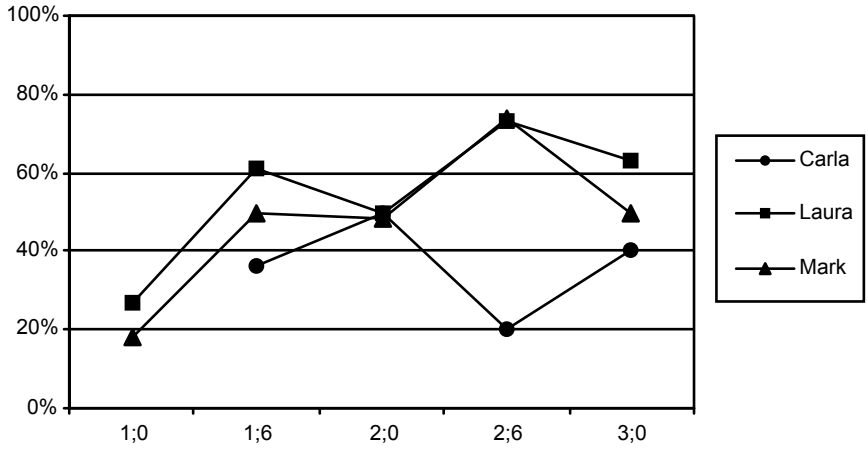

Figure 6.IVa INPUT DC and Response: Percentages of positive responses by the deaf children to strategy B (B: sign/speak while child is not looking at mother)

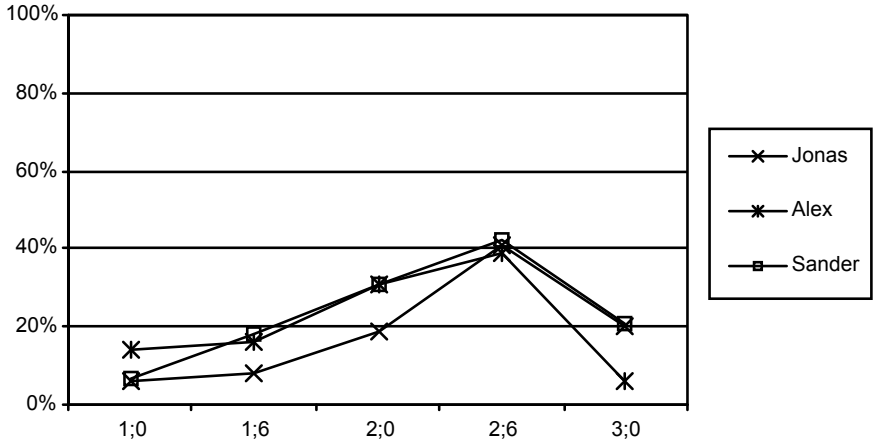

Figure 6.IVb INPUT HC and Response: Percentages of positive responses by the hearing children to strategy B (B: sign/speak while child is not looking at mother)

In general the deaf children respond positively, that is by shifting eye-gaze, to their mother's use of strategy B more often than the hearing children. This is not surprising considering the fact that the mothers mostly use SC or NL with voice with the hearing children. If the mother starts speaking, or signing and speaking simultaneously the hearing child does not need to give visual attention (see also section 6.1.1 and 6.3). Nevertheless, as we showed above (section 6.1.1) the hearing

children see 79% of the signs, by peripheral sight or by dislocation of the signs by the mothers (strategy C).

For strategy D the deaf and hearing children are expected to respond positively to the same extent since the mothers actively try to manipulate their child's attention. Although there is individual variation[9], we can say that Laura, Mark (D) and Sander (H) respond increasingly better as they grow older, but Carla (D), Jonas and Alex (H) are less responsive and not as consistent as the other children.

Spontaneous visual attention of the children
In section 6.1.2 we discussed how all mothers show an increase in the use of strategy A over time. This implies that the children look up spontaneously at their mother more often as they grow older. Figures 6.Va and 6.Vb present the actual number of spontaneous looks (raw figures) of the deaf and hearing children in 10 minutes of interaction.[10]

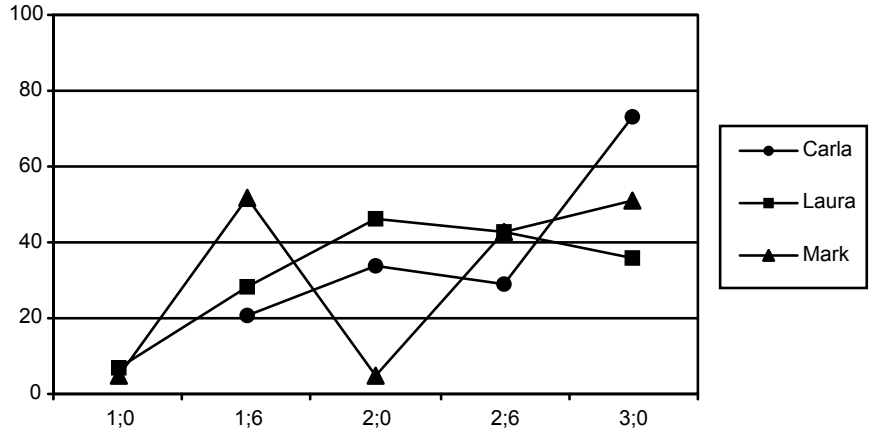

Figure 6.Va OUTPUT DC: Number of spontaneous looks of the deaf children at their mother in 10 minutes of interaction

9 see Appendix to Chapter 6, Table A6.8, page 265

10 see Appendix to Chapter 6, Table A6.9, page 265

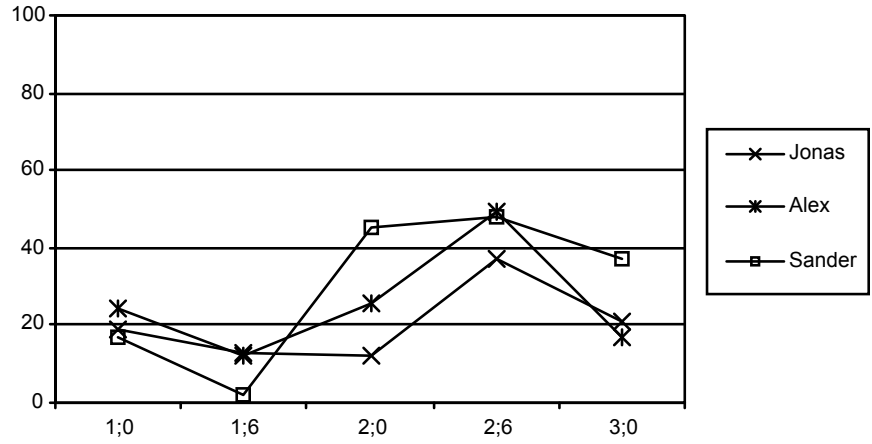

Figure 6.Vb OUTPUT HC: Number of spontaneous looks of the hearing children at their mother in 10 minutes of interaction

We notice first that at 1;0 the hearing children look up at their mother more often than the deaf children. Because of their intact hearing, Jonas, Alex and Sander at this age have had more experience in turn-taking than the deaf children. In previous studies of the deaf mothers of Jonas (at 0;11), Sander (from age 0;3 on) and Alex (from 0;7 on) (Mills and Coerts 1989; Blankenstijn and van den Bogaerde 1989), we found that the deaf mothers always use voice during the first year in the life of the hearing children and hardly sign to them. The hearing children thus receive a considerable amount of auditory input.[11] Van der Stelt (1993:215) found for two hearing girls of hearing mothers the following ranges of 'child looking at mother's face' (corrected for 10 minutes of interaction) between the ages 1;0 and 2;0:

1;0	child 1: 28	child 2: 4
1;6:	child 1: 10	child 2: 40
2;0:	child 1: 4	child 2: 56

These numbers of spontaneous looks differ from the range found for the children in our study at the same ages. Child 1 looks a little more often at age 1;0, the same at age 1;6 and less often at age 2;0; child 2 looks less often at age 1;0, and more often at ages 1;6 and 2;0 compared to our hearing children. There is a considerable difference between the two hearing children of van der Stelt, more so than between the hearing children in our study.

We have no information on the interaction of the deaf mothers with their deaf children during the first year. But we know that the deaf children lacked the auditory

11 We came across only one instance (Sander at 0;4 in Blankenstijn and van den Bogaerde 1989) as specifically meant by van der Stelt, where the mother seemed to imitate the sound-productions of her son (see also section 1.3.2).

input in such an interaction. They had fewer chances to be in a situation in which turn-taking was practiced and this is reflected in the number of spontaneous looks at their mother at the age of 1;0 (see also Harris and Mohay 1997).
The deaf children show a clear increase over time in the number of spontaneous looks, although Carla seems to develop a little later than Laura and Mark. Jonas and Alex, both hearing, show no increase over time, although at age 2;6 we see an increase with a sharp decrease again at age 3;0. Sander does show an increase over time.

Since both deaf and hearing children are seeing 80% of the signs, this would indicate that an 'adequate' level of visual behavior has been reached (see also sections 2.2.2 and 6.1.1). The six children in our study on average look up at their mother once every 14 seconds. More research at later ages of the children, and on visual attention-giving behavior between deaf adults for reasons of comparison, is needed to draw definite conclusions and to establish what an 'adequate level' of visual behavior within sign language communication further entails.

Periods of continued visual contact
Only a few spontaneous looks of the children were unanswered by the mothers in terms of taking the opportunity to convey information. This pattern of communicating, with mutual visual attention is confirmed by the analysis done of strategy A. Strategy A includes a subcategory A' (see section 6.1). This stands for 'All second (or subsequent) utterances that are uttered after S *already* has the attention of Ad (via whatever strategy employed for the first utterance)'. It is expected that as the children grow older, they will not only look more often at their mother, but also for longer periods while communication is taking place.
In Table 6.3 we present the percentages of utterances coded A' of the total number of utterances. We emphasize that subcategory A' was included in the percentages given for strategy A in sections 6.1.2 and 6.1.3.

Table 6.3 INPUT DC+HC: Number and (%) of strategy A' used by the deaf mothers*

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla	-	4 (3)	1 (1)	10 (7)	32 (18)
Children	MLaura	8 (11)	9 (11)	26 (23)	36 (30)	67 (37)
	MMark	1 (2)	19 (19)	45 (29)	21 (15)	34 (44)
Hearing	MJonas	3 (4)	7 (5)	13 (9)	36 (21)	15 (13)
Children	MAlex	21 (13)	47 (24)	20 (12)	47 (24)	4 (2)
	MSander	6 (5)	7 (5)	11 (8)	22 (15)	44 (34)

**Percentages are from total number of utterances*

Overall we can see an increase in the use of this sub-strategy by all mothers. We find that there is a relationship between strategy A' used by the deaf mothers and the

attention-giving behavior of the children. As the children grow more competent in giving visual attention, the mothers adapt their strategies (see also Waxman and Spencer 1997:113). They take advantage of the fact that the child is looking at them to offer more utterances, and they do this increasingly as the children grow older.

We found that the deaf and hearing children can perceive the majority of the signs offered to them through the various strategies. The perception of the spoken (or mouthed) words varies, however, across the children.
In the next section we will look at how accessible the language output of the children is for their mothers.

6.2 Output and accessibility

6.2.1 *Accessibility of the output to the mothers*

The children are clearly learning by the age of 2;6 to give visual attention to communication, but is their linguistic production accessible to their deaf mother? (research question 9 in section 3.2) In order to answer this question, we coded all vocalizations and words and all movements and signs produced by the children as *seen* (+) or *not seen* (-), as has been described in section 6.1.

Results

In Figures 6.VIa and 6.VIb we present the percentages of signs and movements (MOV's) seen by the deaf mothers of the deaf and hearing children respectively.[12]

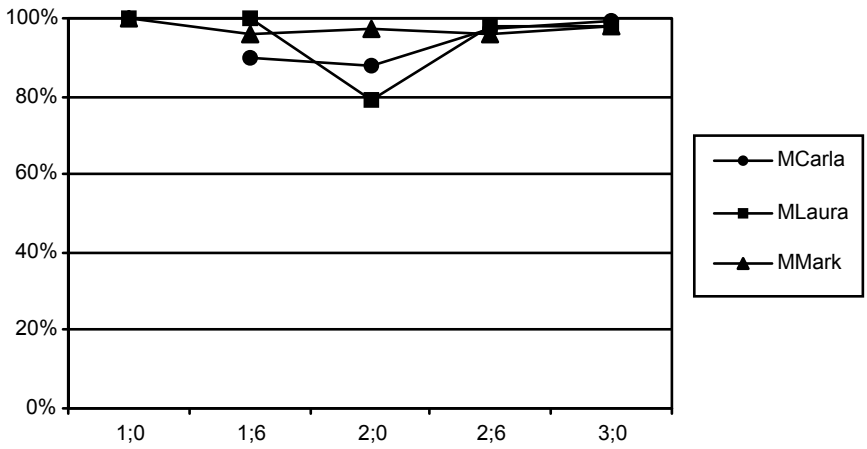

Figure 6.VIa OUTPUT DC: Percentages of signs and MOV's seen by the deaf mothers of the deaf children.

12 see Appendix to Chapter 6, Table A6.10 for the raw data, page 266

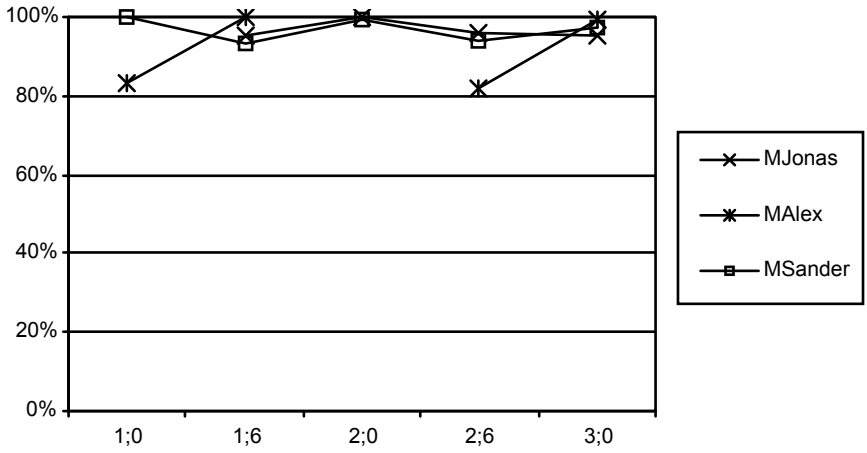

Figure 6.VIb OUTPUT HC: Percentages of signs and MOV's seen by the deaf mothers of the hearing children. NB No signs are produced by Jonas at age 1;0 and by Alex at age 2;0

The mothers see more than 90% of all signs and MOV's at all times with a few minor exceptions (Alex' mother at 1;0 (83%) and 2;6 (82%), and the mothers of Carla and Laura at 2;0 (88 and 79% respectively)). The deaf mothers are almost constantly visually monitoring their children, also called 'framing' by Fogel (1977, in van der Stelt 1993:65): this means that they are looking at the children continuously, except when they themselves are occupied with a toy or a book. In this situation the mothers alternately look at the toy or book and at the child. The mothers check where the children are looking to be able to follow which particular object or picture the children are paying attention to. This behavior is typical also of hearing mothers (see van der Stelt 1993; Tomasello and Farrar 1986) and partly explains why the mothers see most of the signs produced by the children. The role of the children in the visibility of their linguistic output to their mother will be discussed in section 6.2.2.

In Figures 6.VIIa and 6.VIIb we present the percentages[13] of words and vocalizations (voc's) seen by the deaf mothers of the deaf and hearing children respectively.

13 see Appendix to Chapter 6, Table A6.11 for the raw data, page 266

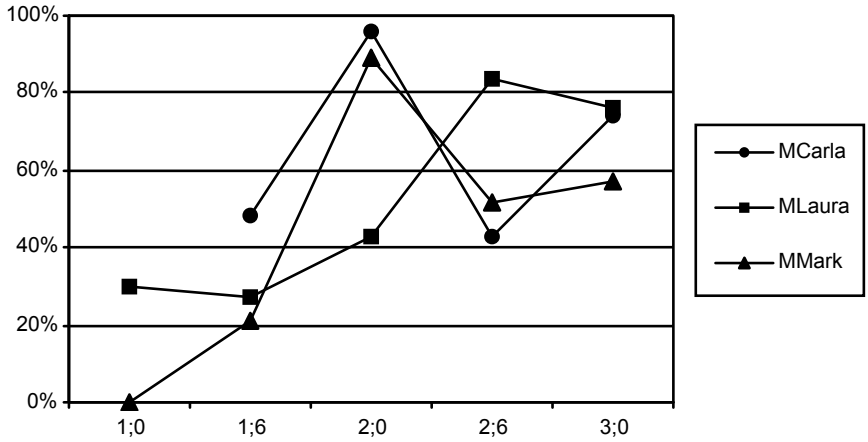

Figure 6.VIIa OUTPUT DC: Percentages of words and vocalizations seen by the deaf mothers of the deaf children

Although we can see an general increase over time for all mothers, the mothers of Carla and Mark show an irregular pattern of words and vocalizations seen at the different points in time. At 2;0 they see more than 80%, but at 2;6 less than 52%. We have no explanation for these fluctuations; there is no difference in the type of activities during the 2;6 sessions from the 2;0 sessions, and the mothers were not less attentive to their children. The children were looking downwards at their toys more often or away from their mothers, which made it more difficult for the mothers to see their lip movements.

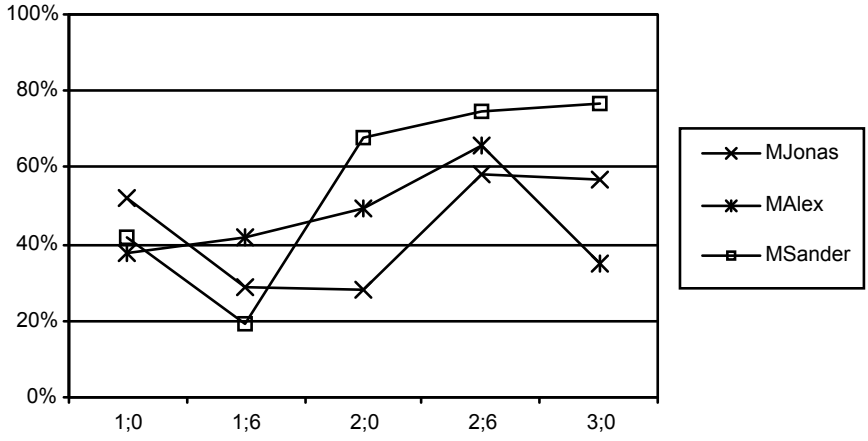

Figure 6.VIIb OUTPUT HC: Percentages of words and vocalizations seen by the deaf mothers of the hearing children

For the accessibility of the spoken language production of the hearing children, we find that Jonas' mother never sees more than 58% of the spoken output and Alex' mother only 49% except at 2;6, and there is no development over time. Sander's mother sees her son's spoken output increasingly over time.

In sum we find that the deaf mothers see the majority of the signs and MOV's produced by the children. The mothers' access to their spoken output, vocalizations and words, however, is generally below 52% up to age 3;0. At 3;0 there seems to be a slight improvement for the mothers of all three deaf children. Considering that the deaf children mainly use SLN (see Figures 5.IIa, b and c), and only little SC and NL, we can conclude that the mothers on the whole do not miss much of the linguistic messages of the deaf children. However, access to the full proposition of the SC utterances of the deaf children is dependent on the nature of these utterances; we will discuss these aspects in section 6.3.
The deaf mothers have satisfactory access to the signing of their hearing children, but miss many of their spoken or mouthed words and/or vocalizations. When we look again at the language choice of the hearing children (Figures 5.IId, e and f), we can see that this may have serious consequences for the mothers' access to their language production in general. This is especially the case with Alex' mother, whose son prefers Dutch and SC until age 2;6 and even at 3;0 produces many NL utterances. Jonas' mother has access to approximately half his spoken language production, with Jonas clearly preferring Dutch and SC over SLN. Sander's mother has better visual access to her son's spoken language production than the other two mothers, where Sander prefers SLN and SC over Dutch. We will discuss the nature of the SC utterances and the need for access to the spoken component in section 6.3.
But first we will sidestep in the next section to look at the (development of the) awareness of the children for the need of visual accessibility of their language production to their mother.

6.2.2 Checking for accessibility

We formulated research question 10 in section 3.2. as follows: "Do the children take care that their mother can see their signs and/or words, and if so, how do they ensure visibility?".

Method

In the first instance the same codes for attentional strategies are used as for the utterances of the deaf mothers (see section 6.1). Besides coding the signed and spoken linguistic utterances of the children, we also coded the movements and vocalizations. As the discussion will focus on the awareness of the children that their linguistic utterances should be visually accessible to their deaf mother, we analyzed the data on the attentional strategies in an additional way for the children. We decided to code an utterance of the children with a 'minus' (-) when the mother's attention was *not* being clearly checked *before* the utterance was produced. The strategies for attention were coded in the following way (see also section 6.1):

Strategy A and A'	neutral (0)
Strategy AB	child does not check: minus (-)
Strategy B	child does not check: minus (-)
Strategy C	child does not check: minus (-)
Strategy D	child checks: plus (+)

Instead of dividing the attentional strategies in non-explicit and explicit strategies, which was done for the attentional behavior of the mothers, we split up the strategies according to whether or not we could see that the child was checking if the mother was paying visual attention. Below we will discuss the rationale behind this coding system, the attribution of 'plus' or 'minus' to a category.
Strategies A and A', where the Signer/Speaker (S) (in this case the child) and Addressee (Ad) (in this case the mother) are looking at each other is coded neutral (0). We cannot be sure that the child is deliberately seeking the mother's eye-gaze before producing an utterance, or that the child is *not* checking for visibility. Strategy D, when the child actively tries to engage the attention of the mother is attributed a 'plus', since it is clear that the child (has) checked or is seeking the mother's attention. A 'minus' is attributed to strategy AB (mother looks at child, but child not at mother), to strategy B (mother is not looking at child) and to strategy C. In the case of strategy C the children never dislocate a lexical sign, but they do produce Points in the visual field of the mother. If an utterance begins with such a Point, the utterance is coded C. However, the children never monitored whether or not the mother was indeed looking at them or at the Point and thus we decided to label strategy C with a 'minus' as well.

Results
We will first describe whether or not the children check if their vocalizations and movements are visible to their mother and next their linguistic utterances.

Checking for visibility of vocalizations and movements in the output
All children except Laura (D) and Alex (H) produce the majority of their vocalizations and movements *without* checking that their mother is looking at them.[14] Laura produces a few voc's and MOV's while she and her mother are looking at each other at ages 1;6, 2;6 and 3;0. Alex also is looking at his mother for the majority of his vocalizations (n=14) at age 2;6. As we discussed in section 6.2, the mothers miss many of the vocalizations and words produced by the children, although movements and signs are perceived to a much higher degree. We can thus conclude that the vocalizations of the children play hardly any role in the interaction between the deaf mothers and the children, contrary to the interaction of hearing mother-child pairs (van der Stelt 1993). Movements (i.e. sign-babbles) were sometimes interpreted by the mothers as signs, but were also ignored on other occasions, even though most of these were visible.

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14 see Tables A6.12a-f in Appendix to Chapter 6, pages 266-267

Checking for visibility of linguistic utterances in the output

We will discuss the visibility of the linguistic utterances in the output of the deaf and hearing children from the age of 2;0. Figure 6.VIIIa shows the percentages of utterances, which were coded with attentional strategies 'minus' check at the four points in time for the deaf children.[15] We only present the data from 2;0 onward, because before this age the children produced less than 10 utterances.

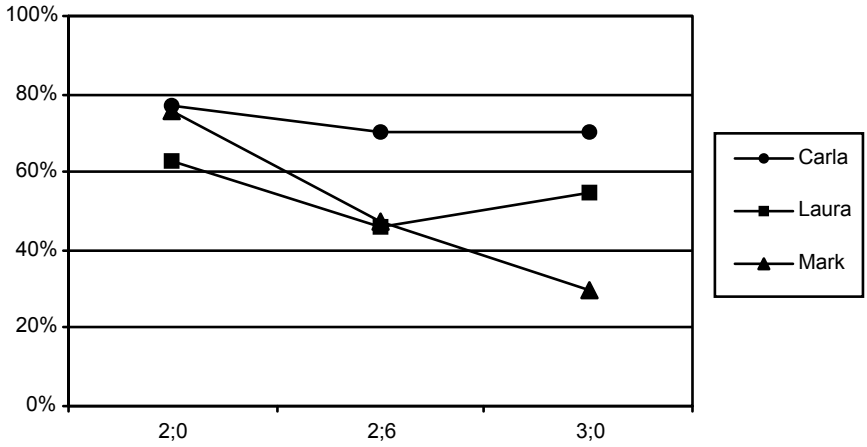

Figure 6.VIIIa OUTPUT DC: Percentages of linguistic utterances made without a check for visual attention by the deaf children

In her use of attentional strategies Carla shows only a slightly increasing awareness that she must check whether or not her mother is looking at her. Mark shows a decrease in unchecked utterances from age 2;0 onwards. With Laura at age 2;6 we see a decrease in unchecked utterances. However, at age 3;0 there is an increase again, so there is no clear steady progress. The variation between the children is quite large: from 30% (Mark) to 70% (Carla) at age 3;0 of utterances without a visual check.

Figure 6.VIIIb shows the percentages of utterances without a visual check[16] by the hearing children.

15 see also Appendix to Chapter 6, Tables A6.13a-c, pages 268 and Table A6.14, page 269

16 see Appendix to Chapter 6, Tables A6.13d-f, pages 268-269 and Table A6.14, page 269

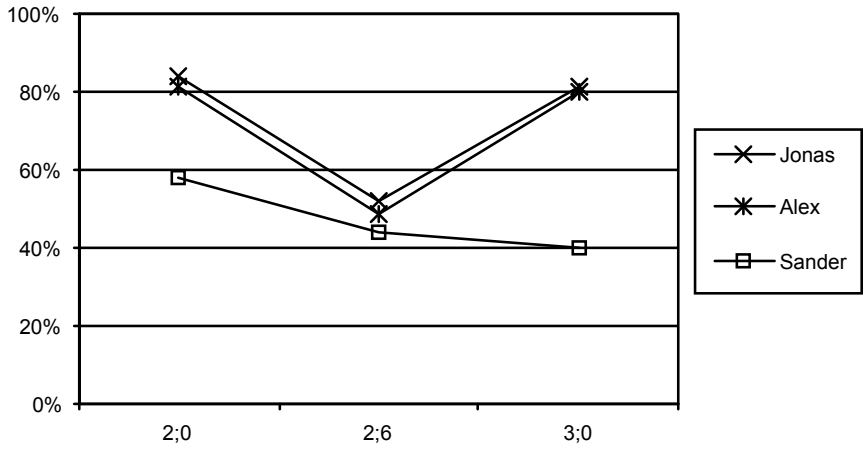

Figure 6.VIIIb OUTPUT HC: Percentages of linguistic utterances made without a check for visual attention by the hearing children

Alex and Jonas do not show consistent behavior and we do not see a decrease in the use of utterances without a visual check, except that at age 2;6 we see an improvement. Sander produces a clearly decreasing number of utterances without a visual check. The difference between Sander and Jonas/Alex is large at age 3;0: 40% versus 80% respectively of unchecked utterances.
In ASL, children from age 2;6 on can be expected to begin to use explicit attentional strategies in sign language interaction situations (Siple, Akamatsu and Loew 1990). These findings are confirmed for SLN. We find that strategy D (actively trying to attract mother's attention by waving an arm, or tapping her) is beginning to be used by Laura (D), Mark (D) and Sander (H) from 2;0 on, by Carla (D) from age 2;6 and Jonas (H) from 3;0 on.[17] It was also found that at that age children become aware of visual attentional requirements in the interaction with a deaf person, in particular the establishing of mutual eye-contact or signing within the other person's visual field. For instance, Richmond-Welty and Siple (1999) discovered that hearing bilingual twins distinguished between hearing and deaf addressees and between English and ASL by different eye-gaze behavior for the two languages. This differentiation was established between the age of 2;0 and 3;0, which coincides with the age found in this study for 'adequate visual behavior (see section 6.1.4).

Summarizing, we have found that Mark (D) and Sander (H) show a clear increase in their awareness that their linguistic utterances should be visually accessible to their mother. This ability seems to materialize after the age of 2;0. Laura (D) and Carla

17 see Appendix to Chapter 6, Tables A6.13a-f, pages 268-269

(D) show a slight increase in awareness. Jonas (H) and Alex (H) do not show this awareness consistently in their use of strategies. The fact that their mothers see as much as they do of the linguistic utterances can be attributed mainly to the fact that they are looking at the children most of the time during the sessions.

6.2.3 Use of voice by the deaf and hearing children

Another interesting aspect in the interaction with a deaf person is the use of voice. Use of voice is irrelevant and unnecessary with profoundly deaf people, because spoken and mouthed words are only visually processed. A clue as to the awareness of the hearing children that they are dealing with a deaf person would be the use of words without voice. It is important to remember that the deaf mothers themselves use voice with the hearing children most of the time (section 6.1.1). This is of course a confusing factor for the hearing children.

For the deaf children we would assume that initially they use no voice when signing or mouthing. However, the increasing use of voice by deaf children as they grow older could point to a growing awareness that the spoken language is separate from the sign language.

In this section we will inventorize the use of voice by the deaf and hearing children over time (see research question 11 in section 3.2).

Method

We looked at the number and percentages of words that were produced *with voice* by the deaf and hearing children. For this analysis we included all vocalizations and all words in the analyzable utterances and in minors ('yes' or 'no' etc.) in NL and SC utterances. The data of the mothers can be found in section 6.1.1.

Suppression of voice by the hearing children

In Table 6.4 we present the data on the words produced by the hearing children with voice.

We see that Jonas (H) almost always uses voice, which is in agreement with his other behavior related to the awareness of the hearing status of his mother. He does not respond visually when asked for attention or look up spontaneously at his mother. Alex (H) at age 3;0 shows a remarkable increase in the number of mouthed words, which does not coincide with his awareness for visual access, e.g. no increase in spontaneous looks (see Figure 6.VIIIb). However, the suppression of voice at age 3;0 indicates that he is aware that his mother cannot hear.

Table 6.4 OUTPUT HC: Number and (%) of words produced with voice by the hearing children in NL and SC utterances

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Hearing Children	Jonas	25 (100)	121 (100)	129 (99)	153 (99)	283 (98)
	Alex	29 (100)	36 (100)	150 (99)	133 (99)	54 (41)
	Sander	24 (100)	10 (48)	5 (5)	9 (7)	56 (37)

Sander (H) seems the only child to be aware, at quite an early age (1;6), that the use of his voice is not required in the interaction with his deaf mother. This interpretation is supported by the fact that with the hearing researchers he always used voice. His suppression of voice as an indication of awareness of the hearing status of his conversational partner is supported by his awareness for visual accessibility.

Use of voice by the deaf children.
The deaf children are expected to decrease the use of voice. We do know that deaf children are reported to vocalize a great deal but for sign language production no use of voice is needed. In section 5.1.2 (Table 5.2) we saw that the deaf children produced vocalizations decreasingly as they grow older. We do not know whether or not the deaf children at these ages are aware that words are spoken with voice (compare the use of voice in NL and SC utterances by the mother of Laura and Mark: 15% and by Carla's mother: 95%). A look at their output with voice might shed light on this aspect. We present the data of the deaf children on number and percentages of words with voice, as well as signs co-occurring with vocalizations in Table 6.5.

Table 6.5 OUTPUT DC: Number and (%) of words produced with voice by the deaf children in NL and SC utterances and signs produced with a vocalization in SLN and SC

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Words	Carla	-	79 (91)	106 (94)	101 (94)	42 (61)
+ voice	Laura	10 (100)	8 (72)	19 (91)	40 (78)	37 (97)
	Mark	2 (100)	36 (95)	9 (47)	33 (52)	5 (23)
Signs	Carla	-	15 (48)	49 (68)	31 (57)	18 (23)
+ vocs	Laura	0	1 (11)	1 (6)	22 (28)	18 (22)
	Mark	0	2 (8)	5 (12)	25 (27)	8* (11)

** corrected for 10 minutes*

Carla (D) and Mark (D) use voice often but decreasingly at age 3;0, while Laura (D) shows a varied pattern. Carla vocalizes more often in her SLN utterances than Laura and Mark, although at 3;0 less so than at the previous ages. At this age her production of SC utterances also increases, which may indicate that the intelligibility of her spoken language production increases. Her mother also uses her voice most of the time, although Carla has only visual access to roughly a third of her mother's spoken or mouthed input. Use of voice may have a relation with the type of language one is using (Ebbinghaus and Hessmann 1996:28; Lucas and Valli 1992) (see also Chapter 9). It has been suggested that the use of voice triggers the production of the grammatical structures of the spoken language. Suppression of voice would trigger the use of grammatical structures of the sign language.
Laura vocalizes more while signing after the age of 2;6 (kindergarten age) as does Mark. They apparently become aware at this age that mouthed (or spoken) words

might have some function or carry meaning and start imitating the lip-movement(s), often with voice. A thorough phonological analysis of the sound productions of deaf children is needed to establish the relationship between vocalizations and the beginning of the production of spoken words (see Beers and Baker 1997; Beers in press). Whether or not there is a relation between the use of voice and the structure of the language output (in particular in SLN and SC) will be discussed in Chapter 9.

6.3 Propositions in two channels

6.3.1 Propositions in the input

We have seen in section 5.3.1 that SC utterances form a substantial part of the linguistic input of the mothers, both to the deaf and to the hearing children. In section 6.1.1 we have shown that on average 83% of the signs are seen by the deaf children and 79% by the hearing children, but that the visibility of the spoken components varies across children and ages. In a SC utterance there can be redundant information because signs and words overlap; on the other hand it is possible that both channels carry separate information. To measure the effect of *not* seeing part of a particular SC utterance, we need to gain more insight in how the linguistic message is distributed over the two channels in the SC mode. More specifically we want to know whether or not missing the signed or spoken part of an utterance means missing (part of) the semantic content of an utterance for the child. This analysis will also shed some light on the question of the status of SC. As is discussed in section 2.2 a distinction can be made between mouthed information which is redundant and that which is functional. Not all authors are agreed that this is important, however.

Method

Since it is possible in SC to produce a word and a sign at the same time in a different channel with either the same or different semantic content, we need to know which part of a proposition is expressed in which channel. We counted as underlying propositions all main verbs or predicates, which had overt (or covert) subjects. This definition is taken from Bellugi and Fischer (1972:184).

The analysis is based mainly on work done by Goldin-Meadow and Morford (1990) and on adaptations of their categories by Iverson, Capirci and Caselli (1994) and Heim and Baker-Mills (1996).[18] We coded all the linguistic SC utterances except minors and unintelligible utterances (see section 4.4.2) in the following way:

Code	*Definition*
f - full	the whole proposition is fully expressed in both channels

18 Please note that Heim and Baker-Mills used different terminology: *supportive* for our *complementary*, and *complementary* for our *supplementary* (o.c. p. 248). The terminology used here is taken from Iverson et al. (1994).

s - supplementary — a part of the proposition is expressed in one channel. It *adds essential content and does not overlap* with that part of the propositional content expressed in the other channel

c - complementary — a part of the proposition is expressed in one channel. Its the content *overlaps totally* with the full propositional content expressed in the other channel

Procedures

Below we will give some examples for the above categories as well as possible combinations, and discuss these with a view to the necessity of having visual access to one or both channels for the deaf and hearing persons.

f	fully signed	POINThorse HORSE
f	fully spoken	that is a horse
		(that is a horse)

For SC utterances coded 'ff' the deaf persons need to see either the signed or the spoken part[19] of the utterance to have access to the proposition. The hearing persons need not pay visual attention to the signing, since they have access to the message through their hearing, if the mother uses voice.

s	supplementary signed	HORSE
s	supplementary spoken	big
		(the horse is big)

For SC utterances coded 'ss' the deaf and the hearing persons need to see both the signed part of the utterance as well as see (for the deaf persons) or hear (hearing persons) the spoken part.

f	fully signed	BICYCLE RED OUTSIDE
c	complementary spoken	out
		(the red bicycle is outside)

For SC utterances coded 'fc' the deaf and hearing persons need to see the signed part of the utterance. Since the spoken part has the same semantic content as the sign, it is irrelevant whether or not the persons see or hear the spoken part. The need for visual attention is the same as for SLN utterances.

c	complementary signed	HORSE?
f	fully spoken	where is the horse
		(where is the horse?)

19 We will not discuss here which sounds of the spoken language are visually accessible to deaf children during the first years of their language development (see e.g. Dodd and Campbell 1987).

> For SC utterances coded 'cf' the deaf persons need to see the spoken part of the utterance, while the hearing persons need not give visual attention, since they will have access to the proposition through their hearing. The need for visual attention is the same as for NL utterances.

Results
The results of the analysis of propositional content for research question 12 are presented in Figures 6.IXa-f.[20] We will discuss the findings per category.

Full in both channels (ff)
This way of combining signs and words, namely expressing the proposition fully in both channels, is used decreasingly with most of the children. This decreasing use may be linked to an increase in complexity (see section 9.1). The median percentage of use is 33%. The chances for access are optimal, since there is much redundancy.

Supplementary in two channels (ss)
The supplementary category, where the full proposition is distributed over the two channels, is used less with the deaf than with the hearing children. With the deaf children 0-20% (median is 10%) of the utterances are supplementary, while with the hearing children we see a range of 0-41% (median is 29%).
The combination of the two channels in this way requires good attention skills from both the deaf and hearing children. The deaf children however have to pay visual attention to both the mouth and the hands. Also a considerable percentage of words are not visible for the deaf children. If the mothers are aware of this, it is surprising that the mothers use this category at all with the deaf children.

Fully signed and complementary spoken (fc)
From Figures 6.IXa-f it is clear that the deaf mothers use this form of SC often with the deaf children (mean 54%) and much less so with the hearing children (mean 15%). The deaf mothers seem to assume that the deaf children are more focussed on signing.

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20 see for raw data Appendix to Chapter 6, Tables A6.15a-f, pages 269-270

Figure 6.IXa Mother of Carla (D)

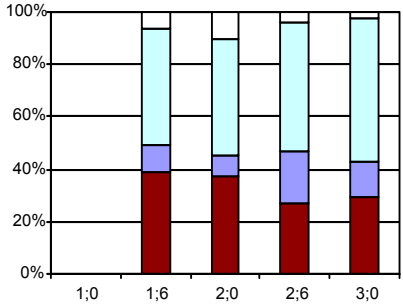


Figure 6.IXb Mother of Laura (D)

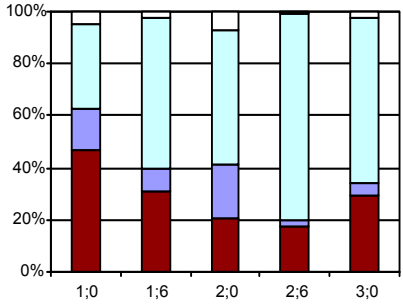


Figure 6.IXc Mother of Mark (D)

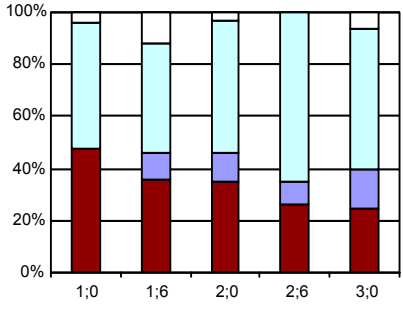


Figure 6.IXd Mother of Jonas (H)

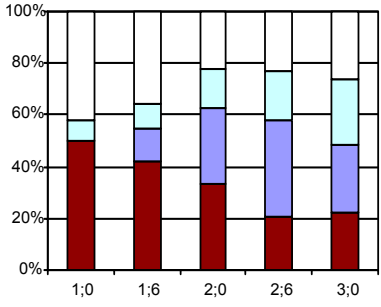


Figure 6.IXe Mother of Alex (H)

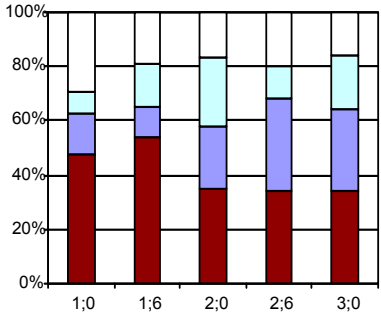
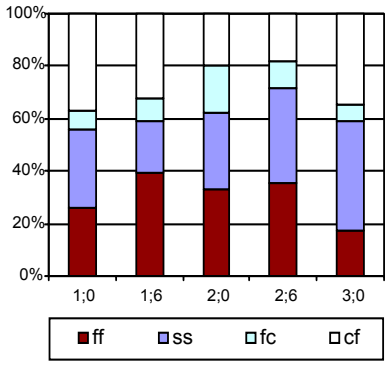


Figure 6.IXf Mother of Sander (H)



Figures 6.IXa-f INPUT: Percentages of different categories of propositional content in the SC input of the deaf mothers

ff = fully signed and spoken
ss = supplementary signed and spoken
fc = fully signed, complementary spoken
cf = fully spoken, complementary signed

Complementary signed and fully spoken (cf)
Here we see the opposite from what we found for the 'fc' category: the mothers use fully spoken utterances complemented by signs fairly often with the hearing children (median is 27,5%) but much less so with the deaf children (median is 4,5%).

By definition the deaf children need to have visual access to the spoken or mouthed words only in the 'ss' and 'cf' utterances since only here are the words essential. In the 'ff' and 'fc' categories the words are redundant. On average Laura and Mark's mother offers them 13% of the SC input in the form of 'ss' and 'cf' utterances. Laura and Mark see 58% and 69% respectively of the words in these utterances and about 89% of the signs, which means that altogether they miss about 16% of the SC input. In the SC input of Carla's mother, however, 21% is of the 'ss' and 'cf' category. Carla sees only 36% of the spoken parts of these utterances and 74% of the signs. Across time she potentially misses about 40% of the total message in the SC input, which is quite substantial.
For the hearing children quite different conditions prevail; they have access to most of the spoken words through their hearing and they see on average 79% of the signs. They need to pay visual attention to the 'ss' and the 'fc' utterances. The SC input consists on average of 42% of such utterances - and the hearing children miss about 8% of the total SC input. A more detailed study on which part of an utterance is missed (beginning, middle or end) and whether or not the missed items are crucial for understanding the message would reveal more precisely the extent to which hearing and deaf children have access to the SC input offered to them. In the analysis of the children's productions we shall see in global terms to what extent this missed input has an effect on their acquisition.

As described earlier (see section 2.2.1) in her description of SLN Schermer calls a spoken component redundant when it does not add anything to the meaning of the sign (1990:87). Ebbinghaus and Hessmann (GSL, 1996:42) say, on the other hand, that the use of a spoken word which confirms the meaning of a sign also serves a function, as yet to be determined. The question arises, whether 'fc' utterances are truly SC utterances or whether they could be considered SLN utterances (as they would be according to Ebbinghaus and Hessmann 1996). Although Schermer did not describe the form 'cf' (fully spoken, complementary signed) as such, we assume that the signed part in 'cf' utterances is redundant. Perhaps these 'cf' category of SC utterances should be considered Dutch.
The 'ss' category in SC utterances can be compared to what Schermer called specifying, disambiguating or complementing functions of spoken words in SLN utterances. Ebbinghaus and Hessmann (1996) consider the signs and words as semantically related, and to interact in the creation of meaning (1996:44). For them it is still far from clear how exactly they should be integrated into a standard view of sign language.

This propositional analysis does not give us enough evidence to decide on the status of the SC utterances. The fact that 'ss' utterances are produced might suggest a third system as discussed earlier (section 2.2.1). The analysis of the structural properties of the SC utterances (Chapter 9) will shed more light on this matter.

6.3.2 Propositions in the output

We will not present the SC utterances of Laura and Mark in percentages, since the number of SC utterances produced by them is so small.[21] We will discuss their data only in comparison to the use of SC utterances by Carla (D) and the hearing children (Figures 6.Xa-d).

Carla mainly uses 'ff' and 'fc' SC utterances. This means that her mother need not see the words since she has access to the message through the signs, of which she sees a high percentage at all times (see section 6.2.1). Carla does produce some 'ss' utterances (10 in total), and proportionally more so than her mother (compare to Figure 6.IXa). At 1;6 and 2;6 Carla's mother misses approximately 55% of the words produced by Carla, which means that she may have missed the full proposition in these 'ss' utterances.

As said before, Laura and Mark produce only a few SC utterances; Laura only of the 'fc' category and Mark one 'ff' and three 'fc', which means that their mother had no need to access their words because she could access the utterances through the signing.

Jonas (H) produces an ever increasing percentage of 'ss' and 'cf' SC utterances (Figure 6.Xb). For these utterances it is essential that his mother can perceive the words - which she did with varying success at the different points in time. But at 3;0, when Jonas mainly produced 'ss' and 'cf' utterances, she saw less than 60% of the spoken words; this means that she did not have full access to many of Jonas' SC utterances.

Alex (Figure 6.Xc) does not sign very much until 2;6 (see also Figure 5.II) and his mother accessed only around 40% of his words. At 3;0 he signs more than before, both in SLN and in 'ss' (63%) SC utterances. But it is at this very age that his mother sees only 35% of his words. With Alex clearly focussing on spoken language we can conclude that his mother has limited access to her son's linguistic output.

Sander produces many 'ff', and 'fc' SC utterances up to 2;0 (Figure 6.Xd), after which age his production of 'ss' and 'cf' utterances increases. So until 2;0 there was a focus on signs, and later equally on signs and words. In Figure 5.IIf we saw that Sander at all ages preferred either SLN or SC and never NL as his first language. Only at 3;0 we see an increase of 'cf' utterances, co-occurring with a slight increase in NL utterances. His mother had access to more than 60% of his words, so the conclusion is that Sander's mother has reasonable access to his output, somewhat better than Jonas' and Alex' mother.

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21 see Appendix to Chapter 6, Tables A6.16b, page 283 and A6.16c, page 271

Figure 6.Xa Carla (D)

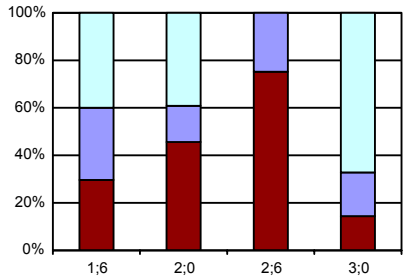


Figure 6.Xc Alex (H)

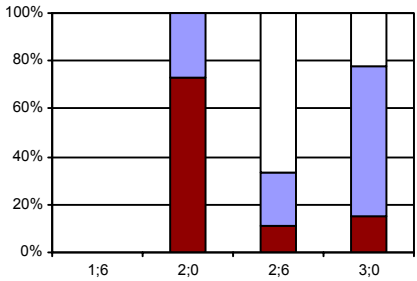


Figure 6.Xb Jonas (H)

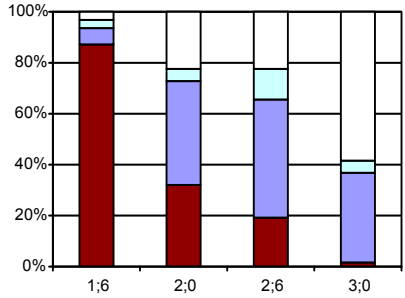
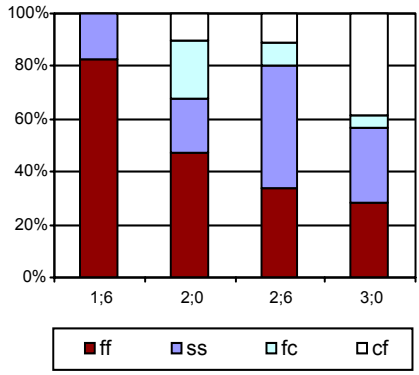


Figure 6.Xd Sander (H)



Figures 6.Xa-OUTPUT: Percentages of different categories of propositional content in the SC output of one deaf child and the hearing children

ff = fully signed and spoken
ss = supplementary signed and spoken
fc = fully signed, complementary spoken
cf = fully spoken, complementary signed

6.4 Relation between quantity of input and attention-giving development of the children

As we discussed in Chapter 2, Harris (1992) and Kyle et al. (1987) found a smaller quantity of input in their deaf mothers. These findings were not confirmed by our data (see Chapter 5). These authors suggest that the smaller quantity of input is probably due to the fact that visual attention is necessary in order to sustain a conversation in a signed language. Since children need to acquire the visual attention skills (Swisher 1992), we would thus suggest that the number of utterances produced by the deaf mothers might be related to (the development of) the visual attention-giving behavior of the children (research question 13 in section 3.2).

Method
We know that the number of spontaneous looks and the number of linguistic utterances increase over this period. We calculated the relation between number of linguistic utterances of the deaf mothers and the number of spontaneous looks of the children as follows. From the five points in time the highest number of linguistic utterances of the mothers was considered to be 100%. The number of utterances produced at the other four points in time, were then divided by the highest number of utterances. The same procedure was followed for the number of spontaneous looks of the children; the highest number of looks is 100%, and the number of spontaneous looks produced at the other points in time are divided by the highest number. This technique should indicate if and how the changes are related to one another.

Results
In Figure 6.XIa-f we present the percentages for the six mother-child dyads.
There are no clear patterns here. The mother of Laura (D) and Mark (D) appears to react to the increase in spontaneous looks of the children, since the increase in number of linguistic utterances comes later. Carla's (D) mother increases steadily. The mothers of the hearing children increase the number of utterances ahead of the increase in spontaneous looks. The children's visual behavior seems to have no influence here.
We have no evidence to support Kyle et al.'s views. Furthermore we did not find that the mothers produced clearly less input.

Figure 6.XIa Mother and Carla (D)

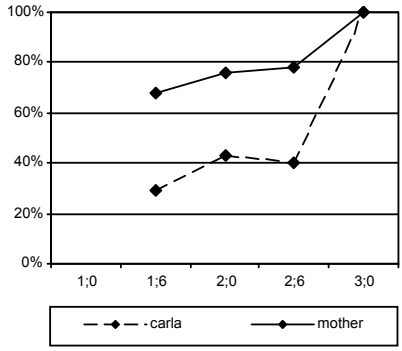


Figure 6.XIb Mother and Laura (D)

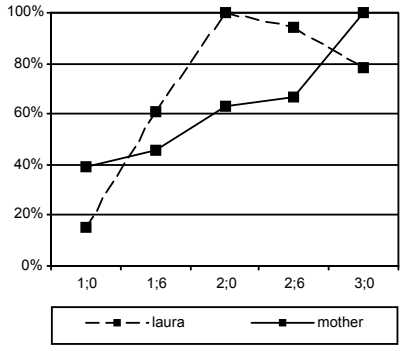
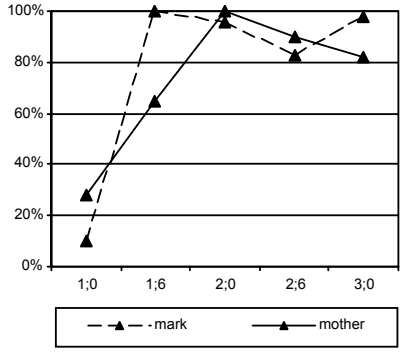


Figure 6.XIc Mother and Mark (D)



Figures 6.Xia-f Relation (%) between the number of spontaneous looks of the children and the number of linguistic utterances of the deaf mothers

Figure 6.XId Mother and Jonas (H)

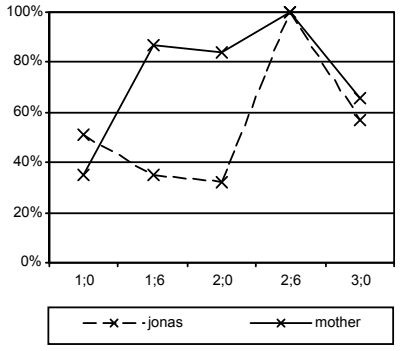


Figure 6.XIe Mother and Alex (H)

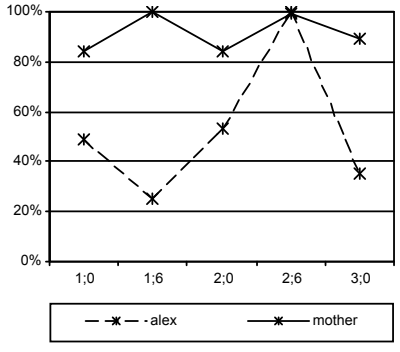
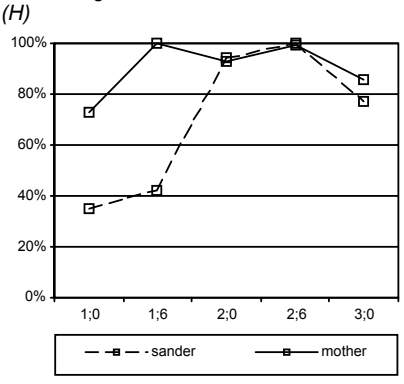


Figure 6.XI f Mother and Sander (H)



6.5 Summary

Accessibility of language is an important issue in the context of deaf families. Signing, which has to be visually accessible, is seen by the children, both the deaf and the hearing, around 80% of the time from the first year on. There is little change over time, this is parallel to findings in England. The spoken input is available to the hearing children aurally since the mothers usually use voice, as opposed to mouthing. The deaf children need visual access to the spoken input, whether as Dutch or part of SC. Their access clearly increases to around 80% at 3 years for Laura and Mark. Carla also improves but still misses a considerable amount (40%) of the input.
The high rate of visibility for signing is partly a result of the mothers' continual visual monitoring of the children. They ensure that the children see signing by waiting for the child to look up and do so increasingly over time. They also produce the signs in the child's field of vision. They do sometimes explicitly attract the child's attention but this gets less as the children get older.
In general the children look up at their mother spontaneously more often in time and the mothers produce more utterances while the child is still looking. The mothers see the children's signing more than 80% of the time at all ages and there is no change. The spoken part is seen increasingly more by the mothers of Laura (D), Mark (D) and Sander (H), but this is more variable with Carla (D). No development can be seen with Jonas' and Alex' (H) mothers.
Some of the children learn to check visually before signing but their development is variable. The awareness of the link between looking and signing has led to spontaneous looking for communication of *others* but not for own production.
In SC the semantic content of an utterance can be missed if accessibility is not optimal and the content is in one mode and not the other. The mothers initially express the full content in both signs and words, but this changes with all children, probably as a result of a decline in the number of one constituent utterances. With the deaf children an increase can be seen in utterances which are fully signed, with some overlapping words. With the hearing children utterances which are partly signed, partly spoken (ss) increase. Only Carla of the deaf children produces enough SC to analyze. All children show a decrease in fully spoken and signed utterances. Carla uses fully signed and partly spoken increasingly, the hearing children increase in partly signed and spoken (ss), and two of them in fully spoken, with some overlapping signs (cf).

The mothers' constant visual monitoring and waiting for visual attention behavior results in their language being seen but also promotes the growth of visual monitoring in the children. They are still learning to monitor visual attention for their own communication. However, in the input the model does not have a great affect by 3 years. The mothers mainly use voice in spoken utterances but the hearing children increasingly suppress voice. This reflects the influence of their awareness of the mother's deafness, not the input.

In the SC input the mothers increasingly produce a large amount of utterances that are fully signed and spoken; the children in these SC output also do so, but this decreases with time. This is more a reflection of the growing complexity of the input and output, than a direct influence from the input.
Carla's mother starts to produce more fully signed, partly spoken utterances and so does Carla. The mother of the hearing children start to produce more partly signed, partly spoken utterances and so do the children. The input seems to be influencing the output.

There are some striking differences between the deaf and hearing children that emerge from these analyses. Compared to the hearing children the deaf children increase more clearly in their amount of spontaneously looking; they react more adequately when the mothers begin to sign by looking at her. Two of the deaf children see more of the spoken input; Carla with the hearing children are more variable. The deaf children appear to be learning more quickly to make language accessible, which in view of their dependence on it is not surprising. Sander is in some respects an exception amongst the hearing children, since his behavior is often more comparable to the deaf children. The Simultaneous Communication in the input and output clearly begins to change in character with the deaf and hearing children. The emphasis with the deaf children is on signing, so the category of utterances fully signed, partly spoken becomes more important. With the hearing children the category partly spoken, partly signed (ss) increases for all children, and fully spoken, partly signed for two.
In these categories the spoken part is essential for the full proposition to come across – the mothers shift therefore in the direction of Dutch. The children reflect this input and the children's output becomes differentiated in the same way.

7 LEXICAL ISSUES IN INPUT AND OUTPUT

In this chapter we will start to look in more detail at the linguistic structure of input and output. We will look at the use of deictic and representational symbols in section 7.1, and at the use of nouns versus verbs in section 7.2. In section 7.3 we discuss the variability in the signed and spoken lexicons, and section 7.4 focuses on the occurrence of lexical equivalents. Section 7.5 summarizes the results from this chapter.

7.1 Deictic and representational symbols

7.1.1 Deictic and representational symbols in the input

The aim of the first analysis is to establish whether or not the children are offered combinations of representational symbols both in SLN and in Dutch. Only these utterances provide syntactic information about the languages used (see section 2.3.1). From the results on the different use of language (section 5.3.1) we now know that the mothers offer many simultaneous utterances (SC) alongside SLN and Dutch. We also now know that some of these utterances are supplementary in semantic content (see 6.3.1). The status of combinations of representational signs and representational words with different semantic content is, however, unclear. Here we will investigate how deictic and representational symbols are used and combined in SLN, NL and SC input (see section 3.3, question 14A).

Method

We distinguish the following two categories, based on categories used by Goldin-Meadow and Mylander (1990) and adaptations of these by Iverson et al. (1994) and by Heim (1994):

deictic	signs and words that derive their meaning completely from the situational context in which they are used (i.e., personal, possessive and demonstrative pronouns and demonstrative adjectives and locative expressions)
representational	signs or words that represent specific referents; their basic semantic content does not change appreciably with the context (i.e., nouns, verbs, adjectives, adverbs, closed-class words)

We selected all analyzable utterances plus Points alone for this analysis[1] (see also Chapter 4, Figure 4.II).

Procedures

Points to parts of the body are not considered to be deictic (following Ahlgren 1990:170) and are coded as representational, except when the point to a body part is the reply to the question "Where is your …?" (e.g. nose). In this case the answer "POINTnose" is interpreted as meaning *here* and the Point is counted as a deictic. The word *zo* 'so' when occurring alone is considered to be deictic when the mother is demonstrating the child how to perform an action. For instance, how to put a Duplo-doll into the seat of a Duplo-car, and simultaneously saying *zo* meaning 'this is the way to do it' (following Heim 1994). *YES* and *NO* (head nods and headshakes) are considered to be representational symbols.[2] Deictic words will be discussed if and when they occur.

Deictic signs are abbreviated to DS, deictic words to DW, representational signs to RS and representational words to RW, representational symbols in general as R. Per session we categorized the linguistic utterances of the mothers, excluding minors and unintelligible utterances as follows in three main categories:

- Deictic Signs (DS) (i.e. Points alone), Deictic Words (DW), and Deictic Sign(s) with one Representational symbol (D/R)

An utterance consists of one (or more) Point(s), which can refer to a person, an object or a location; or it consists of a deictic word (1). Also utterances consisting of one (or more) Point(s) or one or more deictic word(s) with one Representational symbol (signed or spoken) (2).

(1) POINTtobookcase (there)

or

that (that [one])

(2) POINTpicture RABBIT (this is a rabbit)

or

RABBIT (this rabbit)
this

---

1 see Appendix to Chapter 7, Tables A7.1, page 272 and for the children A7.6, page 273

2 In SLN, as well as in other sign languages (see Coerts 1992), head nods and head shakes can function as bound morphemes, and as such should perhaps not be always considered as separate representational symbols. However, we decided to follow Iverson et al.'s definition (1994), which included head nods and head shakes as representational symbols, for reasons of comparison.

- Representational symbol (R)

An utterance consists of one representational sign (3), or one representational word (4), or one representational sign combined with one representational word with the *same semantic content* (5).

(3) RABBIT (a rabbit)

(4) good (well done)

(5) CLEVER (clever you!)
clever

- Combinations of representational symbols

An utterance consists of a combination of at least two representational signs (6) or two representational words (7), with or without additional deictic symbols. If an utterance consists of a combination of two signs, and one word is uttered simultaneously (or vice versa) only the two-symbol combination is considered. Sometimes two (or more) representational signs occur simultaneously with a two (or more) word combination in one utterance (8) (with the same semantic content). In that case both combinations are counted.

(6) POINTtrain TRAIN LONG (that train is long) RS+RS

(7) doll sleep (the doll is sleeping) RW+RW

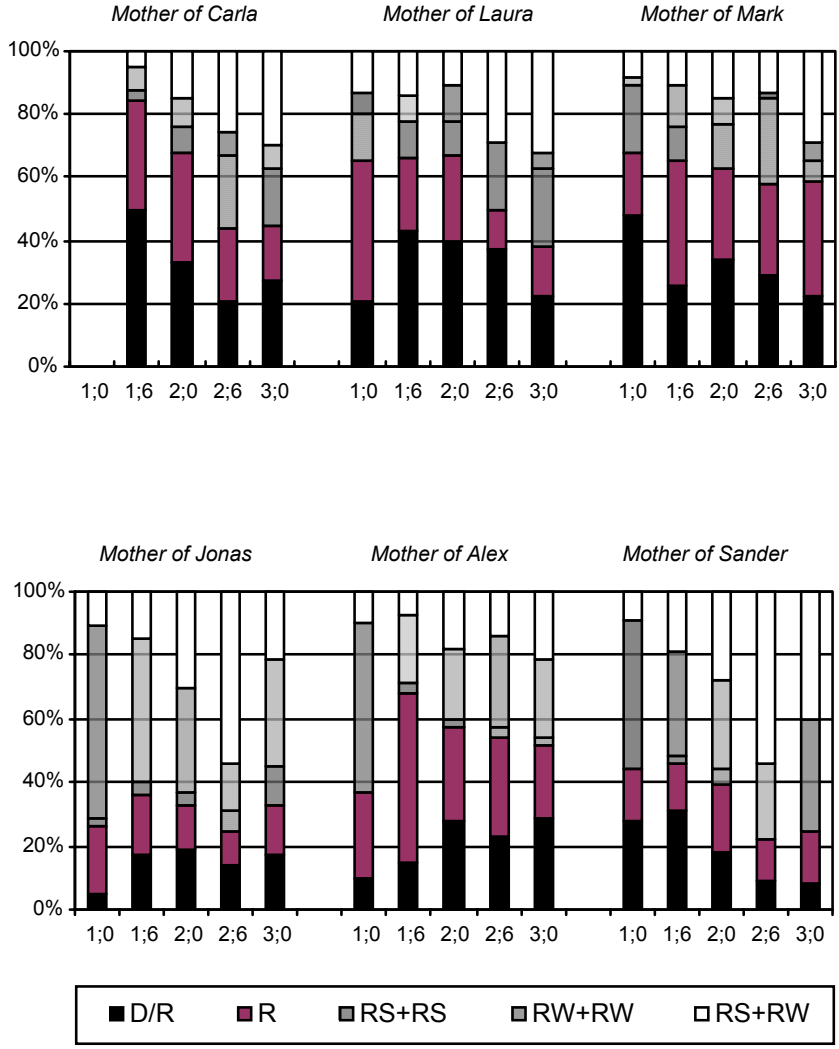
(8) BOOK TAKE POINTbook (take that book) RS / RW
book take

In this analysis we did **not** consider separately utterances such as described in example (9). These were already counted in Chapter 6 as supplementary utterances (ss). The signed and spoken parts were analyzed separately here and in the case of (9) would fall both under R.

(9) HUG ([he is so] sweet [you must] hug [him])
sweet

Results

In all the linguistic input we looked for combinations of representational signs (RS+RS) as evidence for SLN syntax in the input and for combinations of representational words (RW+RW) as evidence for Dutch syntax. Category RS+RW consists of combinations of signs plus combinations of words in SC utterances, and is interpreted as syntactic SLN and syntactic Dutch in combination in a SC context.



D/R = deictic symbol. alone or combined with one representational symbol
R = one representational symbol
RS+RS = combination of ≥ 2 representational signs
RW+RW = combination of ≥ 2 representational words
RS+RW= combination of ≥ 1 representational sign(s) and ≥ 1 representational word(s)

Figures 7.Ia and 7.Ib INPUT DC and HC: Combinations of deictic and representational symbols of the mothers with the deaf and the hearing children

Figures 7.Ia and 7.Ib[3] show the categories as described above, offered by the deaf mothers at the different points in time to the deaf and to the hearing children respectively. We shall discuss the results per category.

The deaf mothers proportionally use category D/R significantly[4] more often with the deaf children than with the hearing children except at age 3;0. Lock, Young, Service and Chander (1990:49) found that hearing mothers' use of pointing gestures with hearing children increases (compared to previous months) around 7 months, 10 months and 13 months. After this there is a steady decrease until 24 months as pointing gestures are steadily replaced by spoken words. This seems also to be the case with the mothers of the hearing children (less so with Alex), but not with the deaf children. This difference may be due to the functions of pointing gestures in sign languages, where they can be personal, possessive and demonstrative pronouns. This function is structurally different from the complementary function they perform in spoken language. The fact that there is more use of deictic signs with the deaf children suggests that from the start the mothers are incorporating deictic gestures in a different way into their linguistic input compared to their use with the hearing children. We will discuss the use of deictic signs further in section 9.7.
This category also includes utterances consisting of a deictic word with or without a representational symbol. We found that the deaf mothers use deictic words only with the hearing children[5], and then only rarely. We will come back to this in Chapter 9, where we will discuss the use of different word-types by the mothers.

Category R utterances (one representational sign or word) are used at all ages with all children. They occur in the input to Jonas (H) and Sander (H) less often compared to the input of the other mothers. The mothers of Carla (D) and Laura (D) seem to use this category less over time.

The combinations of representational signs (RS+RS) or words (RW+RW) reflect the degree of SLN and NL syntax in the input according to the definitions of Caselli and Volterra (1990). The RS/RW category (multiple signs and multiple words combined) is present in the input to all children at all ages. It can be seen that the total number of combinations is greater with the hearing children than with the deaf children. This is probably related to a greater use of deictic signs plus representational signs as a linguistic form with the deaf children. For most children the proportion of combinations in the input increases over time. Mark (D) and Jonas (H) are the exceptions.

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3 see Appendix to Chapter 7, Tables A7.2, page 272 and Table A7.4, page 273 for the raw data and percentages

4 see Appendix to Chapter 7, A.7.5 for Chi-square values per age, page 273

5 see Appendix to Chapter 7, Table A7.2 for information on deictic words in the input, page 272

In Figure 7.Ia we see that the deaf mothers offer the deaf children mainly sign and sign combinations, or sign and word combinations but only small percentages of word and word combinations (range is 0-13%). Most of the Dutch syntax in the input on the basis of which the children might start producing combinations in Dutch themselves is thus offered in a SC context. In section 5.1 we saw that the deaf children receive little Dutch only as a separate language; here we see that they do have evidence for Dutch syntax from the SC input.
The hearing children are offered mainly word and word combinations, and sign and word combinations. Most of the sign combinations are thus offered to the children in a SC context. We do not know at this point whether evidence in SC enables the hearing children to acquire SLN or the deaf children to acquire NL.

Summarizing the section above we can say that the input of the mothers clearly meets the requirements for input formulated by Caselli and Volterra (1990), namely that a truly linguistic system must be offered to children for them to be able to acquire a language. SLN input to the deaf children and NL input to the hearing children is present in the form of combinations, and should enable the children to acquire these languages. However, syntactic NL input to the deaf children and syntactic SLN input to the hearing children is mostly offered in a SC context. These RS+RW combinations form on average 19% of the total input to the deaf children, and 25% to the hearing children. We will need to study the syntactic structure of these combinations in order to establish whether they follow SLN or NL grammatical rules or not (Chapter 9). A further question is whether they can serve as input for grammatical structure and for what system.

7.1.2 The children: from prelinguistic to linguistic symbols

In section 5.3.2 we described how the prelinguistic utterances of the children, i.e. movements and vocalizations, decrease or disappear, as the children grow older. Movements were produced mainly by Carla (D) and Sander (H) at age 1;6. All children showed a decrease in vocalizations, although Carla (D) and Alex (H) produced more vocalizations for a longer period than the other children did. We suggested this might be related to a possibly later development of representational words. In this section we will look in more detail at the first occurrence of representational signs and words in the output of the deaf and hearing children and discuss the relation between the production of movements and vocalizations and the development of the signed and spoken lexicons.
The data on first representational signs and words presented in Table 7.1 come from diary entries made by the mother of Laura (D) and Mark (D), and for Jonas (H) and Alex (H) from a previous study (Blankenstijn and van den Bogaerde 1989). Sander's (H) data are collected by means of a rapid-scanning session of the available videotapes. We found representational signs and words in the 1;6 session of Carla (D); however, since we have no information of her output before this age, we do not know whether these are the first occurrences or not.

Table 7.1 OUTPUT DC+HC: First representational symbols of the children

OUTPUT	Children	first representational sign at age:
Deaf Children	Carla	(<1;6)*
	Laura	0;10
	Mark	0;10
Hearing Children	Jonas	1;2
	Alex	1;0
	Sander	1;0
		first representational word at age:
Deaf Children	Carla	(<1;6)*
	Laura	1;6
	Mark	1;6
Hearing Children	Jonas	1;0
	Alex	0;11
	Laura	1;0

** we have no information of Carla before this age*

Laura (D) produces a few MOV's at ages 1;0 and 1;6, and her first representational sign is reported by her mother to have already occurred at 0;10. Mark's first sign is reported to have occurred at the same age, but contrary to his sister he does not produce any MOV's during the filming sessions. Jonas (H) produces one movement at 1;6 and 2;0, and his first sign occurs around age 1;2. Alex (H), who made no MOV's, produces his first sign at age 1;0, but his production of representational signs shows a different development from that of the other two hearing children (see also later sections). The fact that he produces no movements may be related to the fact that his sign production does not really start to develop within the period of this study. Sander produces some movements at ages 1;0 and 1;6, and his first sign occurs at the age of 1;0.
We see thus that after the first signs appear in the output of the children, movements tend to disappear a few months later.

Vocalizations are produced often by Laura (D) at age 2;0 and by Mark (D) at age 1;6 after which ages vocalizations decrease in their output. Both children produce their first words around 1;6. Although we cannot make an evaluation of the early language production of Carla, we know that from age 1;6 up to age 2;6 she produces significantly more vocalizations than Laura and Mark. In section 5.3.2 we saw that Carla produces more SC utterances than the other two deaf children. We will see whether there is a relationship for the deaf children between the number of vocalizations and the later production of representational words (see section 7.3).
Jonas (H) and Sander's (H) vocalizations decrease after 1;0, around which age their first words appear. For Alex, who produces his first word around 11 months, the number of vocalizations also decrease but they continue to occur more frequently in

his output than in the output of Jonas and Sander. We will see later whether or not this has an influence on his development of spoken language.

In sum we find that as the children start producing representational signs and words the production of movements and vocalizations decreases. The function of vocalizations may be different for the deaf than for the hearing children. With the hearing children vocalizations are decreasingly produced as they are replaced by words. With the deaf children it may be the case that they produce more vocalizations over a longer period of time. Firstly because according to our definitions the sounds they produce are not easily identifiable as 'words' yet, and secondly, because they need more practice than hearing children in order to produce recognizable words. It may be that the more they vocalize, the more practice they get and the more words they will eventually produce. In Chapter 9 we will return to these questions.

7.1.3 Deictic and representational symbols in the output

Pointing gestures (deictic signs) can be expected in young children from approximately 10 months (see for instance Bates, Camaioni and Volterra 1975; Zinober and Martlew 1985; Volterra and Erting 1990). Deictic words appear at different ages in Dutch (Bol and Kuiken 1998:44); for a further discussion of deictic words we refer to Chapter 9.

The first representational signs and words are reported to occur around the first birthday (Bonvillian and Folven 1993, Clark 1993, Volterra and Iverson 1995). Caselli and Volterra (1990) say that *before* children combine two representational symbols, they combine a pointing gesture with a representational symbol (either signed or spoken) (see also Chapter 2). Whether or not children combine two representational signs and/or two representational words, which is considered to be the beginning of syntax is dependent on the input. Only on the basis of a full language model can children acquire that language. This means that, when children are offered a sign language, the expected development is as follows:

1) DS < RS < DS+RS < RS+RS

DS = deictic sign
RS = representational sign

This representation does not imply that whenever a new element or combination is acquired, the element(s) or combination(s) already acquired cannot co-occur with the new ones; in fact, these do not disappear in the language production.

If children are offered a spoken language, the expected sequence of development is:

2) RW
DS+RW < RW+RW

RW = representational word

If children are offered both a sign language and a spoken language (separately or simultaneously) the children will produce the combinations described in 1) and 2) but also combinations in the two different modes (Prinz and Prinz 1979, 1981; Griffith 1985, 1990):

3)

RS, RW DS/RS DS/RW	}	<	{ RS+RS RW+RW RS+RW

The RS+RW combinations remain intriguing, since we do not know to which linguistic system they belong. They may be evidence for SLN for Dutch or for a separate system. Based on the input that we described in Chapter 5 we predict that the children in our study will produce deictic and representational symbols in the sequence described in 3) (see question 14B in section 3.3.)

Results

Figures 7.IIa and 7.IIb[6] show the percentages for the different categories in the analyzable utterances (plus category 'points alone', see Figure 4.II), of the deaf and hearing children respectively over the five points in time. At age 1;0 we have no data from Carla (D) and Mark (D) does not produce analyzable utterances at this age.

As can be seen in Figures 7.IIa the deaf children produce a large proportion of deictic signs at all points in time (range 38-79%) - even at age 3;0 deictic signs (with or without a representational symbol) occur in 40% of the output. The hearing children (see Figures 7.IIb) produce category D/R far less frequently, even though deictic *words* are included in this category. These are produced by the hearing children only[7], mostly from age 1;6 on by Jonas and Alex. Sander produces one deictic word at age 1;0. Contrary to deictic signs, the linguistic status of deictic words is known. We will come back to this aspect in Chapter 9.

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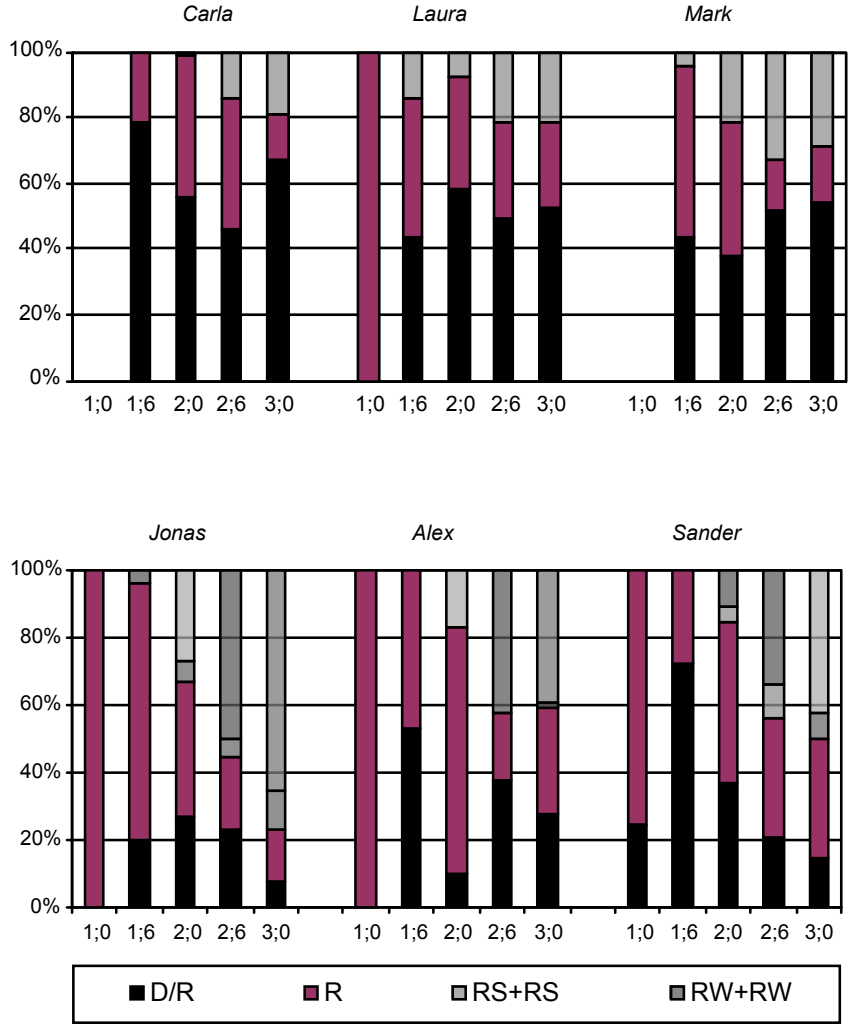
6 see Appendix to Chapter 7, Tables A7.7-A7.12, pages 274-275

7 see Appendix to Chapter 7, Table A7.7, page 274



D/R = deictic symbol. alone or combined with one representational symbol
R = one representational symbol
RS+RS = combination of ≥ 2 representational signs
RW+RW = combination of ≥ 2 representational words
RS+RW = combination of ≥ 1 representational sign(s) and ≥ 1 representational word(s)

Figures 7.IIa and 7.IIb OUTPUT DC and HC: Combinations of deictic and representational symbols of the deaf and hearing children

Single representational symbols are produced at all ages too by all children, but their number decreases.
RS+RS combinations (i.e. SLN syntax) are produced by Laura (D) and Mark (D) from age 1;6 and by Carla (D) from age 2;0. Their input contained many RS+RS combinations (either in SLN or in SC), which enables the children to produce SLN combinations. Jonas (H) and Sander (H) produce sign combinations from age 2;0 on. Even though their input did not contain much SLN (i.e. signs only) (section 5.3.1), apparently the many multiple sign and multiple word combinations (RS+RW) in SC provide much information about RS+RS combinations. These occurred in the input to Jonas in the range of 11-54%, and to Sander between 9-53%. Alex' (H) input of RS+RS combinations almost only occurred in a SC context, but overall was less (range 7-21%) compared to the input to Jonas and Sander. Perhaps this explains why Alex is only starting to produce RS+RS combinations at age 3;0.
None of the children produce multiple sign and multiple word combinations at these ages.

The deaf children produce no RW+RW combinations at all, that is no Dutch syntax. So even though RW+RW combinations were present, mainly in the SC input offered to the deaf children (see section 7.1.1), the deaf children produce no Dutch syntax themselves.
All hearing children from age 1;6 (Jonas) or age 2;0 (Sander and Alex) produce RW+RW combinations. However, they do not produce multiple word combinations simultaneously with sign combinations, which were present substantially in their input.
When we compare the output of the deaf children to that of the hearing children we see that the deaf children in general use more points proportionally (either alone or in combination with one representational symbol) than the hearing children. This was also the case in the input (see section 7.1.1). The hearing children combine representational symbols from the same age on as the deaf children (between 1;6 and 2;0) but they produce a greater proportion. This reflects their input also.

Summarizing the results we can say that in our recordings the children produce representational single sign or word utterances before or at the same time that they start using deictic signs. We have no evidence whether deictic signs were produced before representational signs since the first representational signs were already produced before the first recording. We cannot support or disprove Caselli and Volterra (1990). They claim that children produce deictic signs before representational signs. They also claim that D/R combinations occur before R+R combinations. All children in this study with the exception of Laura (D) did produce D/R combinations before combined R+R symbols.
The deaf children combine representational signs and are thus beginning to produce SLN syntax. They produce no Dutch syntax. This is not consistent with the input they receive. Apparently the spoken or mouthed words in SC utterances (input) cannot serve as uptake for them probably due to access difficulties.

The three hearing children produce NL syntax, and Jonas and Sander also combine representational signs, i.e. use syntactic SLN. Alex, however, produces mainly Dutch combinations, and only at 3;0 begins to combine representational signs. This means that of the six children, only Jonas and Sander show bilingual syntactic skills in their language production.

7.2 Verbs and nouns

7.2.1 Nouns versus verbs in the input

The development of the use of the verbal system of a given language conveys important information on the language acquisition process of a child. In preparation for this discussion in Chapter 9 we will discuss the input and output of verbs versus nouns

As discussed before, verbs are crucial for acquiring the core syntax. But we have also seen that languages differ in their noun bias and that this language specific bias is reflected in the preponderance of nouns in the early production of children (section 1.3.2). We are therefore interested to know how often nouns are used relative to verbs in the signed and spoken input of the mothers and the output of the children (see research question 15, section 3.3).

Method

We counted all nouns and verbs (copulas, auxiliaries and main verbs) in the signed and spoken analyzable utterances of the deaf mothers. We established the ratio as follows: the total number of noun tokens is divided by the total number of noun *plus* verb tokens (N/(N+V)) (see also Tardif et al. 1996). For BSL nouns and verbs are discussed by Sutton-Spence and Woll (1999:108-110) and for ASL the noun-verb distinction has been described by Supalla and Newport (1978). The latter found the following.

> In ASL, the distinction between nouns and verbs and much of the inflectional apparatus of the language appears in the nature of movement of the sign. (Supalla and Newport 1978:93)

The difference between nominal forms and verbal forms in SLN has not been studied yet in detail. Therefore it is sometimes difficult to make the distinction (see section 4.4.3 and Koenen, Bloem and Janssen 1993). Signs were categorized as verbs also on the basis of semantic and contextual information. We looked at all nouns and verbs produced in SLN and in NL, as well as at the signed and spoken nouns and verbs in SC utterances at the session where the children were aged 2;0. We chose this age to make a comparison possible with data presented in other research in several languages (see also section 1.3.2).

Results

In Table 7.2 we present the ratios for signed and spoken noun tokens versus verb tokens in the input of the mothers at age 2;0 of the children.[8]

Table 7.2 INPUT DC+HC : Noun Ratio (tokens) in SLN, NL and SC input of the deaf mothers at age 2;0 of the children (N / (N+V))

INPUT	Mothers	SLN	NL	signed SC	spoken SC
Deaf Children	Mother of Carla	(0)	-	.79	.75
	Mother of Laura	.05	(0)	.42	.38
	Mother of Mark	.08	-	.34	.39
Hearing Children	Mother of Jonas	(1)	.60	.51	.53
	Mother of Alex	(.67)	.27	.59	.54
	Mother of Sander	(.33)	.50	.81	.61

(-) no utterances in this language mode
() these are based on very small numbers

In the SLN input to the deaf children at age 2;0 the noun ratio is very low. Carla's mother produces 4 verbs and no nouns. The mother of Laura and Mark also offers more verbs than nouns (20 and 11 respectively). The noun ratios shown in Table 7.2 in the SLN input to the hearing children is slightly misleading, because Jonas' mother only produces one noun and no verb, Alex' mother 2 nouns and 1 verb, and the mother of Sander 1 noun and 2 verbs. On the basis of these figures we cannot draw any conclusions and we will not further discuss this input.

In the NL input to the deaf children 3 verbs are produced by the mother of Carla, and no nouns are presented at all to any of them. We will not further discuss the NL input to the deaf children. In the NL input to Jonas (H) and Sander (H) we see a noun ratio which is comparable to the noun ratio found in the Gillis and Verlinden study (1988:30, see also section 1.3.2), which was .66. We see a much lower noun ratio in NL with Alex (also compared to the spoken noun ratio in SC), which is comparable to noun ratios found by Tardif et al. (1996) for English and Mandarin.

The signed and spoken noun ratios in the SC input to the deaf children show a difference between Carla's mother and the mother of Laura and Mark. The noun ratios are much higher in the SC input to Carla. This might be related to the fact her mother uses labeling utterances more and for a longer period (Chapter 8). However, for all three mothers the noun ratios of the signed parts of SC are comparable to the noun ratios in the spoken parts of SC. The SC input to Sander (H) has a high signed noun ratio, and this is clearly higher than the signed noun ratios offered to Jonas (H) and Alex (H). The spoken noun ratios are similar in the input to the hearing children, and are also comparable to the noun ratio found in Dutch input by Gillis and Verlinden (1988). When we compare the noun ratios in the SC input to the deaf

8 see Table A7.13 in Appendix to Chapter 7 for full details, page 275

children with that to the hearing children we see that Carla's (D) and Sander's (H) mothers have a higher signed noun ratio than the mothers of Jonas (H) and Alex (H) and a much higher ratio than the mother of Laura (D) and Mark (D).

With Laura (D) and Mark (D) verbs seem to occur more often than with the other children. There is no clear preponderance for nouns with Jonas (H) and Alex (H), although the mothers offer more nouns than English, Italian and Mandarin speaking mothers do. The input to Carla (D) and Sander (H) contains more nouns (both signed and spoken) than verbs. If input is a decisive factor in creating a noun bias in the early vocabularies of the children, we would expect Carla (D) and Sander (H) to produce a high noun ratio, Laura (D) and Mark (D) a low noun ratio, and in Jonas (H) and Alex (H) no clear preference either for nouns or for verbs. We will discuss this further in the next section.

7.2.2 Nouns versus verbs in the output

The same method was followed as for the input. We present in Table 7.3 the noun ratios of the children in our study at age 2;0. Before discussing the results we want to point out that the noun ratios of the children are sometimes based on a very small number of utterances, and must be interpreted with care.[9]

Carla's (D) produces verbs in SLN only, but still her signed noun ratio is high. Her mother's SLN input also contained more verbs than nouns (see Table 7.2). Laura (D) produces slightly more verbs (n=4) than nouns (n=2) in SLN, Mark (D) only three verbs and no nouns. This is similar to their input (more verbs than nouns in SLN). From the ratios for Dutch and SC we can see that Carla (D) uses only spoken nouns. Laura (D) and Mark (D) do not produce any spoken nouns or verbs yet in NL or in SC.

Table 7.3 OUTPUT DC and HC: Noun Ratio (tokens) in SLN, NL and SC in the output of the deaf and hearing children at age 2;0

OUTPUT	Children	SLN	NL	signed SC	spoken SC
Deaf	Carla	.89	1	1	1
Children	Laura	.33	-	-	-
	Mark	0	-	-	-
Hearing	Jonas	.40	.60	.29	.68
Children	Alex	-	.81	1	.71
	Sander	.82	.90	.89	.78

(-) means no utterances in this language mode

Jonas (H) signed noun ratio is much lower in SC than in SLN, and both are lower than the spoken noun ratios. Compared to his mother his signed noun ratio is lower, i.e. proportionally he uses more signed verbs than she does. His spoken noun ratio is

9 see Appendix to Chapter 7, Table A7.14 for details, page 275

similar in NL and SC, and resembles that of his mother's. Alex (H) produces no SLN at all and only nouns in the signed parts of SC. He has a high noun ratio both in NL and in the spoken parts of SC. His output does not resemble the input of his mother. Sander (H) has a high noun ratio in all language modes, and his signed noun ratio in SC is the only ratio that resembles his mother's. In general the hearing children show a much higher spoken noun ratio than their mothers, except Jonas for signs both in SLN and SC. The noun ratios for NL and spoken parts of SC of Alex and Sander are the same or higher than the one found for Maarten (.80) in the Gillis and Verlinden study (1988).

We can conclude that we have found some evidence for a direct influence from the input of the mothers on the production of nouns by the children, but then on an individual basis. Carla (D) and Sander (H) met our expectations for a high noun ratio, and Laura (D) and Mark (D) for a low ratio. Jonas (H) and Alex (H) were expected to show no preponderance for nouns on the basis of their input. However, both Jonas and Alex have a high noun ratio for spoken nouns, and Alex also for signed nouns. Jonas' lower noun ratio for signs is contrary to expectations, and not consistent with his input.
In Chapter 9 we will take a look at the development of the verbal system in the language output of the children, where we might find more facts that might explain the paucity of verbs in the output of the children.
In the next section another lexical aspect, variability in the signed and spoken lexicons of the mothers, is discussed and compared in the interaction with the deaf and with the hearing children.

7.3 Variability in signed and spoken vocabulary

As described in Chapters 1 and 2 the lexical richness of the languages in the input is important for vocabulary development of the children. We want to describe the variability in vocabulary in signs and words, measured in proportion of different types in the input of the mothers and in the output of the children (see research question 16, section 3.3).

Method
As the mothers use mainly SLN and SC with the deaf children, and NL and SC with the hearing children, we decided not to look at the vocabularies per language but per modality, i.e. we looked at all the signs produced in either SLN or SC, and all the words produced in either NL or SC.
In many acquisition studies the TTR (Type-Token Ratio) is used to measure lexical development in children or to measure lexical variability in the input (Templin 1957; Cross 1977; Fletcher 1985). Recently, however, doubts have been expressed about the TTR as an adequate measure (Richards 1987; van Hout and Vermeer 1988; Richards and Malvern 1997, Malvern and Richards 1999)). Van Hout and Vermeer

remark that there are different independent problems in producing a valid measure (1988:119) among others length of text, type of text, word categories and developmental phase of the child.
Despite these restrictions in the use of TTR measures we decided to use this measure. Further research is necessary to develop an adequate measure of the vocabulary (see Richards and Malvern 1997). The number of different types is calculated as follows: the number of (signed or spoken) types of a sample is divided by the total number of (signed or spoken) tokens. We only present data if at least a hundred tokens are produced.
Firstly we investigate the richness of the signed and spoken vocabulary that is offered to the children through the TTR. Secondly, we are interested in the variety in the vocabularies that are offered to the children at the different points in time. For instance is it the case that the children are offered the same words over and over again in each session? In order to gain insight into the variability we measured the number and percentages of *repeated* sign types and word types across all sessions. Thirdly, we take a brief look at the cumulative vocabulary of the children over time.

Procedures

Regarding the type of text we believe that the different samples are comparable, even though the toys that are used may differ within the free play situation (but see chapter 4, Bacchini et al. 1995). Since word categories are different in SLN and Dutch we decided to not make a word category analysis (e.g. content words versus function words) at this point (see section 9.7 for a discussion of these sign or word classes).
Word types were defined as follows (adapted from Templin 1957:160; Miller 1981:42; and Fletcher 1985:42 in Richards 1987:204)

1) Compound nouns count as one word
2) Expressions functioning as a single unanalyzed unit (e.g. *dank je wel* 'thank you' or *tante Gerda* 'aunt Gerda') are counted as one word
3) Inflections and bound morphemes do not count as separate words. Inflected and non-inflected forms of the same stem count as a single type (e.g. *gaat* 'goes' and *gaan* 'go', or *ik* 'I' and *mij* 'me').
4) Demonstrative pronouns (e.g. *deze, die, dat* 'this/these' 'that/those' are counted as one type.

For sign types the same rules apply, with a few clarifications:

1) Classifiers used in verbs are not counted separately. For example: *JIJ Ccl-OPDOENstok* 'YOU Ccl-PUT-ONstick' (put it [the ring] on the stick) or *Bcl-OPDOENsuikerpot* 'Bcl-PUT-ONsugarbowl', (put it [the lid] on the sugarbowl). The type *PUT-ON*, meaning 'to put something on something', is counted once.
2) All Points are ignored as a type, whether they are *POINTto-object, POINTto-person* or *POINTto-location*.

3) Inflections do not count as separate types. Inflected verbs and verbs in citation form count as a single type (e.g. *1KIJKEN2* 'I look at you' and *KIJKEN* 'look', *or candy-in-bookPAKKEN1* 'I take the candy-in-the-book' and *PAKKEN* 'take'.

For the second analysis we consider the variety of the vocabulary over time by calculating the number of repeated types used at the five points in time in the following manner:

- The sign and word types produced in the first session of a particular mother-child dyad are considered to form the basic lexicon of the mother or the child
- In each consecutive session we looked at the number of *repeated* types (i.e. types occurring in more than one session) produced by the mother or the child in relation to the total number of types.

The third analysis concerns the cumulative vocabulary in signs and words of the children during the sessions. From the second session onwards (age 1;6) we counted the number of new signs and words in the vocabularies of the children, including the signs and words produced in the preceding session(s). The cumulative vocabulary of the children is of course based on the five sessions of 10 minutes of interaction, and does not give a picture of their full vocabulary.

7.3.1 Variability in the input

The TTR for **signs**[10] in the input of the deaf mothers ranges between .21 and .46, with a median of .35. No significant difference is found for the number of sign types of each mother at the different points in time[11] or per age group.[12] Furthermore the richness of the sign vocabulary offered to the deaf children is similar to that offered to the hearing children. We can conclude that across time the lexical richness of the sign vocabulary remains more or less the same, whereas we would have expected it to increase.

We measured the number and percentages of repeated sign types across all sessions. These signed data are presented in Table 7.4.[13]

10 see Appendix to Chapter 7, Tables A7.15 and A7.16 for details, pages 275-276

11 see Appendix to Chapter 7, Table A7.17, page 276

12 see Appendix to Chapter 7, Table A7.18, page 276

13 see Appendix to Chapter 7, Table A7.19 for details, page 276

Table 7.4 INPUT DC+HC: Number and (%) of repeated sign types and total number of signs of the mothers, pooled over time

INPUT	Mothers	repeated sign types	total number of sign types
Deaf Children	Mother of Carla	48 (19)	254
	Mother of Laura	51 (18)	290
	Mother of Mark	54 (21)	255
Hearing Children	Mother of Jonas	51 (20)	261
	Mother of Alex	58 (23)	254
	Mother of Sander	69 (24)	290

Table 7.4 shows that the percentages of repeated sign types are more or less the same in the input to the deaf and hearing children. We can conclude that the variety in the sign vocabulary of the mothers is the same with the deaf and with the hearing children. In quantity and quality (related to variety) there is no difference in the input. Considering the fact that in section 5.2 (Figures 5Ia-f) we found that the deaf mothers use mainly SLN and SC with the deaf children, but NL and SC (and some SLN) with the hearing children, this is surprising. We would have expected more signs with the deaf children than with the hearing children on the basis of these findings. This finding suggests a similar lexical use of signs in Simultaneous Communication, even though we found that the use of the two channels is different with the deaf and with the hearing children in terms of propositions (see section 6.3).

The range for the TTR for **words**[14] in the input of the deaf mothers is between .23 and .61 (median .37). In general we find that per mother the TTR does not change significantly over time, except for the mother of Mark (D) (χ^2=16.14, df=4, p≤0.005), who produces fewer word types at age 2;0.[15] We did find a significant difference[16] in the TTR between the deaf mothers at ages 1;0 and 1;6.

Also, the input offered to the deaf children differs significantly[17] from that offered to the hearing children at ages 1;0, 1;6 and 2;6. This indicates that at those ages the deaf children are offered a more varied word lexicon in comparison to the hearing children.

14 see Appendix to Chapter 7, Tables A7.20 and A7.21 for details, page 277

15 see Appendix to Chapter 7, Table A7.22 for Chi-square values per mother across time, page 277

16 see Appendix to Chapter 7, Table A7.23 for Chi-square values for all mothers per age group, page 277

17 1;0 : χ^2 =15.26, corrected for df=1, p≤0.001
1;6 : χ^2 =10.64, corrected for df=1, p≤0.005
2;6 : χ^2 =14.95, corrected for df=1, p≤0.001

In Table 7.5 we present the data for the repeated word types.[18]

Table 7.5 INPUT DC+HC: Number and (%) of repeated word types and total number of word of the mothers

INPUT	Mothers	repeated word types	total number of types
Deaf Children	Mother of Carla	58 (22)	263
	Mother of Laura	49 (19)	253
	Mother of Mark	63 (27)	230
Hearing Children	Mother of Jonas	91 (25)	367
	Mother of Alex	102 (28)	361
	Mother of Sander	129 (29)	448

The percentages of repeated word types are not significantly different (χ^2 = 0.27, corrected for df=1, p≤0.001) in the input to the deaf and to the hearing children. But the total number of word types is different (χ^2 = 95.75, corrected for df=1, p≤0.001). The deaf children are offered fewer words. In our opinion the difference in quantity of words offered to the deaf children carries more weight than the fact that they are offered a more varied spoken lexicon. The spoken words are offered mainly in a signed environment (see section 6.3) which may reduce the focus on the words. Furthermore, the percentages of spoken words that were actually seen by the children were not very high (see section 6.1.1). Also, the fact that more types are offered implies that the words are repeated less often. Whether or not this lessens the chance for the children to acquire those words will be discussed in the next section.

In sum we can conclude that the **sign** lexicon that is offered to the deaf and to the hearing children is similar in size and in variety. From the results presented in section 7.1.1 where we discussed the use of representational signs in combinations, we know that these signs are offered to the deaf children in either a SLN or a SC context, whereas the hearing children see most of the signs in SC utterances. This difference may have its influence on the actual acquisition of vocabulary by the deaf and the hearing children. The hearing children may consider signs to be always connected to spoken words, since they encounter them by themselves less often. We will look into this aspect in sections 7.3.2. and 7.4.
In contrast to the sign lexicon the **word** lexicon offered to the hearing children is significantly larger than that offered to the deaf children. And even though the spoken input to the deaf children seems to be more varied, this fact probably does outweigh the importance of the smaller size of the vocabulary. The deaf children simply encounter fewer words during interaction than the hearing children do.

18 see Appendix to chapter 7, Table A7.24 for individual data, page 278

7.3.2 Variability in the output

The same method was used with the children as with the mothers as described in the section above. Furthermore we look at the cumulative vocabulary of the children over time.

Results

In Table 7.6[19] the TTR for **signs** are presented. We give the data of those sessions where the children produce more than 100 tokens. The hearing children produce fewer than 100 tokens in each recording (except Sander at age 2;6) and therefore their data are not presented in Table 7.6.

Table 7.6 OUTPUT DC: TTR for signs

Deaf children	2;6	3;0
Carla	(.45)*	.58
Laura	.40	.35
Mark	.35	.42

** fewer than 100 tokens*

Carla has a higher TTR at age 3;0 than Laura and Mark. We cannot compare her TTR to earlier ages, because she did not produce 100 tokens in earlier sessions. Laura and Mark show a significant change over time in the number of sign types.[20] Around age 2;6 their sign vocabularies seem to level out, indicating that the higher number of sign types in earlier sessions may very well fall within the period of the 'vocabulary spurt'.

We prorated the tokens of the children to a hundred tokens, in order to be able to compare them. The children differ significantly from each other at most ages.[21] These differences can be attributed to individual variation and not to hearing status, since we found no statistically significant differences between the deaf children and the hearing children as groups.

Next we will look at the total number of sign types and the repeated sign types in Table 7.7[22] in order to gain insight into the variety of the children's vocabularies as we did for the mothers.

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19 see Appendix to Chapter 7, Table A7.25 for the raw data, page 278

20 see Appendix to Chapter 7, Table A7.26 for Chi-square values across time, page 278

21 see Appendix to Chapter 7, Table A7.27 for Chi-square values at different ages, page 278

22 see for the data per session Appendix to Chapter 7, Table A7.28, page 279

Table 7.7 OUTPUT DC+HC: Number and (%) of repeated sign types and total number of sign types of the children

OUTPUT	Children	repeated signs types	total number of sign types
Deaf Children	Carla	22 (19)	119
	Laura	7 (7)	101
	Mark	22 (20)	110
Hearing Children	Jonas	9 (13)	72
	Alex	2 (11)	18
	Sander	16 (13)	120

The percentages of repeated sign types differ significantly for the children individually (χ^2 = 21.6, df=5, p≤0.001), but not for the deaf and the hearing children as a group (χ^2 = 1.82, corrected for df=1, p≤0.001). Carla and Mark (D) repeat more sign types in general than the hearing children, and show the same percentages as their mother. Laura has a very low percentage of repeated sign types, lower than the other children and also lower than her mother. This is of course related to the fact that her amount of language during the sessions is small until age 2;6 (see section 5.1.3). The hearing children repeat fewer signs (mean 12%) than their mothers (mean 23%).

The deaf children produce an equal number of total sign types, but the hearing children differ significantly from each other (χ^2=74.4, df=2, p≤0.001) and also from the deaf children (χ^2=26.22, corrected for df=1, p≤0.001).
In sum then Carla (D), Laura (D), Mark (D) and Sander (H) produce significantly more sign types than Jonas (H) and Alex (H), although the variety in the sign vocabularies shows individual differences. Laura displays a greater variety than the other children, which may be partly explained by the smaller amount of language she produces until age 2;6 (section 5.1.3).

In Table 7.8 we present the TTR for **words** for the hearing children.[23] We give the data of those sessions where the children produce more than 100 tokens. The deaf children produce fewer than 100 tokens in each recording and are thus not represented in Table 7.8.

23 see Appendix to Chapter 7, Table A7.29 for the raw data, page 279

Table 7.8 OUTPUT HC: TTR for words

Hearing children	2;6	3;0
Jonas	.45	.34
Alex	.30	.39
Sander	.54	.52

Jonas (H) shows a significant change in the word TTR, whereas Alex and Sander do not.[24]

A comparison of the children per age reveals (with tokens prorated to 100) that the children differ significantly[25] from each other, especially so at ages 1;0 and age 2;0, and that significant group differences[26] (deaf versus hearing) occur at ages 1;0, 1;6, and 2;6. We can conclude that the hearing children seem to develop according to expectation, but that the deaf children considerably lag behind in their spoken language development. This is of course to be expected because of their low access to the spoken language.

Table 7.9[27] shows the numbers of repeated and total word types.

Table 7.9 OUTPUT DC+HC: Number and (%) of repeated word types and total number of word types of the children

OUTPUT	Children	repeated word types	total number of word types
Deaf	Carla	3 (9)	33
Children	Laura	3 (18)	17
	Mark	0 (0)	6
Hearing	Jonas	48 (23)	209
Children	Alex	32 (25)	127
	Sander	42 (21)	203

The children are significantly different in the percentage of *repeated* word types individually (χ^2=28.99, df=5, p≤0.001) but not per group (χ^2=3.56, corrected for df=1, p≤0.001). Laura (D) has the same percentage of repeated types as her mother, but Carla and Mark show a much lower percentage than their mothers. The hearing children resemble each other and also their mothers for percentage of repeated word types.

24 see Appendix to Chapter 7, Table A7.30 for Chi-square values across time, page 279

25 see Appendix to Chapter 7, Tables A7.31 for Chi-square values per age, page 279

26 see Appendix to Chapter 7, Tables A7.32 for comparison of DC and HC, page 280

27 see Appendix to Chapter 7, Table A7.33 for full details, page 280

The difference in the *total* number of word types is statistically significant, per individual child (χ^2 =437.9, df=5, p≤0.001) as well as per group (χ^2 =390.46, corrected for df=1, p≤0.001). Mark (D) has significantly fewer word types than Laura does (χ^2=19.72, df=2, p≤0.001). She in turn has fewer types than Carla. Carla has the largest spoken vocabulary, as predicted in section 7.1.2 on the basis of her vocalizations. Alex (H) produces fewer types than Jonas and Sander (χ^2=23.3, df=2, p≤0.001), which may also be connected to the fact that he continues to produce vocalizations up to a later age than the other two hearing children.

Huttenlocher et al. (1991) found that *amount* of maternal talk during their observation period was the best predictor of children's growth in vocabulary (in Snow 1994:9) in a monolingual situation. Our findings seem to support their conclusion only in part, this being a multilingual situation. The mothers offered the deaf and hearing children a sign vocabulary, which was similar in terms of quantity of vocabulary (see section 7.3.1). The output of the children shows differences. The deaf children Carla, Laura and Mark, and Sander, who is hearing, have a similar sign vocabulary in size (see above) although the variety in their vocabularies differs. But Jonas' (H) and Alex' (H) sign vocabularies are much smaller, despite the similar input. They focus more on Dutch in terms of language choice (see section 5.3.2). This is reflected in the development of their sign lexicon and is not a result of the lexical input.
The mothers offer the deaf children fewer word types than the hearing children, although the variability of the vocabularies is comparable (see above). This is reflected strongly in the output of the children. As expected, the deaf children produce significantly fewer word types than the hearing children, with big individual differences in the variety of their word lexicons. The fact that the deaf children produce fewer words is of course also related to their hearing status - the acquisition of a spoken language by deaf children is always problematic (Mogford 1988; Beers and Baker 1997) and shows great differences in ultimate success rate.

Finally we will examine very briefly, the cumulative sign and word vocabularies of the deaf and hearing children in 10 minutes of interaction over the five points in time (Figures 7.IIIa and 7.IIIb respectively).[28]

28 see Appendix to Chapter 7, Tables A7.34 and A7.35, page 280

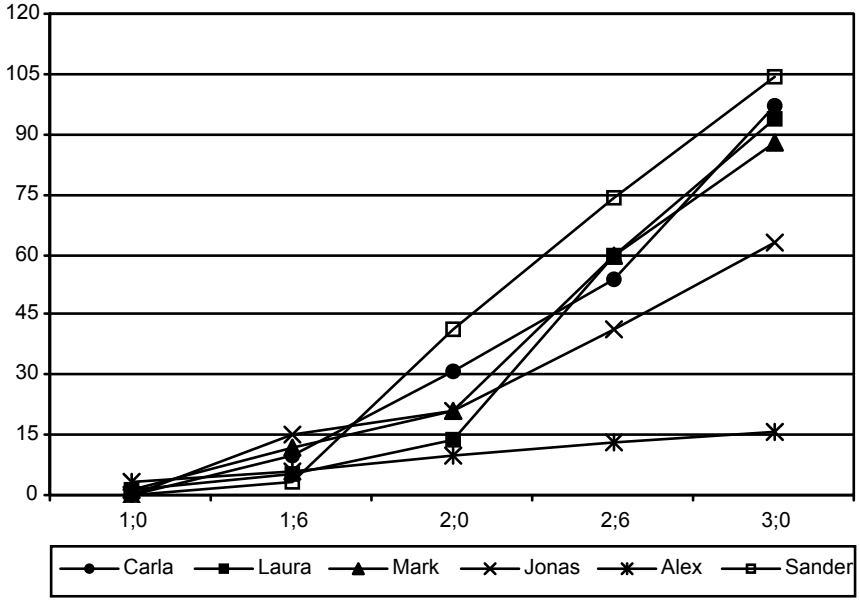


Figure 7.IIIa OUTPUT: Cumulative sign vocabulary (in types) of the deaf and hearing children based on 10 minutes of interaction

The sign vocabularies of Laura and Mark increase the most at age 1;6, and Carla's (D) at age 2;0. We consider those points in time as the period in which they have their 'vocabulary spurt' (Clark 1993:27). Jonas (H) and Alex (H) also show the largest increase in their sign vocabularies at age 1;6 (although Alex produces only a few signs) and Sander (H) at 2;0. At age 3;0, the three deaf children and Sander have similar sign vocabularies in terms of age; Jonas' is a little smaller and Alex only has 18 signs (based on 10 minutes of interaction).

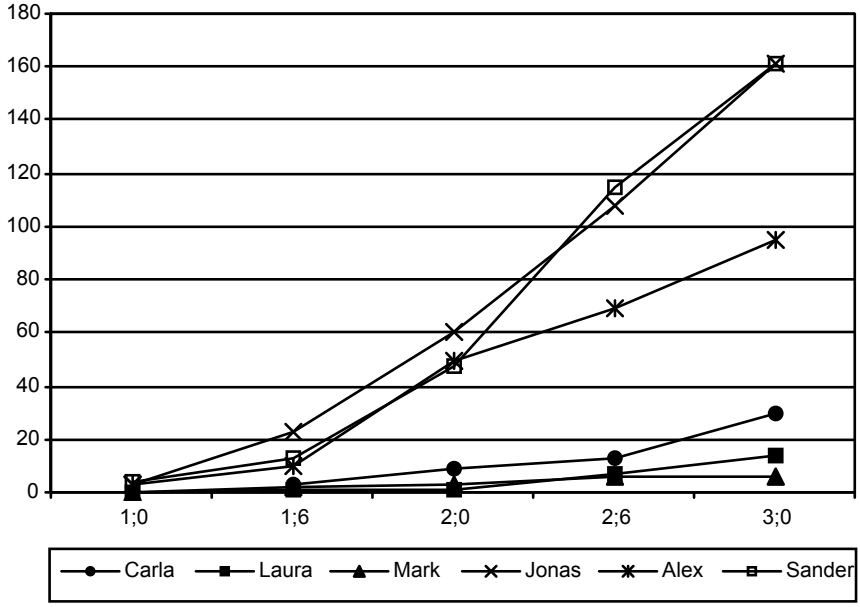


Figure 7.IIIb OUTPUT: Cumulative word vocabulary (in types) of the deaf and hearing children based on 10 minutes of interaction

The increase in word types is very gradual with the deaf children. Carla has a slightly larger vocabulary than Laura and Mark at age 3;0. This may be due to a more proficient use by Carla of her residual hearing, although according to the audiometric tests she has no better hearing than Laura or Mark (see section 4.1). The input of Carla's mother is probably important here. She predominantly offers Carla SC with use of voice (see section 6.1.1), which may stimulate the use of voice and the use of spoken elements in Carla's output.
Hearing children acquiring their first language show a vocabulary spurt at around 1;6 when they have acquired 50 words (Ingram 1989). If there is a comparable spurt in a second language or in bilingual acquisition, then we must assume that the spurt has yet to come for the deaf children.
Alex' word vocabulary increases the most at age 2;0, although his development slows down after this age in comparison to Jonas and Sander. These two hearing children are expanding their word vocabularies quickly and consistently. We thus find that Alex lexical development somewhat lags behind that of the other two hearing children after age 2;0. Apparently it takes him longer to produce intelligible words, which is reflected in his higher production of vocalizations (see section 5.1.3).

We have shown that there is considerable variation in the size, the richness and the variety of the sign lexicons of the deaf and the hearing children at the different ages. The deaf children and Sander (H) seem to develop in a similar way with respect to

vocabulary size. This is also reflected in their cumulative vocabulary. Jonas (H) has a smaller lexicon than the deaf children and Sander (H), and Alex (H) produces only a few sign types. Also with respect to variety (repeated types) there is individual variation. Laura shows slightly less repetition in her choice of signs. The hearing children resemble each other in percentage of repeated sign types. In section 7.3.1 we found that the sign lexicon offered to the deaf and hearing children was similar in size, richness and in variety. However, the signs are offered in SLN and SC contexts to the deaf children and mainly in SC context to the hearing children. This may explain the difference in lexicon of Jonas (H) and Alex (H), but does not explain why Sander's signed lexicon (H) resembles that of the deaf children. Input alone cannot explain the differences in the sign lexicons between Sander and the other two hearing children.
Concerning the word lexicons we found substantial differences between the deaf and the hearing children. The deaf children lag behind the hearing children in size, richness and in variety. Even though the mothers offer the deaf children far fewer words than the hearing children, the difference cannot be explained by input factors alone. The very fact that the deaf children have only visual access to the spoken words diminishes their chances of processing the words fully. The fact that the deaf children do not have full visual access to the word in the input (see Chapter 6) is also partly responsible for their slower development.

7.4 Lexical equivalence in input and output

As described in section 1.4.2 children initially may use words from different languages in one utterance. Whether or not this is a result of mixed input, or evidence that in the beginning there is no separation of language by the children is still under discussion. An indication that children are truly acquiring two languages is the use of lexical equivalents.

7.4.1 Lexical equivalence in the input

The languages that we are studying, SLN and NL, are produced in different modalities - SLN in the visual-gestural modality, and Dutch in the oral-auditive modality. Perhaps this modality difference gives the children enough evidence that two different languages are being used. Or does the fact that signs (e.g. *BOOM* 'TREE' and words (e.g. *boom* 'tree' can be produced simultaneously cloud the issue in any way? The fact that signs and words can be produced simultaneously may obscure the fact that Dutch and NL are two separate languages. There is also the possibility that through the simultaneous use of signs and words (SC) a third linguistic system is offered to the children (Romaine 1995, see sections 1.4.2 and 2.2). Such a third system could show characteristics of both languages, e.g. the syntactic structure of the one and the lexicon of the other language. An analysis was carried out to find out whether or not the children are indeed offered evidence for SLN, NL and possibly

SC as a third system, and whether they show evidence for these languages in their output (see research question 17 in section 3.3).

Method
In order to look for lexical equivalents in the input we distinguished the following categories of language use which shows a contrast between languages:
1) SLN versus NL (e.g. 'TREE' and 'tree')
2) SLN (versus SC, e.g. 'TREE' and 'TREE/tree')
3) NL (versus SC, e.g. 'tree' and 'TREE/tree')

Procedures
1) Evidence for SLN and NL
In this category are included all sign and word types that refer to the same concept and furthermore, that occur without a simultaneously spoken or signed equivalent. Those sign and word types never occur simultaneously but do appear signed only and spoken or mouthed only (Figure 7.IV).

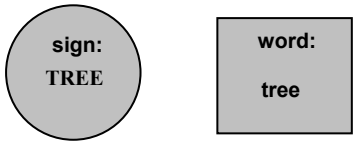


Figure 7.IV INPUT: Evidence for SLN and NL

The underlined signs and words in the following utterances are the targeted items:

(10) *BOOM HOOG* (SLN utterance)
TREE HIGH

(11) *wat een mooie boom* (NL utterance)
what a nice tree

If both examples occur in the input, the child will have encountered evidence for SLN and NL labels for the concept [tree]. If the concept were expressed only by a sign type occurring in a signed utterance or, vice versa, only by a word type in a spoken utterance, that would *not* per se be evidence for SLN and NL to exist as two separate linguistic systems.

2) Evidence for SLN
Signs sometimes occurring alone and sometimes co-occurring with a word (with the same meaning) are evidence for SLN (see Figure 7.V).

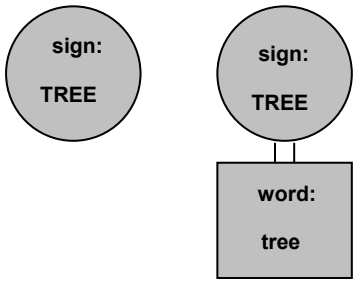


Figure 7.V INPUT: Evidence for SLN

Examples (12) and (13) illustrate this situation:

(12)	*BOOM* HOOG TREE HIGH	(SLN utterance)
(13)	*POINTboom* *BOOM* *dat is* *boom* POINTtree TREE that is tree	(SC utterance)

The fact that the sign also occurs by itself gives support for the existence of SLN as a separate language.

3) Evidence for NL
Words sometimes occurring alone and sometimes co-occurring with a sign (with the same meaning) are evidence for NL (see Figure 7.VI).

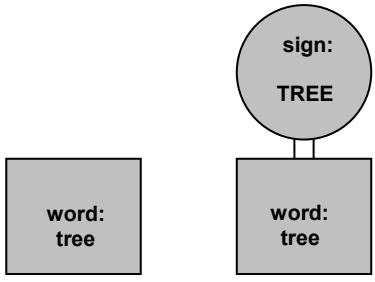


Figure 7.VI INPUT: Evidence for NL

(14) *dat is een boom* (NL utterance)
that is a tree

(15) *POINTplaatje* *BOOM* (SC utterance)
dat is een *boom*
POINTpicture TREE
that is a tree

If the situations depicted in Figures 7.V and 7.VI both occur in the input (i.e., a sign occurs alone and sometimes together with a word which also appears by itself) then this might be lexical evidence for the child that there are two linguistic systems: SLN and NL, and perhaps a third, SC.

No evidence
If for instance the sign *BOOM* 'TREE' occurs *only* in the signed utterance *BOOM HOOG* 'TREE TALL' and an utterance like example (11) *wat een mooie boom* 'what a nice tree' is never offered, the child will encounter only evidence for SLN and not for NL for the concept [tree]; there is no lexical equivalent in NL. The sign and the word for a certain concept both have to occur but separately for the child to find lexical evidence for SLN and NL as separate languages.
There are also signs and words that occur *only* simultaneously. These combinations offer no evidence to the child as to the existence of SLN and NL as different languages.

Results
The results are shown in Table 7.10. The percentages in the last column headed 'No evidence' refer to those lexical items that are only signed alone (and never spoken) or spoken alone (and never signed) or always simultaneously signed and spoken. The percentages in this column represent the lowest percentages occurring at any of the five points in time for a particular mother.[29] Signs and words of this category offer no evidence that SLN and NL are separate languages.

29 see Appendix to Chapter 7, Tables A7.36 - A7.41, pages 281-282

Table 7.10 INPUT DC+HC: Highest % of lexical equivalence of the deaf mothers across all points in time

INPUT	Mothers	Evidence for SLN and NL	Evidence for SLN	Evidence for NL	No evidence
Deaf Children	Mother of Carla	0	8	5	88
	Mother of Laura	1	11	3	87
	Mother of Mark	1	12	1	86
Hearing Children	Mother of Jonas	3	6	15	83
	Mother of Alex	1	5	13	83
	Mother of Sander	2	3	12	85

NB the percentages shown are of the highest occurrence in all points in time; therefore the percentages do not add up to 100%

Although we do find some lexical equivalents for SLN and NL the percentages are very small. More evidence for SLN is found with the deaf children than with the hearing children. NL evidence is presented more to the hearing children than to the deaf children. In our samples the bulk of the lexical symbols produced by the mothers occur without there being a lexical equivalent in one of the other modes. This means that on a lexical basis there is hardly any evidence in the input of the deaf mothers that they are producing SLN or Dutch as a separate system. As mentioned above, the modality difference may offer the children a clue that two languages are being used simultaneously, at least lexically. A further analysis of the *structure* of the SC input may reveal morphosyntactic evidence for its existence as a separate system. This will be discussed in Chapter 9.

7.4.2 Lexical equivalence in the output

We present the data on lexical equivalents in SLN and NL in the output of the children in Table 7.11.[30]

Table 7.11 OUTPUT DC+HC: Percentages of lexical equivalence of the children across all points in time

OUTPUT	Children	Evidence for SLN and NL	Evidence for SLN	Evidence for NL	No evidence
Deaf Children	Carla	10	8	3	83
	Laura	0	10	0	90
	Mark	0	7	0	93
Hearing Children	Jonas	4	2	8	84
	Alex	3	3	3	83
	Sander	2	4	8	87

30 see Appendix to Chapter 7, Tables A7.42 - A7.47 for full details, page 282-283

Although the deaf mothers hardly provide any lexical equivalents in SLN and Dutch (see Table 7.10), Carla shows that for 10% of her sign vocabulary she also produces spoken lexical equivalents. This provides some evidence that she is separating SLN from NL. However, Laura and Mark do not show this awareness (no equivalents in SLN and NL), although all three deaf children show some evidence of SLN being a separate language in contrast to SC. This is comparable to the input they were offered. The deaf children show no awareness that NL is a separate language, even though there was some evidence in their input.
Jonas (H) and Sander (H) show some evidence that they perceive SLN and NL as separate languages. Their output reflects the input of their mothers - although there is not much lexical evidence in the input, it is maybe enough for Jonas and Sander to conclude that there are two systems. To what extent the Simultaneous Communication of the children is a system in itself will be discussed in Chapter 9.
On the basis of lexical equivalents the other children show little evidence that they are aware that SLN and NL are separate languages. The modality difference therefore in the input in itself does not appear to provide the children with a clue that different channels are being used for different languages.

7.5 Summary

The analysis of deictic and representational signs and words showed that a considerable use of deictic signs with a representational sign or word were used in the input. This decreased in time with the hearing children but remained important in the input to the deaf children. In general representational signs in combination were increasingly offered, although these were mostly offered in a SC context with the hearing children. Words are increasingly offered in combination to the hearing children; word combinations were mainly offered in SC to the deaf children. In the children movements and vocalizations start to disappear after the first sign and word respectively appear. The first representational signs were already being produced before the beginning of the study as were the first words of the hearing children. The deaf children produced their first words around 1;6. All the children increase their production of combinations of representational signs over time, but there is variation between the children in the amounts. The hearing children increase their production of word combinations; the deaf children do not yet produce word combinations.

When the representational signs were analyzed in terms of the dominance of nouns in relationship to verbs at two years of age, a complex picture emerges. The mothers showed a strong preference for nouns in Dutch similar to the input in hearing families. In SC and SLN there was individual variation. Laura and Mark's mother showed far less noun dominance; Jonas' and Alex' mothers showed a moderate dominance and Sander's and Carla's mothers had a strong dominance. It is not clear how this variation can be explained. It is possible that where the other uses voice (all

except Laura's and Mark's mother) that Dutch exerts an influence on this aspect of language. The children show a similar variation at age two years in their output.
The input showed an expected amount of lexical variety (TTR) in signs and this does not change over time; the variety in words increased at age 1;6 but was constant after that. Only Jonas showed a change in the variety of his lexical production. The other children were constant but there was considerable individual variation. The children showed a vocabulary spurt in signs around two years of age. Word development was more steady.
The vocabulary was also analyzed to see if there was much lexical equivalence between languages, which might be an indication to the children that they are learning separate languages. There were not many equivalents in the input, and also not in the output of the children.
There are several areas here where the input apparently influences the children's production. The children reflect the amounts of combinations types offered to them on the whole in their output. The deaf children produce combinations in signs, not in words, and the hearing children produce combinations in words and signs as in the input. Alex received less input of sign combinations and does not produce them until 3;0, later than the other two hearing children. The hearing children do however receive most examples of sign combinations in SC but they produce them in SLN; clearly the SC input serves as a model for SLN. The children also in general reflect their individual mother's level of preference for nouns. The variety of vocabulary was similar in signs for the deaf and hearing children, yet the children showed different rates of acquisition. Sander showed the greatest increase amongst the hearing children, which again reflects his greater orientation to signing despite the similarity of his input to that of the other mothers. The small amount of lexical equivalence in the input is also reflected in the output. The children appear not to split simultaneous combinations of signs and words, but acquire these combinations as combinations.

Again there are considerable differences between the deaf and hearing children; some of these are a result of the input, others not. The combination of deictic sign (Point) and representational sign or word was still being commonly used with the deaf children at age 3;0, whereas with the hearing children it had decreased. The deaf children use this also more and the hearing children less. This is a reflection of the fact that the deictic sign is part of SLN, which as a language is offered more to the deaf children (see Chapter 5). The combination of Point and representational sign stays therefore as part of the language, whereas with the hearing children point combined with word disappears as the spoken input becomes more complex. The deaf children receive very few combinations of words in Dutch, as might be expected from the little Dutch input they receive; however they are offered more word combinations in SC. The hearing children do receive signed combinations, mainly in SC. This difference is reflected in their output. The hearing children receive in total more combinations of representational signs or words than the deaf children. This can be partly explained by the fact that Point combined with

representational signs remains common for the deaf children and is part of SLN. The two groups of children are not clearly different in the age at which they produce their first sign; they differ by six months though in the production of the first word. Six months is nevertheless a brief delay considering how inaccessible the input is to the deaf children.

There was no difference in the variety of lexicon offered in signs (TTR) to the deaf and hearing children. The spoken vocabulary offered to the deaf children showed more variety but was a great deal smaller than to he hearing children, as might be expected since they receive so little Dutch. The deaf children start to produce words later and their vocabulary grows more slowly, as a result of their input but also their hearing status. Two of the hearing children are slower in sign vocabulary. Sander is the exception since he seems to be more oriented to signing despite being hearing.

8 FORMAL AND FUNCTIONAL ASPECTS IN INPUT AND OUTPUT

In this chapter we shall take a brief look at some of the functions and forms of the utterances in the input of the deaf mothers and the output of the children. In particular to explore the relationship between function and form. A clear link between the two may be facilitative to acquisition (see Chapter 1). In section 8.1 we discuss some aspects of methodology, and in section 8.2 we describe declarative, interrogative and imperative sentences. Section 8.3 deals with affective propositions. In section 8.4 we look at functional evidence for SLN and NL in the input. A summary follows in section 8.5.

8.1 Forms and functions in SLN, NL and SC

We are interested to find out how declarative, interrogative and imperative forms and functions occur in the input of the mothers at the different ages of the children, and whether or not the mothers offer the deaf and hearing children comparable input in this respect. We will also look at the form and functions in the output of the children, to compare to the input of the mothers.

There exist full descriptions of the declarative, interrogative and imperative forms that the average native speaker of Dutch uses in different functions (see ANS 1984:1061-1068). In Dutch the verb is moved to first position in questions and this *form* may help the child to identify its interrogative *function* in the input. When the verb is in second position, this indicates to the child that the utterance is a declarative. The match between form and function may thus be facilitative for the acquisition of certain aspects of the grammar of Dutch. There is not much information on the forms and functions that Dutch mothers use with their young children up to age 3;0 (but see Schaerlaekens and Gillis 1987; van de Weijer in press).
Moreover, to date there are only incidental descriptions of declarative and interrogative forms in adult SLN (Bos et al. 1988; Coerts 1992; Schermer et al. 1991). In SLN, questions are formed by means of non-manual grammatical markers, among other things. These can serve as a trigger for the child that the utterance has a different function than, for instance, a declarative utterance. Studies on the imperative form, and functional use of all the forms above have not been done yet for SLN. No description at all exists for the use of these SLN and NL forms and functions in simultaneous communication. Also we face the issue that the deaf mothers in our study perhaps do not use 'correct' or native-like spoken Dutch with

their children (see also Chapter 9). This may make it more difficult for the children to establish a link between function and form. The utterance in (1) exemplifies the different Dutch that is used by the mothers. The correct Dutch sentence might be: 'Voor de volgende keer zal mama de suikerschep zoeken' (Before we play this the next time, mummy will look for the sugar spoon). The preposition *voor* is then left out, as well as the auxiliary *zal* 'will' and two articles *de* 'the'. The second part of the compound *SUIKER^SCHEP* is also missing, giving a different meaning to the spoken part of the SC utterance. In fact, this sentence follows SLN rules, except that the verb is not in final position.

(1) *VOLGENDE KEER MAMA ZOEKEN SUIKER^SCHEP*
volgende keer mama zoeken suiker
NEXT TIME MOMMY SEARCH SUGAR^SPOON
next time mommy search sugar

(Before we play this the next time, mummy will look for the sugar spoon)

In the next example (2) the idiomatic Dutch equivalent of the spoken part of the utterance would be: "Er zijn huizen hier, in de straat" (There are houses here, in the street). In the spoken part the verb *heb* 'have' is used instead of the verb *zijn* 'are'. This verb is also incorrectly inflected. *Huizen* 'houses' (subject) is in initial position, *er* 'there' is deleted and there is no preposition *in* and there is no article *de* 'the' before *straat* 'street'. The structure of the sentence is thus more SLN-like than NL-like (see also Schermer 1990).

(2) *HUIZEN POINThuizen STRAAT POINTstraat POINTstraat*
huizen heb straat pff straat
HOUSES POINThouses STREET POINTstreet POINTstreet
houses have street pff street

(There are houses here, on this street)

In order to gain insight into some functions of the input, despite this lack of detailed information on forms in SLN and SC, we decided to make a very global inventory of the input of the mothers regarding the declarative, interrogative and imperative functions they use. We will also look at the use of labeling utterances to compare our data with that of Kyle et al. (1987). Labeling utterances are a subcategory of Declaratives (see Method and Procedures in the next section).

8.2 Declaratives, interrogatives and imperatives

8.2.1 Declarative, interrogative and imperative input

We will first examine the proportion of utterances with a declarative, interrogative and imperative function in the input of the deaf mothers (see research question 18 in section 3.4). We will also look at the form of these declarative, interrogative en imperative utterances. These aspects will be examined in the output in the following section (8.2.2).

Method

All analyzable utterances of the mothers and the children are coded per language mode, that is in SLN, in Dutch and in SC. We distinguish the following categories:

I	D	Declarative
	D1	Declarative, incorrectly formed
	DL	Labeling declarative
II	Q	Interrogative consisting of a *wh*-question sign/word only
	Q1	Correctly formed *yes/no*-question
	Q2	Correctly formed *wh*-question
	Q3	Interrogative, incorrectly formed
III	I1	Imperative in form
	I2	Imperative, incorrectly formed

A more detailed explanation of these categories is given below in Procedures.

Procedures

1 Declarative sentences are sentences that describe an action or state (3). If the utterance has a labeling function, we add a sub-code: L (4). Declaratives in *function* but not in *form* are coded as D1 (5) (see also Scheper et al. (in press) on omissions in first position in the sentence)

(3)	D	*BOEK LEZEN* BOOK READ	(you are reading a book)
(4)	DL	*dat is een boek* that is a book	(that is a book)
(5)	D1	*ga je rijden* go you drive	(you are going to drive)

The verb in (5) is in first position, which in Dutch indicates a question-form. However, from the context and the mother's facial expression it was

clear that this utterance had a declarative and not an interrogative function.

2 The form of interrogative sentences has been described for SLN (Coerts 1992) and NL (e.g. ANS, 1984: 1064 ff). We established whether or not an utterance was a correctly formed interrogative on the basis of the following criteria:

SLN non-manual marker *q* (*yes/no*) (6) or non-manual marker *wh-q* is used with or without a *wh*-question sign (7)

NL inversion of the verb occurs (8)
a *wh*-question word is used (9)
intonational questions (rising intonation, but no inversion of verb) (see example (10))
(this last category is quite common in spontaneous mother-child interaction)

If these criteria are met the utterances are coded with:

Q if the utterance consists of a *wh*-question sign/word only
Q 1 if it is a correctly formed *yes/no*-question
Q 2 if it is a correctly formed *wh*-question
Q 3 the utterance is not an interrogative in *form*, but has an interrogative *function*
Note: the deaf mothers make use of intonation contours only rarely in NL. Therefore, if an utterance is a question in form, but no interrogative intonation is used we coded such an utterance as incorrect in form (see example (10)).

(6) SLN Q1 _____*q*
BOEK LEZEN (shall we read a book?)
BOOK READ

(7) SLN Q2 _____*wh-q*
WAT LEZEN WAT (what do you want to read?)
WHAT READ WHAT

(8) NL Q1 *zullen we een boekje lezen* (shall we read a book?)
shall we a book-dim. read

(9) NL Q2 *wat is dat* (what is that?)
what is that

(10) NL Q3 *ik moet hier zitten* (should I sit here?)
I must here sit

Although in example (10) there is no rising intonation, it was clear from the context and the way the mother paused after the utterance and the manner in which she looked at the child, that she asked him a question. It is unclear in this instance whether or not her facial expression should be interpreted as a non-manual grammatical question marker here. But the child interpreted it as an interrogative, and replied: "Yes".

3 Imperative forms are well described for Dutch (e.g. ANS, 1984:426, 1065) but not at all for SLN. For Dutch therefore we coded:

I1 if the utterance is an imperative in *form* (11)
I2 if the utterance is an imperative in *function*, but not in *form* (12)

(11) I1 *pak die bal* (take that ball)
take that ball

(12) I2 *pakken bal* (take the ball)
take-inf ball

For SLN utterances we used only the functional code I3 (14) since formal characteristics of SLN imperatives have not been described yet. If the utterance did not contain a verb, or consisted of one sign or word only we coded: I (13)

(13) I *PAKKEN* (take)
TAKE

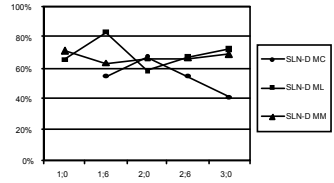
(14) I3 *BAL PAKKEN* (take that ball)
BALL TAKE

Results
We display the results in Figures 8.I for the deaf mothers with the deaf children and with the hearing children in the three language modes, in order to be able to show a possible development in their use of the three main functions that we distinguish.[1]

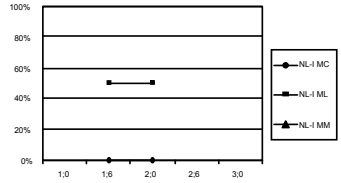
Taking the results across all language modes, the hearing children are offered more interrogatives than the deaf children (see also Table 8.1). The number of imperatives is comparable as is the number of declaratives.

1 see also Appendix to Chapter 8, Table A8.1 for the numbers and percentages, page 284

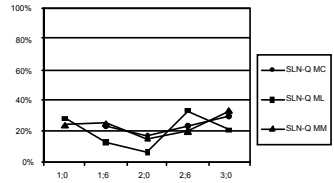
INPUT DC: Declaratives in SLN



INPUT DC: Declaratives in NL



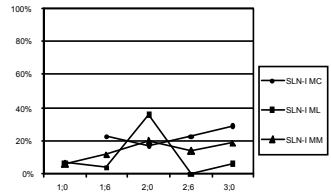
INPUT DC: Interrogatives in SLN



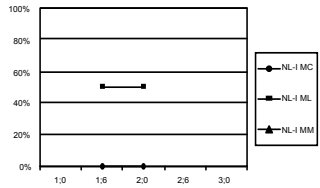
INPUT DC: Imperatives in NL

No interrogatives produced in Dutch by the deaf
mothers with the deaf children

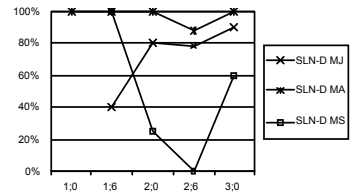
INPUT DC: Imperatives in SLN



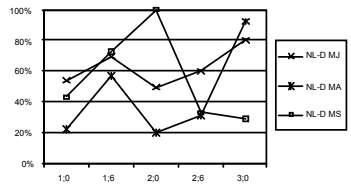
INPUT DC: Imperatives in NL



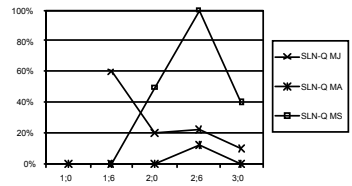
INPUT HC: Declaratives in SLN



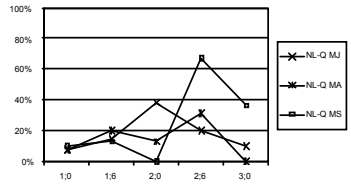
INPUT HC: Declaratives in NL



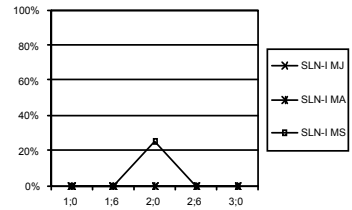
INPUT HC: Interrogatives in SLN



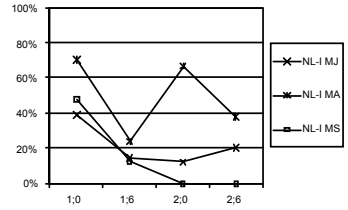
INPUT HC: Interrogatives in NL



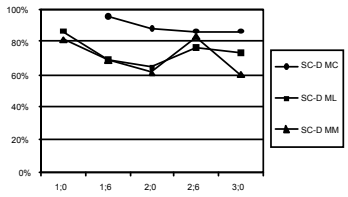
INPUT HC: Imperatives in SLN



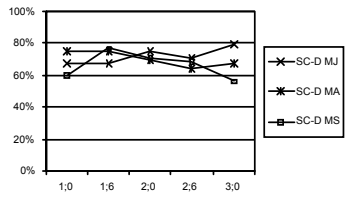
INPUT HC: Imperatives in NL



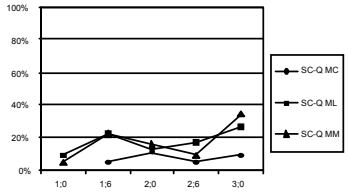
INPUT DC: Declaratives in SC



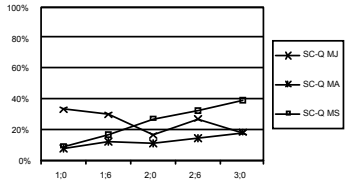
INPUT HC: Declaratives in SC



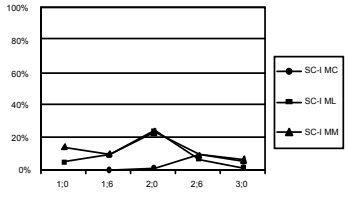
INPUT DC: Interrogatives in SC



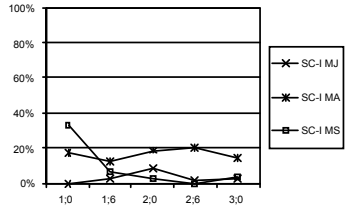
INPUT HC: Interrogatives in SC



INPUT DC: Imperatives in SC



INPUT HC: Imperatives in SC



Figures 8.I INPUT DC+HC: Declaratives, interrrogatives and imperatives in the input of the deaf mothers

When we look at the patterns of the three functions in the three language modes in the input to the deaf children we can see that the SLN input and the SC input more or less look similar: many declaratives, but at most times also interrogatives and imperatives. The NL input (very small, Chapter 5) has only some declaratives, a few imperatives, but no interrogatives. All spoken interrogatives in the input to the deaf children are in SC. Imperatives occur mainly in SLN and SC. This would lead us to expect, on the basis of input alone, no interrogatives in the NL output of the deaf children, but only declaratives and perhaps imperatives.

We might expect the deaf children to produce all three functions in SLN and in SC.
The input to the hearing children shows erratic patterns in SLN and NL and there is much individual variation, as well as no consistent line over time. In SLN declaratives and interrogatives (in total only 13) are offered, but hardly any imperatives. In the NL input we see at times a high percentage of declaratives, but at other times a high percentage of interrogatives (Mother of Sander at 2;6) or imperatives (Alex' mother). On the basis of this input it is difficult to make predictions for the acquisitions of these forms by the hearing children. Van de Weijer (in press) found approximately 58% declaratives, 19% interrogatives and 23% imperatives in monolingual Dutch input to a child at age 2;6 to 2;9. Our mothers offer on average at ages 2;6 and 3;0 54% declaratives, 23% interrogatives and 23% imperatives. These percentages are highly comparable to those of van de Weijer.
In the SC input to the deaf children we see a very slight decrease over time in declaratives and a slight increase in the use of interrogatives, but imperatives do not change. To the hearing children the percentages of declaratives in SC are more or less stable, although at age 3;0 we see some differences between the mothers. Alex and Sander are offered increasingly more SC interrogatives, contrary to Jonas' input of interrogatives, which decreases slightly over time. Imperatives decrease slightly in the SC input to all three hearing children. On the whole the hearing children are offered more signed and spoken interrogatives than the deaf children (see also Table 8.1), and similar signed imperatives. However, the hearing children are offered many more spoken imperatives (see Table 8.2 for the total number of imperatives). Signed imperatives decrease over time in the NL and SC input with all children but not in SLN with the deaf children.

As far as functions are concerned we find the input to the deaf and hearing children similar in SC. The input in SLN is more varied to the hearing children, whereas with the deaf children there is more consistency. The input in Dutch to the hearing children also shows more variation. In section 8.2.2 we will consider the influence of the input on the acquisition of these functions by the deaf and hearing children.

Within the category of declarative utterances labeling utterances in general are expected to be highly represented, but decreasingly over time (see also section

2.2.2). We present the data for labeling utterances in Figures 8.IIa for SLN, in Figure 8.IIb for NL and in Figure 8.IIc for SC input[2]. Percentages are of the total of analyzable utterances of the mothers per language.

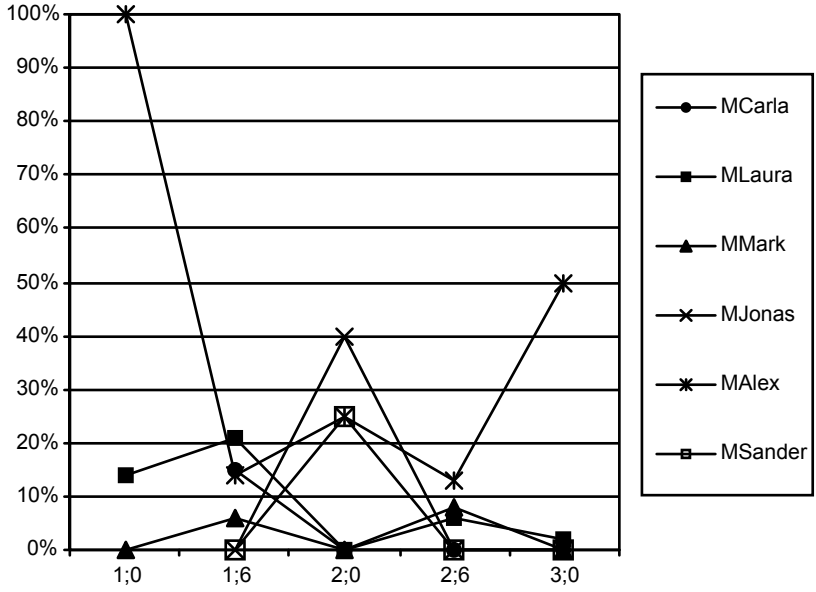


Figure 8.IIa INPUT DC+HC: Labeling utterances in SLN

We can see a decrease in labeling utterances in SLN with all children, except with Alex where there is an increase at 3;0. The increase in the SLN input with Alex is surprising – it is however at age 3;0 that Alex begins to produce more SLN and SC than at earlier ages (see section 5.3.2). His mother possibly uses more labeling utterances at this point to stimulate his acquisition of vocabulary. The activities were not remarkably different. With the hearing children there appears to be a slightly larger use of labeling, although Jonas' mother only produces them at age 2;0.

In spoken Dutch (see Figure 8.IIb) we see that actually only with the hearing children labeling utterances are used, with the deaf children these rarely occur. At 1;6 there is a peak in the use of these utterances, and after age 2;0 of the children they almost disappear altogether from the NL input to the hearing children.

2 See Appendix to Chapter 8, Table A8.2, page 284

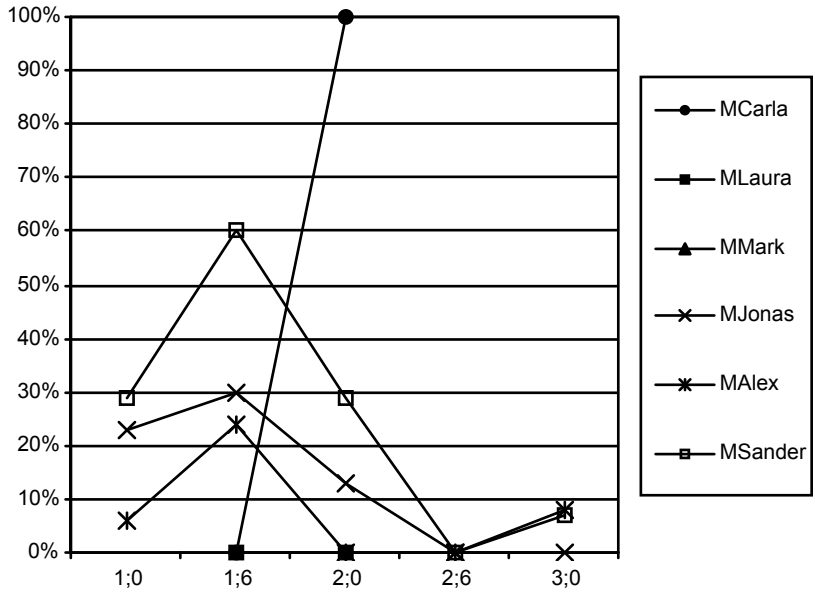


Figure 8.IIb INPUT DC+HC: Labeling utterances in NL

The percentages of labeling utterances in the SC input to all children show a decrease except with Carla (D) and Alex (H) after age 2;6 (see Figure 8.IIc).

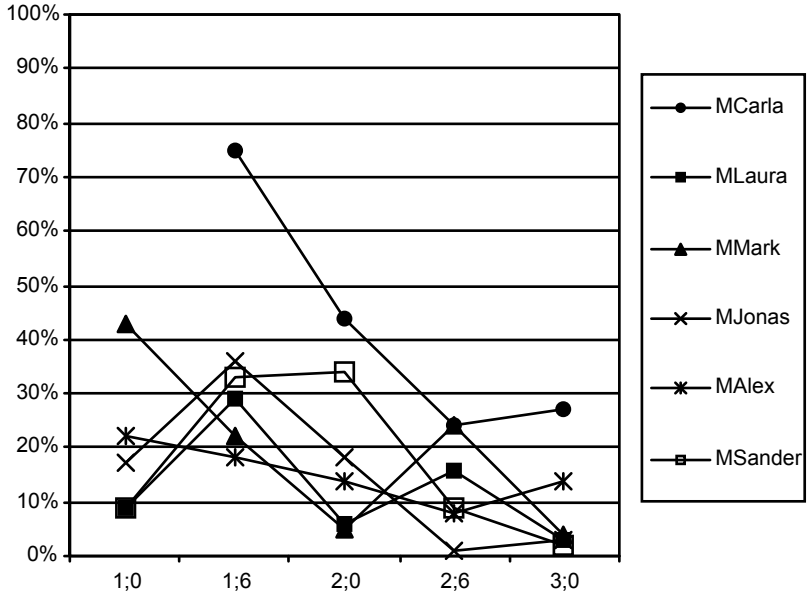


Figure 8.IIc INPUT DC+HC: Labeling utterances in SC

At age 3;0 labeling utterances only very rarely occur, except with the two children mentioned. There might be a relation here with the development of the visual attention patterns of Carla (D) and Alex (H) (see Chapter 6), which is a little slower compared to the other children in reaching an 'adequate' level. This fact may influence the mothers to use labeling strategies for a longer period, to continue 'training' their visual attention. With Alex we found that he started to combine representational signs only at age 3;0, later than the other children (see Chapter 7). This may also induce his mother to continue to use labeling utterances more than the other mothers.

We can conclude that the use of labeling utterances decreases as might be expected. There seems to be a relation with the visual attention training of the children who are offered linguistic information in the visual-gestural modality. Once the children are judged to have acquired the appropriate visual attention-giving behavior for sign interaction, the use of labeling utterances decreases in the input. This is then a specific aspect of input in deaf families.

For the discussion of form of interrogative and imperative sentences we have collapsed the data of the functions in SLN and the signed parts in SC, and of the functions in Dutch and in the spoken parts of SC. The form of declarative sentences will be discussed in length in Chapter 9.
We present information on the form of interrogatives in Table 8.1.

Table 8.1 INPUT DC+HC: Number and (%) of subcategories Q, Q1, Q2 and Q3 in signed and spoken Interrogative sentences of the deaf mothers, pooled over time.

INPUT	Signed to deaf children		Signed to hearing children		Spoken to deaf children		Spoken to hearing children	
Q	40	(18)	54	(17)	23	(16)	42	(12)
Q1	80	(35)	75	(24)	10	(7)	50	(15)
Q2	90	(39)	104	(33)	32	(22)	145	(43)
Q3	19	(8)	78	(25)	82	(56)	103	(30)
Total Interrogatives	229		311		147		340	

Q = wh-word/sign only *Q2 =wh-word/sign question*
Q1 = yes/no-question *Q3 =question in function only, incorrect form*

The deaf children are offered in signs over the whole period more or less equal percentages of *yes/no* interrogatives (Q1 – 35%) and *wh-q* sign questions (Q2 - 39%), and only a few interrogatives that do not have the correct interrogative form (Q3 - 8%). Over time we find a decrease in incorrectly formed signed interrogatives with Laura and Mark; with Carla this is less evident. We can also see an increase over time in *wh-q* sign questions, except with Mark whose mother shows an increase in signed *yes/no-* questions. In comparison to signed interrogatives they are offered more spoken interrogatives that are incorrectly formed (56%), and more *wh-*

q word questions than spoken *yes/no*-questions. Spoken interrogatives that are incorrectly formed tend to increase over time with all three deaf children. We must bear in mind here, that the rules for spoken interrogatives in Dutch have been described in much more detail than the rules for signed interrogatives (in SLN). It could be the case that signed interrogatives termed incorrect by us in the interaction between mothers and children would be judged grammatical by adult native signers. A NL example of a Q3 interrogative is given in (15), which actually shows a typical SLN order (with topicalization of *bos* 'forest').

(15) [ML, 3;0-utt. 57]
NL *bos, kan overheen* (can you go *over* the forest? [instead of *through*
forest, can over the forest])

The hearing children are offered more *wh-q* sign questions (Q2 - 33%) than *yes/no*-questions (Q1 - 24%). They receive more incorrectly formed signed questions (Q3 - 25%) than the deaf children. Over time this category Q3 decreases in the input to Jonas, increases with Sander and remains more or less the same with Alex. Their spoken input has 43% of *wh-q* word questions (Q2), but also many incorrectly formed spoken questions (Q3 - 30%). In general Q3 in words increases over time, but there is some individual variation at the different ages of the children. An example is given below of an interrogative in Dutch without verb inversion and without a rising intonation.

(16) [MJ, 1;6-utt. 152]
NL *jij kan tekenen* (can you draw)
you can draw

With the deaf children the focus is, again, on the signed mode with many correctly formed interrogatives, whereas 56% of the spoken interrogatives are incorrectly formed. With the hearing children the signed and spoken modes look more similar, but incorrectly formed interrogatives occur often both in signed and spoken modes. With both deaf and hearing children incorrectly formed spoken interrogatives increase, whereas correctly signed interrogatives increasingly occur with the deaf children, but are varied in the input to the hearing children.
Quantitatively and qualitatively there are substantial differences in the input of interrogatives to the deaf and to the hearing children. This may have its influence on the acquisition of these forms by the children, which we will discuss in section 8.2.2. In section 9.6.1 we will discuss the different forms of signed interrogatives in more detail.

Next we will look more closely at the form of imperatives in the input of the deaf mothers. Table 8.2 shows the results for the subcategories.

Table 8.2 INPUT DC+HC: Number and (%) of subcategories I, I1 I2 and I3 in Imperative utterances of the deaf mothers, pooled over time.

INPUT	Signed to deaf children	Signed to hearing children	Spoken to deaf children	Spoken to hearing children
I	1 (-)	8 (6)	5 (6)	5 (2)
I1	-	-	31 (37)	133 (55)
I2	-	-	47 (57)	104 (43)
I3	139 (99)	134 (94)	-	-
Total Imp.	140	142	83	242

I =one word sign imperative *I1 = imp. in form*
I2 = ungrammatical spoken imperative *I3 signed imperative*
***NB I3** for signed imperatives does <u>not</u> mean ungrammatical, since a distinction between incorrect and correct forms for imperatives in SLN cannot yet be made (see Procedures)*

As mentioned earlier, the signed imperatives in the input to the hearing and deaf children are quantitatively the same, except that with the hearing children they occur mainly in SC whereas with the deaf children they are also present in SLN.
More spoken imperatives are used with the hearing children than with the deaf children; and of these 55% have the correct imperative form (I1) versus 37% with the deaf children. The higher percentage of spoken imperatives with the hearing children is mainly caused by the mother of Alex (H), who uses significantly more imperatives than the other mothers.[3] Many of these were in the form of attention-getters like *kijk eens* 'look here' or *kom maar* 'come here'. In general though spoken imperatives decrease over time in the input to all children.

In the next section we will discuss functional and formal aspects in the output of the children.

8.2.2 Declarative, interrogative and imperative output

We give the percentages for signed and spoken declaratives, interrogatives and imperatives in the SLN, NL and SC output of the deaf and hearing children in Figures 8.III.[4]

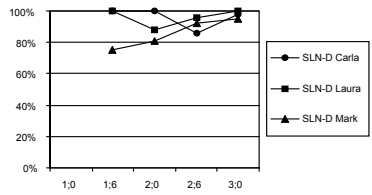
Figures 8.III show that the deaf children mainly produce signed declaratives and a few interrogatives (total n=21) and hardly any imperatives in SLN and SC. When they produce NL utterances these are all declaratives. Since there were also no interrogatives in the NL input, this is not surprising.

---

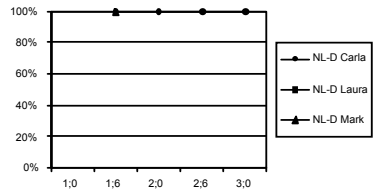
3 signed Imperatives $\chi^2 = 92.82$, df=5, $p \leq 0.001$
spoken Imperatives $\chi^2 = 259.3$, df=5, $p \leq 0.001$

4 See Appendix to Chapter 8, Table A8.3, page 284-285

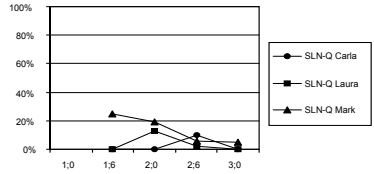
OUTPUT DC: Declaratives in SLN



OUTPUT DC: Declaratives in NL



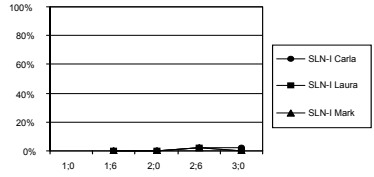
OUTPUT DC: Interrogatives in SLN



OUTPUT DC: Interrogatives in NL

The deaf children produce no interrogatives in NL

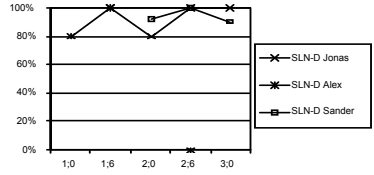
OUTPUT DC: Imperatives in SLN



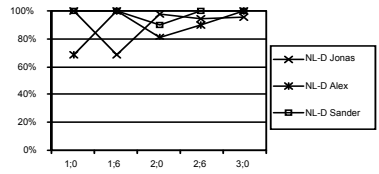
OUTPUT DC: Imperatives in NL

The deaf children produce no imperatives in NL

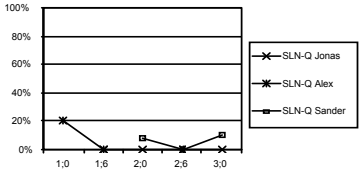
OUTPUT HC: Declaratives in SLN



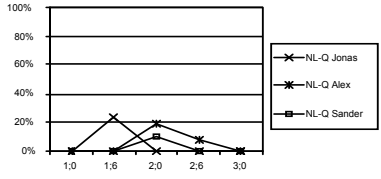
OUTPUT HC: Declaratives in NL



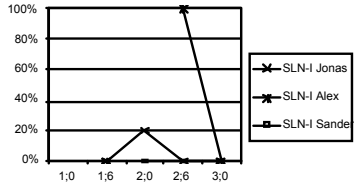
OUTPUT HC: Interrogatives in SLN



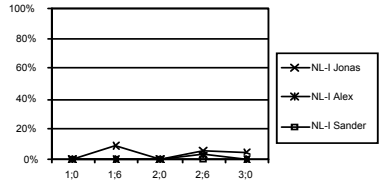
OUTPUT HC: Interrogatives in NL



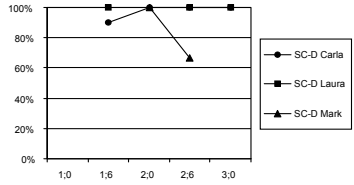
OUTPUT HC: Imperatives in SLN



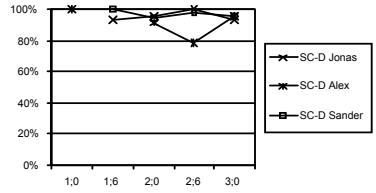
OUTPUT HC: Imperatives in NL



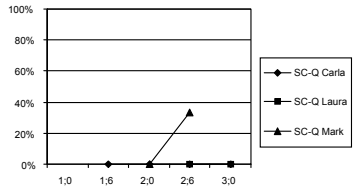
OUTPUT DC: Declaratives in SC



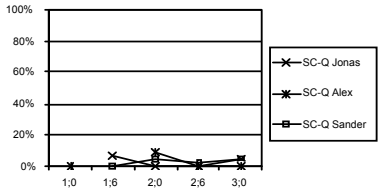
OUTPUT HC: Declaratives in SC



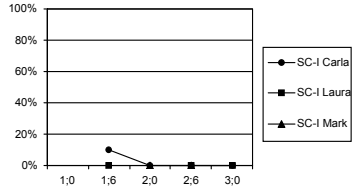
OUTPUT DC: Interrogatives in SC



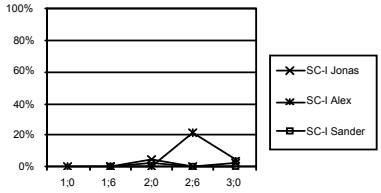
OUTPUT HC: Interrogatives in SC



OUTPUT DC: Imperatives in SC



OUTPUT HC: Imperatives in SC



Figures 8.III OUTPUT DC+HC: Declaratives, interrogatives and imperatives in SLN, NL and SC utterances of the deaf and hearing children

Interestingly, the percentages of interrogatives in SLN decrease over time. It is unclear why this is so, but probably interactional aspects play a role here.
Declaratives are also the largest category in the production of the hearing children, but questions do occur (n=45), mainly spoken or in SC. Alex' question in SLN at 1;0 is one *wh*-question sign *WHERE*, in imitation of his mother's question where the cat was. The hearing children produce slightly more imperatives than the deaf children, but very few in total (n=12) and mainly in NL and SC. Compared to the input the children produce even more declaratives than their mothers, and far fewer questions, which they start producing at different ages (see also section 9.6.2)

Before discussing the form of interrogative and imperative utterances of the children, we will briefly look at the use of labeling utterances in their output. Figures 8.IVa, 8.IVb and 8.IVc show labeling utterances in SLN, NL and NL output.[5] Not all children produce labeling utterances in all languages at all points in time.

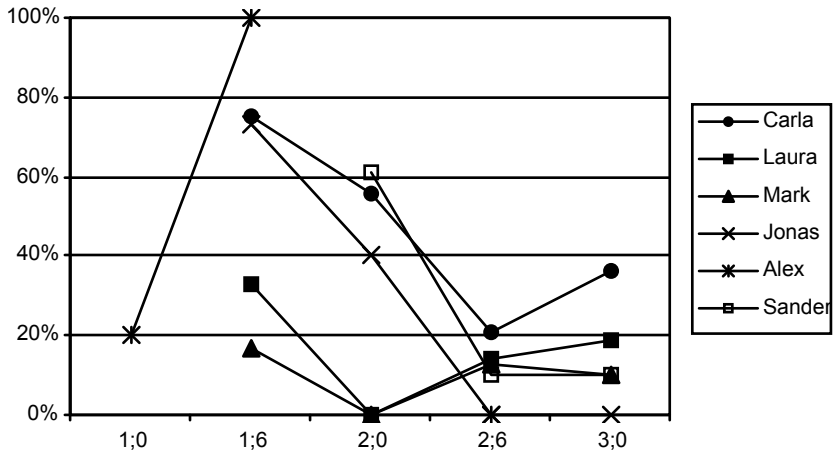


Figure 8.IVa OUTPUT DC+HC: Labeling utterances in SLN

All children show a clear decrease in SLN labeling utterances up to age 2;6, after which age there is an increase in the output of Carla (D). Alex (H) hardly seems to label at all in SLN after age 1;6.

5 See Appendix to Chapter 8, Table A8.4, page 285

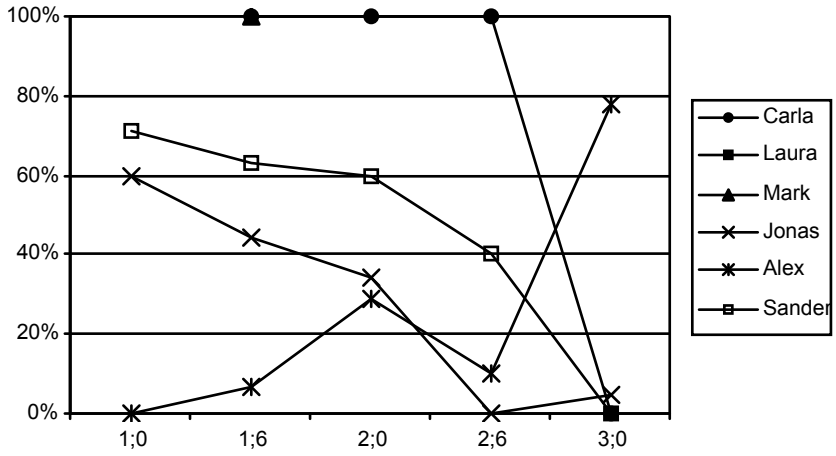


Figure 8.IVb OUTPUT DC+HC: Labeling utterances in NL

In Dutch (Figure 8.IVb) the deaf children only produce labeling utterances. The hearing children show a decreasing use of labeling in NL, except for Alex (H) at age 3;0, who shows an increase compared to 2;6. In SC (Figure 8.IVc) we see that the deaf children have no consistent production of labeling utterances over time. The hearing children produce them decreasingly as they grow older.

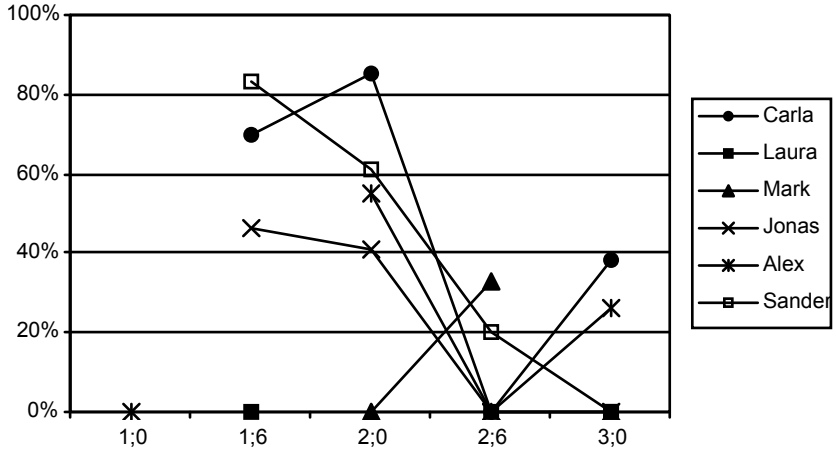


Figure 8.IVc OUTPUT DC+HC: Labeling utterances in SC

The deaf children produce labeling utterances decreasingly in SLN and SC and their Dutch consists only of labeling utterances. Sander (H) appears to be the only one who shows a more or less consistent, decreasing line in the three language modes. Jonas (H) does not produce many labeling utterances, but he does so in all three modes, and decreasingly over time. Alex (H) and Carla (D) show an increase at age 3;0. When we look at their input we also find an increase in SLN and SC in labeling utterances (section 8.2.1). Apparently, the use of labeling in the interaction between these children and their mothers becomes more important in *signing* at this age. Even though the use of labeling utterances is probably a characteristic of the interaction (labeling utterances in the input elicit labeling by the children) there is the added factor of their slower development in adequate visual attention-giving behavior (see Chapter 6). Their mother continues to give them 'simple' input (i.e. labeling) in order to continue training their attention-giving and this may induce them to use labeling utterances for a longer time themselves. These pragmatic aspects are thus still very important at this stage of their development.

Next we will look at the form of interrogatives and imperatives in the output of the children. The deaf children together produce 20 signed interrogatives, none of which carries the appropriate nonmanual marking. Two are *yes/no*-questions (see also section 9.6.2). The one *spoken* interrogative (Mark at 2;6) is one word in a SC utterance, without a *wh-q* word or a rising intonation:

POINTpuzzel ANDER WAAR
ander
POINTpuzzle OTHER WHERE
other

The deaf children produce their first *wh-q* sign *WHERE* or *WHAT* in the following sessions: Carla at 2;6, Laura at 2;0 and Mark at 2;0.

The hearing children use 12 signed interrogatives, 8 of which contain a *wh-q* sign. Alex produced his first *wh-q* signs at age 1;0, Jonas at age 1;6 and Sander at age 2;0. Surprisingly the hearing children seem to be somewhat earlier in producing these than the deaf children. Three signed interrogatives, from Jonas and Sander, carried a nonmanual marker. They produced 33 spoken interrogatives, and ten of these were incorrectly formed, but typical for child language. Some examples of interrogatives by the hearing children are:

Dutch:

(17) Alex 2;0
is dit? (What is this?)
is this?

(18) Alex 2;0
oma eventjes? (Can I just talk to granny? [on the phone]
granny just?

SC:

(19) Jonas 1;6
WAAR (Where is the pen?)
pen
WHERE
pencil

(20) Sander 3;0
AV - POINTsander DOEN (What shall we play?)
wat zullen wij doen?
WHAT - POINTsander DO
what shall we do?

We see that the children do not produce signed interrogatives very often. These usually contain a *wh-q* sign, but they hardly ever have the correct grammatical form: nonmanual markers are left out in signed questions. The input to the deaf children was usually better formed than the signed interrogatives in the input to the hearing children, and yet the hearing children are the only ones to produce the correct form.
The deaf children produce no spoken interrogatives, even though their input contained them, albeit often in an incorrect form. The hearing children are offered many (incorrect) spoken interrogatives, and produce these themselves, also often incorrectly formed, although acceptable child forms. They leave out *wh-q* words or the required rising intonation. We probably see here some influence from the input on the acquisition of these forms by the children, although incorrect forms of questions can be expected at this age in monolingual hearing children.

Utterances with an imperative function were signed only (n=5) by the deaf children, and signed (n=8) and spoken (n=13) by the hearing children. For instance:

(21) Alex 2;6
mama grond (Mummy must sit on the floor)
mummy floor

(22) Jonas 2;0
nee niet, zeg jij (Don't say: what are you saying?)
no not, say you

(23) Carla 2;6
POINTkopje ROEREN (Stir that)
POINTcup STIR

We find that the imperatives produced by the deaf and hearing children still are simple in structure, but most are normal for children at their age (see also Chapter 9). The deaf children use only sign imperatives, whereas the hearing children produce imperatives both spoken and signed.

8.3 Affective propositions

In an earlier study of the interaction between the deaf mothers with the hearing children we found that the mothers showed a tendency to express affective messages towards the children in the spoken modality (see Chapter 2). This has also been found for ASL. These studies concerned the period before the children were one and a half years old. It is not known what the children do when they produce language. We are therefore interested in how affective propositions are expressed by the deaf mothers and, if they are expressed by the children, how (research question 19 in section 3.4).

Method
All declarative utterances that carry an affective or emotional meaning were coded separately. These utterances were labeled 'phatic' by Moores and Moores (1982) and were found to be predominantly spoken by American deaf mothers with deaf children under 6 months of age. Examples of such phatic utterances in SLN and Dutch are:

(24)	SLN	*KNAP POINTjij* CLEVER POINTyou	(clever you!)
(25)	NL	*stout jij* naughty you	(you are naughty)

Results
With the hearing children the preference for the spoken modality for affective utterances seems to persist between 1;0 and 3;0 in the same way as it did prior to 1;0 (Mills and Coerts 1990) (see Table 8.3). We have no information on the interaction between the mothers and their deaf children before their first birthday, however the mothers do not show any preference for speech for the affective function with the deaf children after this age. They prefer signs to express affective messages in the communication with their deaf children.

Table 8.3 INPUT DC+HC: Percentages and (number) of affective utterances as distributed across the signed and spoken input of the deaf mothers

Affective utterances	signed	spoken
DC	74% (125)	26% (43)
HC	40% (68)	60% (102)

The children produce very few affective propositions, and all these were comments about their own behavior or performance. The deaf children altogether produced 8 affective utterances, and all of these were signed, the same as in their input. Jonas (H) produces one spoken affective proposition and Sander (H) one in SC. Their input of affective propositions was mainly spoken. For these (few) affective propositions then, the output seems to reflect the language choice of the input of the deaf mothers. It is worth mentioning that the point in time in the first year when the mothers realize that the child is deaf should probably influence the input.

8.4 Functional evidence for separating SLN and NL in the input

Sometimes it is the case that there are differences in the functional use of two languages in a bilingual environment. For instance, Mills and Coerts (1990) found that deaf mothers use both signs and spoken language with their hearing children during the first year of their life. They used signs predominantly for object-oriented talk, and spoken language for person-oriented interaction. In this study we find that affective utterances are predominantly spoken with the hearing children, and signed with the deaf children.

Furthermore we found, that the deaf mothers offer the deaf children in Dutch only declaratives, whereas interrogatives and imperatives only occurred in SLN and SC input. The deaf children also only produced declaratives in Dutch. This is of course also connected to their level of development in Dutch, which we will discuss further in section 9.1.2. In the interaction between the deaf mothers and their deaf children we do find a difference between the functional use of the three language modes, namely that questions and directives are produced in signs only.

For the input to the hearing children and for their output also we did not find any functional differences in the use of the three language modes, on the basis of which the children can begin to separate the SLN from NL, except for the use of affective utterances.

8.5 Summary

Declaratives are clearly dominant in the input to all children in all modes; questions and imperatives are present but do not make up much of the input. The proportions are comparable to those found for Dutch input in hearing families. The proportion of imperatives decreases in general over time; there is only an increase in questions with one child, Sander. Within the declaratives labeling decreases with all children over time, as might be expected. The SLN and SC input is similar in terms of distribution of functions; in the Dutch input there are more imperatives. It is not clear why this is; adult-adult interaction needs to be investigated to see if this also occurs. The input to Carla (D) and Alex (H) contains more labeling in general than the input to the other children; this is possible related to the children's slower development in visual attention patterns. The mothers concentrate on labeling as a simple language function in the first instance. In the interrogatives the *wh*-questions show an increase over time. Signed questions are quite often incorrect in form, that is they have no non-manual marker, but this number decreases over time with the deaf children. Spoken interrogatives are often incorrect in form and this number increases with time (30-56%). This is possible related to the fact that the majority of Dutch questions are produced in a SC context and come under the influence of SLN syntax. We will return to this question in Chapter 9. Affective utterances are produced in the input to all children, only more related to the spoken mode with the hearing children as had already been found in their first year. Affective utterances are more related to the sign mode with the deaf children.

In the output declaratives are also clearly dominant; there are few questions and even fewer imperatives. Labeling utterances decrease with almost all children. There are no clear differences between the language modes in terms of distribution of functions, except of course that the deaf children have also no Dutch. The deaf children show a decrease in the proportion of questions they produce over time; it is not clear why this is the case. The deaf children produce their first *wh-q* sign at 2;0 to 2;6, the hearing children at 1;6-2;0. The non-manual marking of sign questions is almost totally absent, except for a few cases in the hearing children. The spoken questions of the hearing children show errors as might be expected.

The input to the children shows a dominance of declaratives and this is reflected in the output. This is probably more an influence of interaction than form. The children are offered some interrogatives and imperatives but very few are produced by the children, again probably as a result of interaction. The sign questions that are offered are more correct to the deaf children than the hearing children but the hearing children appear to be more correct and earlier in their production of sign questions. It is not clear why this is the case; it indicates that input is not having an effect in this aspect. The mothers of Carla (D) and Alex (H) both increase their amount of labeling at age 3;0 and so do the children. This suggests that the amount of labeling produced by the children is strongly influenced by the interaction and input of the mothers.

The mode selected for expressing affectives is also reflected in the children. The hearing children express affective utterances in speech as do their deaf mothers, whereas the deaf children use sign as do their mothers.

The deaf and hearing children do receive different input to some extent in terms of functions, not only related to the preferred modes with the two groups. Interrogatives and imperatives in total are offered slightly more to the hearing children; it is not clear why. Signed imperatives occur only in SC in the input to the hearing children, which emphasizes again their little input in SLN. Sign interrogatives are more often correct and increase with the deaf children; this is not the case with the hearing children. Of the hearing children Jonas and Sander do seem to be earlier with their production of *wh-q* question signs and with non-manual marking of questions than the deaf children; this is not a result of the input but possibly of the fact that they are further with this function in Dutch. On the other hand spoken interrogatives are more often incorrect with the deaf children than with the hearing children. This in general confirms the results from earlier chapters that the deaf children are receiving an input which is more focussed on SLN. The affective function shows a clear difference between the two groups, since hearing children have more affective utterances in speech and produce these too, whereas the deaf children receive them only in sign and produce them in SLN.

9 STRUCTURAL ASPECTS IN INPUT AND OUTPUT

In Chapter 8 the focus was on functional aspects of the input and output. In that context some attention was also paid to form, in particular in relation to function. Some aspects of form were different in the input from what might be expected. In this chapter we will pursue the discussion of form structure in the SLN, NL and SC utterances. Section 9.1 concentrates on the MLU's of the different languages. In section 9.2 we will look at the data on the realization of verbs and in 9.3 at verb positions. The realization of arguments is presented in section 9.4 followed by section 9.5 on the inflection of verbs. Section 9.6 deals with morphological markers. The use of function words (in NL and SC) and sign classes in SLN is described in section 9.7. Section 9.8 discusses whether or not there is structural evidence for SLN and NL in the input. All sections will be summarized in section 9.9.

9.1 MLU and MLUL10

The mean length of sentences is generally considered one of the indications of the developmental stage a child is in during the process of language acquisition. The mothers' input is usually slightly ahead of their children's in term of length, as has been often established in the literature (e.g. Snow 1994). This is generally interpreted as the input acting as a stimulus to growth in the child. In section 7.1.1 we described how the mothers and children produced many deictic signs in combination with a representational sign and/or word. Combinations of signs, or words, indicate SLN or NL syntax. We found that the deaf mothers offered the deaf children mainly sign combinations and hardly any word combinations. With the hearing children there were word and/or sign combinations, but fewer sign combinations. These findings will of course be reflected in the MLU of SLN and NL of the deaf mothers, and in the third language mode, Simultaneous Communication (as defined in Chapter 5). On the basis of the findings in Chapter 7 and 8 we might expect that the SC used by the mothers and the deaf children will be structurally different form the SC used by the mothers and the hearing children. This is important to explore, since we want to find out whether or not the SC used with and produced by the children may be considered to be a 'third system' as defined by Romaine (see also Chapters 1 and 2).

We will use both the Mean Length of Utterance (MLU words) and the Mean Length of 10 Longest Utterances (MLUL10). The latter gives us an impression of the longest structures the mothers and children use. We are especially interested in where

development can be seen, and furthermore we will compare the data of our subjects to the literature. We will clearly make comparisons between the input and the output, where we expect that the input will have a higher MLU than the output (question 21 in section 3.5).

Method
We calculated the MLU's in signs for SLN and in words for NL by dividing the number of signs/words (including POINTS) by the number of utterances. The MLU for SC was analyzed in three different ways: once for the SC utterances as a unit (SC-MLU), once for the signed parts of SC utterances (MLU-s) and once for the spoken parts of the SC utterances (MLU-w). One important aspect for the count of SC utterances as a unit is that signs and words that are uttered simultaneously are counted in two ways. If the semantic content of the sign and the word is the same, the sign/word combination is counted as one element. If the content is not the same, the sign and word are counted separately.[1]

9.1.1 MLU's in the input
We already know that the deaf mothers of the hearing children offer them hardly any SLN (section 5.1) and only few multi-sign combinations (section 7.1.1) in SLN. We therefore only present the SLN-MLU of the deaf mothers to the deaf children (Table 9.1).

Table 9.1 INPUT DC: SLN-MLU of the deaf mothers with the deaf children

INPUT to DC	1;0	1;6	2;0	2;6	3;0
MCarla	-	1.1	1.3	1.3	1.6
MLaura	1.2	1.5	1.7	1.9	2.0
MMark	1.4	1.2	2.2	1.9	1.4

With the deaf children the SLN-MLU ranges between 1.1 and 2.2. With Carla and Laura there is a slight increase over time. With Mark the MLU is highest at age 2;0 and afterwards decreases. At 3;0 this may be caused by the fact that Mark was uncooperative during the session (see section 4.3). However, it may also be due to an increasing use of morphological markers, which can reduce the number of signs in an utterance.[2] We will discuss these aspects further in sections 9.3 and 9.5. The MLUL10 for SLN with the deaf children ranges from 1.3 to 4.2 and increases as the children grow older.[3] Although a comparison across languages of MLU's cannot be

1 see Appendix to Chapter 9, *Procedures* for a detailed description of the calculations, page 286

2 I thank Heleen Bos for discussing these aspects with me.

3 see Appendix to Chapter 9, Table A9.1, page 289

made, it is interesting to see that Kantor (1982:139) found for two deaf mothers the following MLU's (in signs) in ASL with their deaf children:

age 1;0 MLU 1.6
age 1;8 MLU 1.7
age 2;6 MLU 2.4

These are slightly higher than the SLN-MLU's produced by the mothers in our study.

In the Dutch input the deaf mothers have a mean NL-MLU of 1.7 with their deaf children, and we see no development.[4] Gregory and Barlow (1986) found that deaf mothers with their deaf children produce MLU's (in words) of English of 1.75, 1.36 and 1.11 at ages 2;0, 2;6 and 3;0 respectively. The hearing mothers in their study had MLU's over 3. A low MLU appears to be characteristic for the spoken language of deaf mothers to their young deaf children.
With the hearing children there is no clear development in the NL-MLU of the deaf mothers either (see Table 9.2).

Table 9.2 INPUT HC: NL-MLU of the deaf mothers with the hearing children

INPUT to HC	1;0	1;6	2;0	2;6	3;0
MJonas	2.1	2.2	(3.1)	(1.4)	2.3
MAlex	1.8	1.3	1.7	1.7	1.3
MSander	2.1	1.6	(1.9)	(1.7)	1.9

** Brackets indicate that 10 or fewer NL utterances are produced*

If Tables 9.2 and 9.3 are compared, we can see that the NL-MLU's of the deaf mothers remain below those found for Dutch hearing mothers with their hearing children in the studies of Wijnands (forthcoming), Gilles and Verlinden (1988:21) and van de Weijer (in press).

4 see Appendix to Chapter 9, Table A9.2, page 290

Table 9.3 INPUT: MLU in words of Dutch hearing adults to hearing children

Mother of	age of child	MLU in words
Wijnands		
Bram	1;9	3.5
Bram	2;0	3.4
Sarah	2;5	3.5
Bibiche	3;0	3.1
Dennis	3;0	3.8
Gillis & Verlinden		
Maarten	1;6	3.2
Maarten	1;11	3.8
V.d.Weijer		
child	2;6-2;9	3.2

(Gillis et al.'s MLU (1988) is based on 500 utterances of the adult)

Either the deaf mothers are not very skilled in Dutch or they prefer to use simple Dutch. As we did not make an analysis of the mothers' spoken Dutch used with hearing adults, we cannot give an assessment of their spoken language skills. The MLUL10 for Dutch input to the HC is even further below the norm of Dutch mothers with hearing children, and it actually decreases over time. We find a range of 2.8 (age 1;0) to 1.3 (age 3;0).[5] Taking this result together with the finding (Chapter 5) that the amount of Dutch input also decreases over the period studied (Figures 5.Ia-f), we must conclude that Dutch becomes less important and less complex in the input to the hearing children. We may expect that this can have an effect on the acquisition process of the hearing children.
Summarizing, the SLN input shows a minimal increase in MLU, and the Dutch input shows no increase in length with time. This picture may be different for SC, since this is the most frequent form of input to both groups of children. We do indeed find an increase of MLU in the SC utterances (see Figure 9.I).[6]

5 see Appendix to Chapter 9, Table A9.3, page 290

6 see Appendix to Chapter 9, Table A9.4, page 290

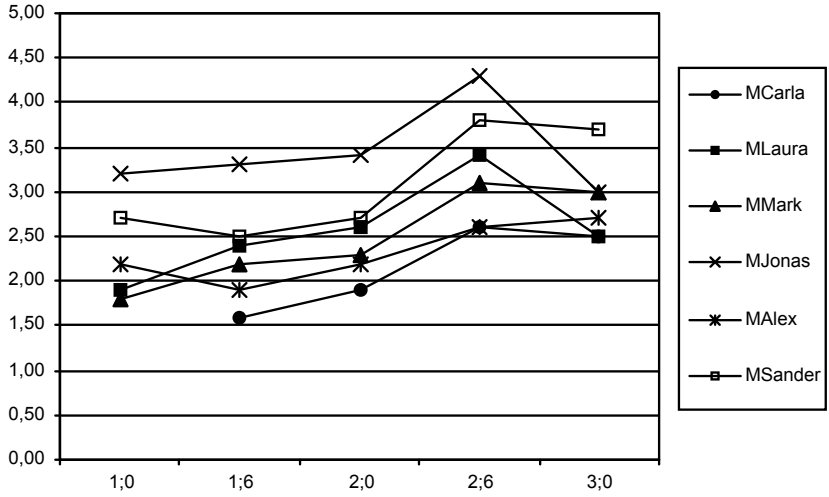


Figure 9.I INPUT DC+HC: Development of SC-MLU of the deaf mothers with the deaf and hearing children.

We can see a development in the SC-MLU of the deaf mothers, both with the deaf and with the hearing children. The SC-MLU with Jonas and Sander is at all times slightly higher than with the deaf children and Alex. This is also the case with the ranges of the MLUL10 of the SC utterances[7], except with Alex at ages 1;0 and 3;0. On the whole the SC-MLUL10 in the input to the hearing children is higher (3.5 - 10.6) than in the input to the deaf children (2.6 - 7.5).
To see whether the higher SC-MLU is caused by multi-sign or multi-word parts, we will next look at the MLU-s (the signed parts) and the MLU-w (the spoken parts) of these utterances (see Figures 9.IIa and 9.IIb).[8]

7 see Appendix to Chapter 9, Table A9.5, page 290

8 see Appendix to Chapter 9, Table A9.6, page 290

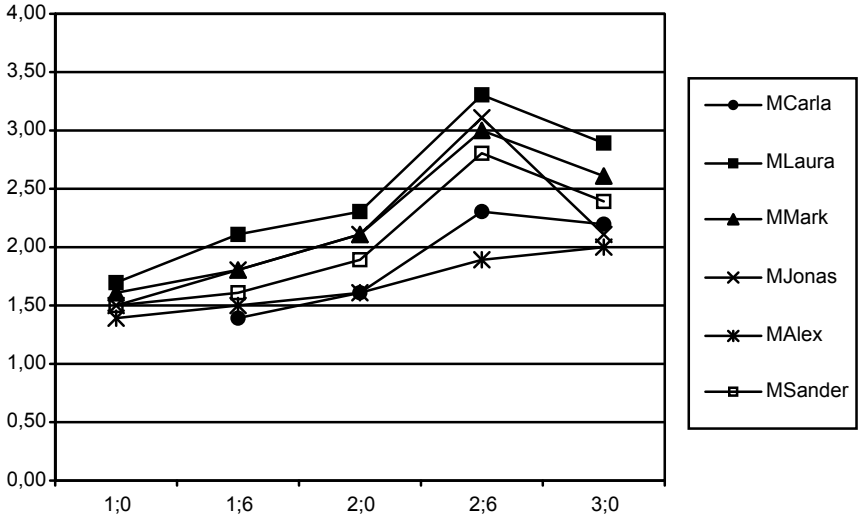


Figure 9.IIa INPUT DC+HC : Development in MLU-s of the deaf mothers with the deaf and hearing children

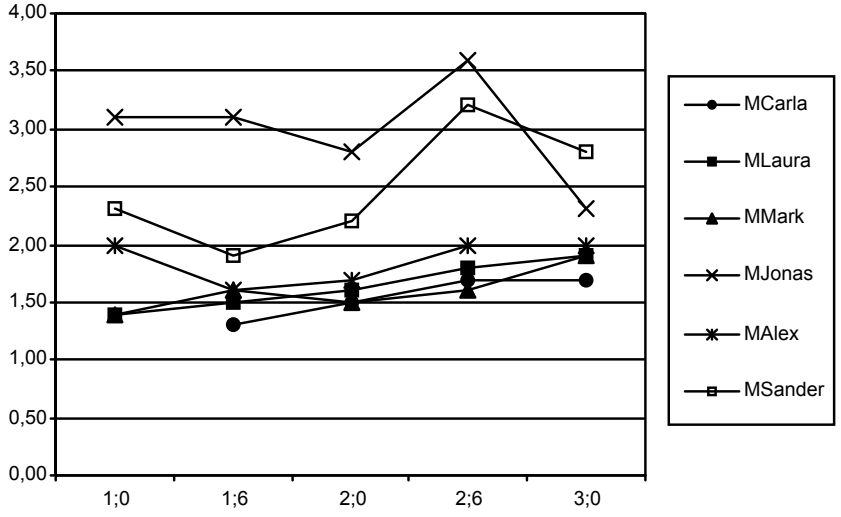


Figure 9.IIb INPUT DC+HC : Development in MLU-w of the deaf mothers with the deaf and hearing children

We find that both with the deaf and the hearing children there is a development in the MLU-s, which is slightly higher with the deaf children. It is interesting to see that the

MLU-s with the deaf children is higher than the SLN-MLU (see Figure 9.I). In Chapter 7 we examined combinations and found these in SLN and SC. This result shows that the longest utterances are usually offered in SC with the deaf children. The MLU-s with the hearing children is higher than 2.0 after age 2;0, which confirms that multi-sign combinations are used fairly regularly in their SC input.
The MLU-w remains more or less the same with Alex, it increases with Sander, and is inconsistent with Jonas. We can see a small development with the deaf children, even though it remains below 2.0. This means that also in the SC utterances the deaf children are not offered long word combinations often. The MLU-w with the hearing children is higher than with the deaf children. Also, the MLU-w in the SC utterances offered to the hearing children is at all times higher than the NL-MLU.
The longest utterances are thus offered in SC, simultaneously in two modalities (see also Chapter 5). However, the emphasis is different for the deaf and the hearing children, namely on signs with the deaf children and on words with the hearing children. In the next section we will see how these input data influences the output of the children.

9.1.2 MLU's in the output

We present the SLN-MLU's of the deaf and hearing children in Table 9.4.

Table 9.4 OUTPUT DC+HC: SLN-MLU in all children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	1.2	1.1	1.6	1.8
Children	Laura	(1.0)*	(1.0)	1.4	2.0	1.8
	Mark	0	1.5	1.5	2.3	2.3
Hearing	Jonas	0	1.0	(1.0)	(1.2)	(1.0)
Children	Alex	(1.0)	(1.0)	0	(1.0)	(1.0)
	Sander	(1.0)	1.0	1.1	1.3	1.4

** Use of brackets indicates that fewer than 10 SLN utterances were produced.*

The SLN-MLU of the deaf children ranges between 1.1 and 2.3, which is almost exactly the SLN-MLU of the input of their mothers. However, the three deaf children show a clear development over time unlike the input. The MLUL10 of the deaf children ranges from 1.1 to 3.9[9] and also increases over time. The MLUL10 of the deaf children is comparable with the MLUL10 for SLN in the input (see 9.1.1). The deaf children produce multi-sign SLN increasingly as they grow older. The mothers do not clearly have a stimulating role, since the development appears to run parallel in time.
The hearing children produce SLN-MLU's between 1.0 and 1.4, and there is hardly any development over time. MLUL10 for SLN is 1.5 at the most. As we found that

9 see Appendix to Chapter 9, Table A9.7, page 291

the mothers offer almost no multi-sign SLN to the hearing children, we can conclude that the input is reflected in the output of the hearing children.

We present in Table 9.5 some MLU's found for different sign languages, coming from various studies of children at comparable ages. For ASL Hoffmeister has studied one child, Kantor two children, Richmond-Welty and Siple studied two sets of fraternal twins, one set of deaf fraternal twins monolingual in ASL and one set of hearing fraternal twins who were raised bilingual-bimodal in ASL, English and combined signing and speaking.

Table 9.5 MLU's in ASL in children of different ages

Study	Language	Age	MLU
Hoffmeister 1978	ASL	2;5	1.9
		3;2	1.9
Kantor	ASL	1;0	1.0
1982		1;9	1.6
		2;6	1.5
Richmond-Welty	ASL	2;0	1.8
& Siple 1999	monolingual	3;0	3.8
	ASL	2;0	1.5
	bilingual	3;0	3.1

Although we cannot compare the SLN-MLU's to the MLU's of these other sign languages, we do see that the most development takes place between the age of 2;0 and 3;0 and not earlier. This can also be observed in the children in this study.

We already know that the deaf children produce no combinations in NL (see section 7.1.3). This is of course reflected in their MLU's for Dutch - never more than 1.0. In Table 9.6 we present therefore only the NL-MLU in the Dutch output of the hearing children.

Table 9.6 OUTPUT: NL-MLU's in the output of the hearing children

HC	1;0	1;6	2;0	2;6	3;0
Jonas	(1.0)	1.1	1.7	2.3	2.1
Alex	(1.0)	1.1	1.4	2.4	1.5
Sander	(1.0)	(1.0)	1.2	(1.2)	1.7

** Use of brackets indicates that fewer than10 NL utterances were produced*

The hearing children's NL-MLU develops over time. It ranges between 1.0 and 2.4, which is slightly higher than the mothers' NL-MLU (highest was 2.2 - see table 9.2). This means that the children's Dutch develops despite the fact that their mother's

input becomes simpler over time. Of course, the hearing children also interact with other hearing members in their families, which has an influence on their spoken language acquisition. The deaf mothers' NL-MLU was lower than that of hearing mothers of hearing children, and we see that the children's NL-MLU's in interaction with their deaf mother are also lower than the MLU's of hearing Dutch children (compare Tables 9.6 and 9.7).

Table 9.7 MLU 's and MLUL10 (in words) of Dutch hearing children at different ages
10

Study	Age	MLU
MLU		
Gillis & Verlinden	1;6	3.2
1988: Maarten	1;11	3.8
Legtenberg 1989: Daantje	2;0	2.5
	2;6	±2.7
	3;0	±5.5
V.d.Stelt 1993: Claire	2;0	3.2
Fanny	2;0	1.1
Schlichting 1996 (p.178)	1;6-2;0	1.3
n=20 for all ages	2;0-2;6	1.9
	2;6-3;0	2.6
MLUL10:	± 1;1	2.7
Schlichting 1996	± 2.4	3.39
	± 2;10	5.48

We must bear in mind of course that the spoken Dutch produced in interaction with their deaf mothers may not be representative of their Dutch produced in interaction with other hearing persons. They probably adapt their Dutch to the hearing status of their mother in that they leave out certain words which they might have produced when speaking to a native speaker of Dutch (see also Chapter 6).

The NL MLUL10[11] for the hearing children ranges between 1.2 and 3.1. It is larger than their mothers' and increases as they grow older whereas their mothers' MLUL10 decreased. So while Dutch contains less often multi-words in the input as the children grow older, the children's use of multi-word utterances in Dutch increases. Schlichting (1996:176) found MLUL10's for Dutch hearing children of hearing parents which are higher than what the hearing children produced in interaction with their deaf mother.

Since the deaf mothers mostly offer multi-sign or multi-word utterances in SC, we may expect that the children will also have a high MLU in their SC utterances. This is in fact the case. In Figures 9.IIIa and 9.IIIb we present the SC-MLU's of the deaf

10 We cannot compare to the data in GRAMAT (Bol and Kuiken 1988) because MLU was measured in morphemes.

11 see Appendix to Chapter 9, Table 9.8, page 291

and hearing children respectively (the SC utterances here are taken as a unit).[12] Not all children produce SC utterances at all points in time.

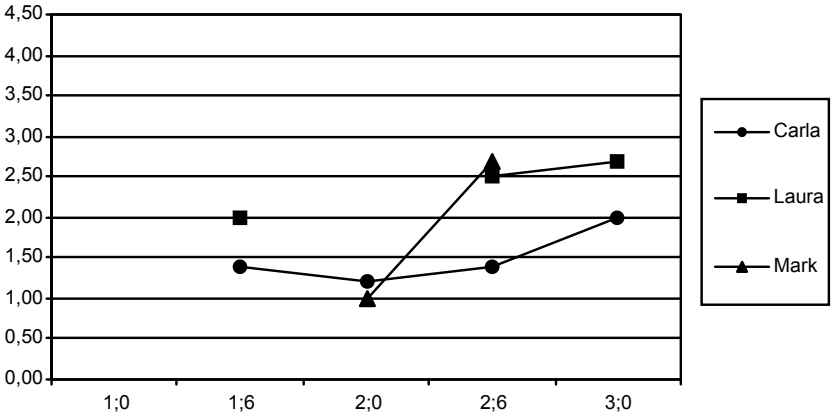


Figure 9.IIIa OUTPUT DC: Development of SC-MLU's of the deaf children

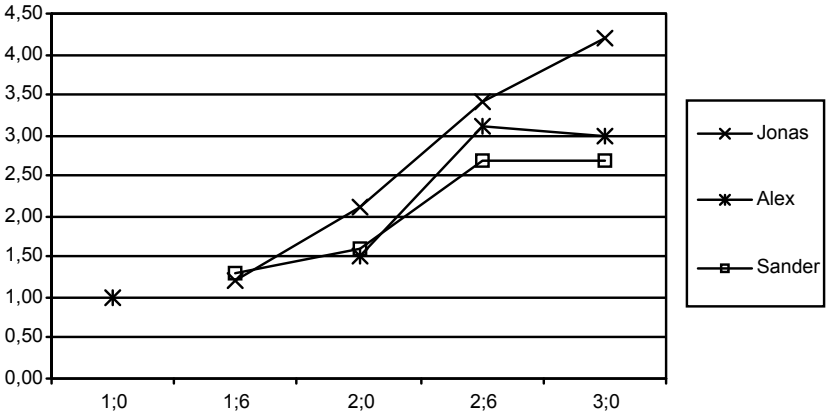


Figure 9.IIIb OUTPUT HC: Development of SC-MLU's of the hearing children

The deaf children show an increasing SC-MLU over time, even though the actual number of SC utterances is low. Laura and Mark have a SC-MLU over 2.0 after age 2;6. The hearing children also show an increase in SC-MLU up to age 2;6, with continuing increase with Jonas at 3;0. Even though the deaf children produce far

12 See Appendix to Chapter 9, Table A9.9, page 291

fewer SC utterances than the hearing children (Chapter 5), development in SC can be observed, although the SC-MLU of the hearing children is larger at 3;0.
The SC-MLUL10 of the deaf children could only be established for Carla (1.2 – 2.8). The SC-MLUL10 of the hearing children ranges between 1.5 – 7.5[13] which indicates a more complex development in general, but which is also linked to the fact that they produce *more* SC than the deaf children.

With the mothers (compare Figure 9.I) we found that the longer SC-MLU with the deaf children was caused by more multi-signed parts of SC utterances (measured in MLU-s), while with the hearing children MLU-w was higher, especially so with Jonas and Sander (H) (compare Figures 9.IIa and 9.IIb). We have made the same analysis for the deaf and hearing children, and present these data in Figures 9.IVa and 9.IVb.[14] We present the mean percentages, because the deaf children have so few SC utterances in all.

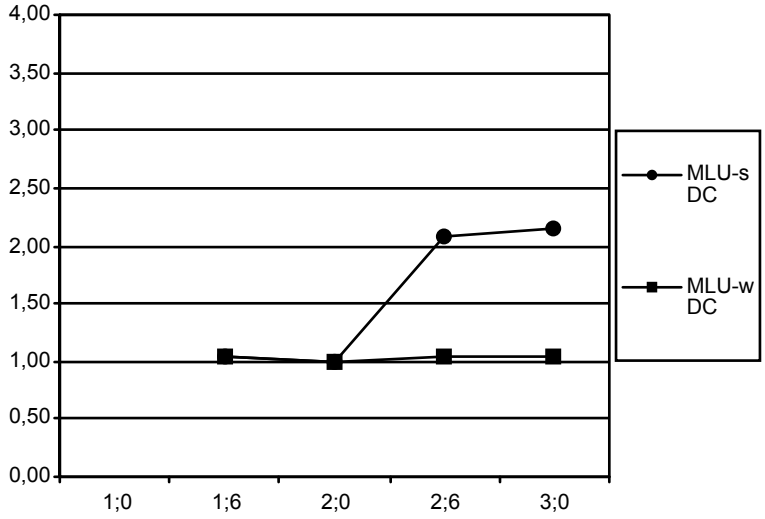


Figure 9.IVa OUTPUT DC: Development of MLU-s and MLU-w of the deaf children

13 see Appendix to Chapter 9, Table A9.10, page 291

14 see Appendix to Chapter 9, Table A9.11, page 292

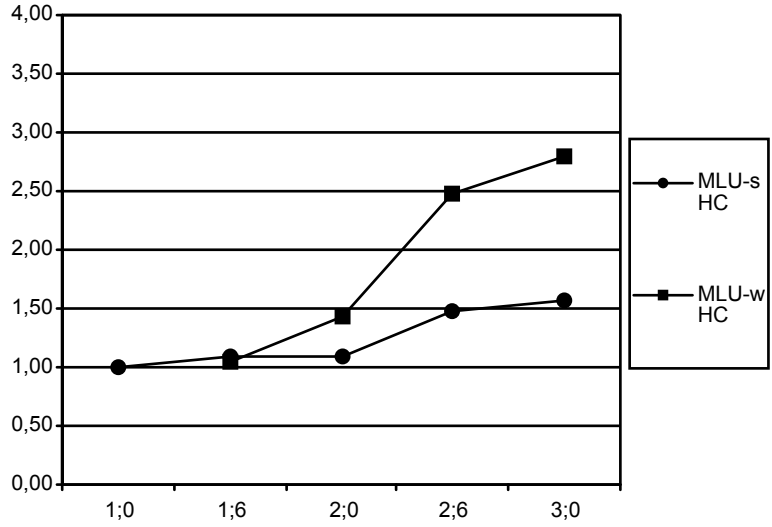


Figure 9.IVb OUTPUT HC: Development of MLU-s and MLU-w of the hearing children

For all children we see a development over time in the different MLU's. For the deaf children it is clear that the larger SC-MLU is caused by a larger MLU-s from age 2;0 on, and that there is no development in their MLU-w. The hearing children produce a higher MLU-w than MLU-s in their SC utterances. It is interesting that up to age 1,6, the MLU-s is more or less the same for all children (around 1.0). At age 2;0, however, differences appear both in MLU-s and MLU-w between the deaf children and the hearing children. The deaf children's MLU-s in general increases. The MLU-s of the hearing children also increases, but the MLU-w of the hearing children increases more steadily and more rapidly, despite the fact that their mothers' MLU-w remained the same over time. All this indicates that after age 2;0 the development of the deaf and hearing children, at least in using SC, starts to differentiate. The deaf children focus on the signing, and the hearing children on the words. This point in time corresponds with the developmental pattern of visual attention-giving behavior (see Chapter 6). Around this time the children have learned the appropriate attention-giving behavior belonging to either a spoken language or a signed language, which may influence their own language production.

We can summarize this section by saying that the deaf children mainly show a development in SLN or sign-based SC, which is a reflection of their input. Signed input had the longest MLU in SC, and the deaf children reflect the use of signing in their own production of SLN and SC. The MLU of the spoken parts in the SC input is never higher than two. Therefore it is not surprising that the acquisition of Dutch, or of word-combinations in a SC context shows no development in the output of the deaf children. And apart from the fact that complex Dutch or spoken parts in SC

utterances hardly occur, we have to take into consideration that the deaf children can only process the spoken or mouthed words visually. These two factors can explain why there is no spoken development.
The hearing children mainly show development in NL and word-based SC, which is not really a reflection of the input offered to them. The hearing children are presented with multi-signed parts in SC input, and do show some development in their own signed SC production, especially after age 2;6. However, their development in Dutch and in the spoken SC is much more evident and once again confirms that hearing children of deaf parents focus on the spoken words. In general the hearing children seem to be slightly ahead in their development of language than the deaf children.

9.2 Realization of verbs

In this section we will look at the realization of verbs in the analyzable SLN, NL and SC utterances. In section 7.1.1 (combinations of representational signs and words to deaf and hearing children) and section 9.1 (variation in MLU in input) we have begun to establish what syntactic input is available in SLN, NL and SC utterances on the basis of which the children can acquire the syntactic rules of a particular language. The use of the verbal system in a language is a useful tool to start exploring the syntactic system in more depth. We will therefore first look at how many verbs are produced in SLN, NL and SC utterances in input and output (question 22 in section 3.5).

Method
Firstly, we distinguish utterances *without* a verb and utterances *with* a verb in SLN and NL and in the signed and spoken parts of SC utterances. The presence or absence of a verb has different implications in SLN and NL. Dutch has a copula and SLN has not. Omission of the copula in an obligatory context in NL and SC utterances yields an ungrammatical utterance and points to an influence of SLN. Furthermore, Dutch has many auxiliary verbs which are used extensively (see ANS 1984; Schlichting 1996), whereas SLN only has a few. These few are used in various ways and differently from NL (see Bos 1994; forthcoming). The omission of auxiliary verbs in NL utterances and in the spoken parts of SC utterances again would indicate the influence of SLN syntax. Examples of grammatical and ungrammatical utterances are given in Procedures.

Procedures
For this analysis only analyzable utterances were used (see for definitions section 4.4.2). This causes some difference in the total number of utterances per language in comparison to data used in section 9.1 (for MLU, where utterances coded as 'Points alone' were included). All SLN, NL and SC

utterances without a verb and containing a verb were analyzed, also one-sign/word utterances consisting of a verb only.
• Our first step is to look at the SLN and NL utterances. The SLN utterances are analyzed in the same way as the signed parts in the SC utterances (see below), the NL utterances the same as the spoken parts in the SC utterances (see below).
• Our second step is to distinguish four categories for the SC utterances:
1 no verb in the signed part, no verb in the spoken part (Vsln-Vnl-)
2 a verb in the signed part, no verb in the spoken part (Vsln+Vnl-)
3 no verb in the signed part, a verb in the spoken part (Vsln-Vnl+)
4 a verb in the signed part and a verb in the spoken part (Vsln+Vnl+)

All SLN, NL and SC (signed and spoken parts) utterances were then subdivided in three categories:
1 *grammatical:*
a) a verb is present, e.g.

SLN	*POINTjij BOEK PAKKEN*	(go get the book)
	POINTyou BOOK FETCH	
NL	*wil je drinken?*	(do you want a drink?)
	want you drink?	
SC	*POINTboek KIKKER*	(that is a frog)
	dat is een kikker	
	POINTbook FROG	
	that is a frog	

b) no verb is necessary (SLN and signed part of SC only)

SC	*JONGEN GROOT*	
	BOY TALL	(the boy is tall)

2 *ungrammatical:*
For this analysis we consider an utterance to be ungrammatical only when obligatory verbs are omitted. We do not analyze whether or not the right *form* of the verb is produced, or whether for instance function words are left out in an utterance. These analyses will be done in sections 9.5 and 9.6.
c) a copula is omitted (NL only)

NL	*konijntje zacht*	(the rabbit is soft)
	rabbit soft	

d) an auxiliary verb is omitted (NL only)[15]

NL	*jij drinken?*	(do you want to drink?)
	you drink?	

e) other verb omitted

SLN	*POINTjij BOEK*	(you read the book) *or* (you have a book)
	POINTyou BOOK	

15 Whether or not SLN has auxiliary verbs and if so how they are to be applied is currently being studied by Heleen Bos (forthcoming).

NL *jij boek*
you book

3 *other:*
f) one sign/word or one constituent
NL *gele ring* (yellow ring)

We do not look at the grammaticality of utterances of one sign and/or word if it does *not* consist of a verb, because in relation to the development of verb use these are not relevant. Utterances consisting of one (spoken and/or signed) verb were analyzed according to the grammatical/ ungrammatical distinction.
Ellipsis was not considered in this analysis. Roelofs defines ellipsis as "an utterance without (part of) a predicate or without obligatory arguments" (1998:66). There is no information available on ellipsis in SLN or SC. Ellipsis in Dutch is described in ANS (1984:794) for adult users. However, no studies are know on the use of ellipsis in parent-child interaction in Dutch (but see Roelofs 1998; Blankenstijn and Scheper forthcoming)

9.2.1 Presence of verbs in the input

The relatively high percentage of nouns in the input (see section 7.2.1), already suggested that there might be a low proportion of utterances containing a verb in SLN, NL and SC utterances if the utterances are not so long. Also, we demonstrated in section 7.1.1 and in section 9.1[16] that only 3% of SLN input to the hearing children consisted of more than two representational signs, indicating a very low level of syntactic input. To the deaf children the mothers presented 13% of (potentially) syntactic NL input, however with a MLU below 2.5 (see Table A9.2). This leads us to expect few verbs in the SLN input to the hearing children and in the NL input to the deaf children.

SLN and NL input

Since the number of verbs in the input are small, we decided to pool the input data for the deaf and for the hearing children up to age 3;0.[17] Individual variation will be mentioned if relevant for the discussion.
We found that of the SLN input offered to the deaf children only a third of the utterances (n=122, 33%) contains a verb. A slight increase over time in the use of verbs can be observed. Of the analyzable SLN utterances without a verb (n=246) 72% belongs to category 5 (one sign/one constituent), which was to be expected from the relatively low MLU (see section 9.1). The remaining utterances fall in category 1b (grammatical: no verb necessary).

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16 see Appendix to Chapter 9, Table A9.1 for SLN MLUL10 in the input to the hearing children, page 289

17 For individual data see Appendix to Chapter 9, Tables A9.12-A9.17, pages 292-293

With the hearing children verbs are used too (n=29, 47%), but per session fewer than 10 SLN utterances in total are offered. The deaf mothers proportionally use more SLN verbs with the hearing children (47%) than with the deaf children (33%), but this difference may be due to the low numbers. The mothers offer 33 SLN utterances without a verb; 79% consist of one sign/one constituent, and in the remainder no verb is necessary.

NL utterances with a verb are only really used with the hearing children (n=137, 49%). A decrease in the use of NL verbs can be observed in the input to Jonas and Alex, an increase in the input to Sander. There are only 3 spoken verbs offered to Laura (D) and none to the other deaf children, so we will not further discuss the NL input to the deaf children.
Of the 144 NL utterances without a verb offered to the hearing children 91% consist of one word/one constituent (see also NL-MLU in section 9.1.1). The remaining input consists of NL utterances where a copula, an auxiliary or a main verb is omitted. We see that the NL input to the hearing children is predominantly very simple and sometimes grammatically incorrect (5%) with regard to presence of verb.

SC input
In Figures 9.Va-f[18] we present the SC input of the deaf mothers, subdivided in SC utterances *without* a verb (Vsln-Vnl-) and SC utterances *with* a verb, according to the modality in which a verb occurs.

18 See Appendix to Chapter 9, Tables A9.18 - A9.23, pages 293-294

Figure 9.Va Mother of Carla

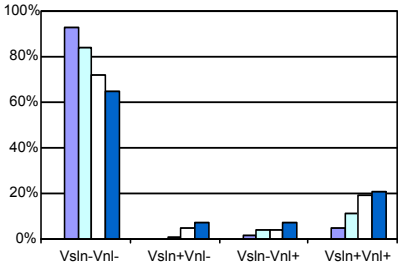


Figure 9.Vd Mother of Jonas

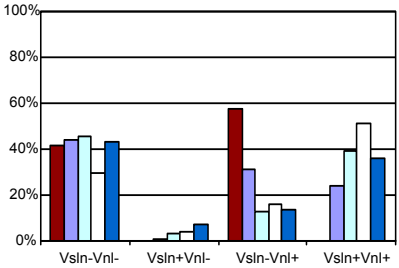


Figure 9.Vb Mother of Laura

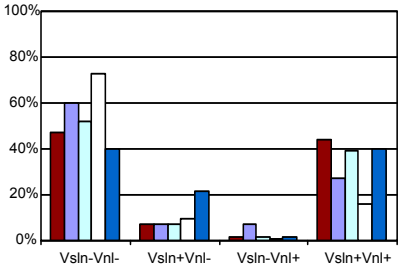


Figure 9.Ve Mother of Alex

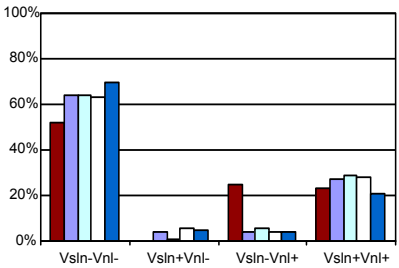


Figure 9.Vc Mother of Mark

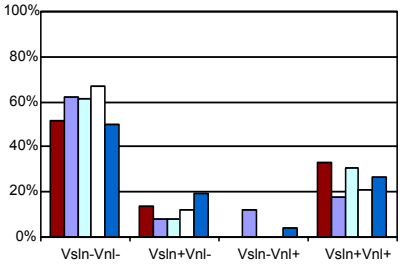
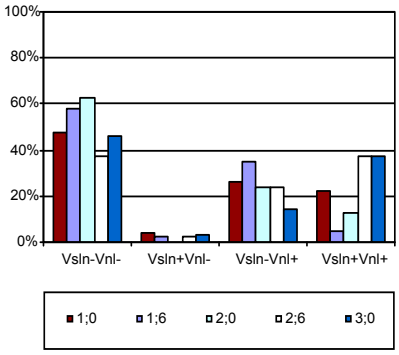


Figure 9.Vf Mother of Sander



Figures 9.Va-f INPUT DC+HC: SC utterances without and with a verb in the input of the deaf mothers

SC utterances *without* a verb (Vsln-Vnl-) form the largest category for all mothers. Many of these SC utterances consist of one *spoken* or one *signed* word/constituent.[19] A typical example is (1):

(1) *POINTtrein TREIN* (that is a train)
trein
POINTtrain TRAIN
train

In utterances such as these there is no verb in the signed part, which is fully grammatical, and one spoken word is uttered simultaneously with the lexical sign.

There are a few occasions (mean 2% or less) that a main verb is omitted as exemplified in (2).

(2) *y/n-q* (Let's do something else now, ok?)
WIJ NU ANDERS
nu even wat anders ok
y/n-q
WE NOW ELSE?
now just something else ok

It is not certain that we are dealing here with an ungrammatical signed part - these utterances need to be studied further. In this example the verb 'doen' (to do) is omitted in the spoken part.
Ungrammatical spoken utterances[20] are found on average in 12% of the SC input without a verb with the deaf children and in 18% with the hearing children. Commonly a copula, an auxiliary and/or a main verb are left out in the spoken part when no verb is needed in the signed part - these ungrammaticalities in the spoken parts seem likely to arise under the influence of the verbal structure of SLN.
On the whole we find that SC utterances *without* a verb, consisting of more than one sign or word, seem to be influenced by SLN syntax in that copulas and auxiliaries are not present, both with the deaf and with the hearing children. The spoken parts are clearly subordinate to the signed parts. This leads to more ungrammatical spoken parts with the hearing children than with the deaf children, simply because the mothers speak or mouth more with them than with the deaf children.

With the deaf children category Vsln+Vnl- (signed verb present) is small but increases over time. With the hearing children this category is also small but it remains more or less the same over time. A typical example is (3) (NB the verbs WASH and SCRUB are located on the picture of the doll in the book):

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19 see Appendix to Chapter 9, Tables A9.24 - A9.29, pages 295-296

20 see Appendix to Chapter 9, Tables A9.24 - A9.29, pages 295-296

(3) [ML2;6]
OH LIEF POP BAD WASSENboek SCHROBBENboek
lief pop bad
OH NICE DOLL BATH WASHbook SCRUBbook
nice doll bath
(Oh, the sweet doll is being washed and scrubbed in the bath)

With the hearing children category Vsln-Vnl+ (spoken verb present) is much larger than with the deaf children, even though it seems to be decreasing over time (see example (4). The deaf mothers differ individually. Jonas' mother uses this category decreasingly, Alex' mother mainly uses this category when Alex is 1;0 and the mother of Sander continues to use this category more or less to the same extent across the different points in time.

(4) *TREIN*
daar gaat de trein
TRAIN
there goes the train
(there goes the train)

Utterances like example (4) are used far more with the hearing children (mean 72%) than with the deaf children (mean 42%). This confirms the patterns found in the MLU section (9.1.1), where we saw that the emphasis in SC input lies on signs with the deaf children and on words with the hearing children (see also section 6.3.1).

The final category Vsln+Vnl+ (signed and spoken verb present) occurs in the input to all children. It is the second largest for all mothers, although there are individual differences (see Figures 9.Va-f). We can see no clear development in this category. A typical example is shown in (5):

(5) [MS2;6-utt. 62]
MENEER STERK 3aPAKKEN1 KOGEL
meneer sterk pakt kogel
MISTER STRONG 3aTAKE1 CANNONBALL
mister strong takes cannonball
(Mr. Strong picks up the cannonball)

NB In this example we overlook the omission of the article before 'cannonball' with respect to grammaticality.

In conclusion we have found that the number of utterances *with* a verb varies considerably among the mothers in all modalities. The mothers use a signed verb in approximately a third of the SLN input with the deaf children and in 47% of the SLN input to the hearing children (but few instances). In spoken Dutch verbs are virtually

only presented to the hearing children in about half of the NL input; some utterances (about 5%) are therefore ungrammatical. In SC input we find that the mothers offer the children many utterances without a verb (range = 37 - 93%) in either part. There is much individual variation. These SC utterances are under the influence of SLN. If a verb occurs in the SC input, it occurs most often in both parts. SC utterances with only a signed verb increase in the input to the deaf children and are rare in the input to the hearing children. SC utterances with only a spoken verb occur decreasingly in the input to the hearing children, and more so than in the input to the deaf children.

9.2.2 Presence of verbs in the output

In section 7.1.3 we found that the deaf children all combine representational signs (syntactic SLN) but no representational words (syntactic NL). We expect therefore only a few spoken verbs produced by the deaf children. The hearing children combine both signs and words and thus produce syntactic SLN and NL. In their output we therefore expect both signed and spoken verbs, despite a very low SLN-MLU (see section 9.1.2).

SLN and NL output[21]

The deaf children in total produce 290 SLN utterances without a verb, which is 76% of the total SLN output. Of these, 44% (n=128) consist of one sign/constituent (category 5). They produce 154 utterances (53%) in which no verb is required (category 1). They also produce 7 utterances (3%) where a main verb is left out (category 4). This category was not found in the input. Compared to the input we find that in the output there is a higher percentage of category 1 (mainly labeling) utterances compared to category 5 (one constituent). The deaf children start producing signed verbs from about age 1;6 (n=4, 17%) and increasingly so, both in number and proportionally. At age 3;0 on average 35% of their SLN utterances contains a verb (n=50). Altogether they produce 92 utterances with a verb (see Table 9.8).

The hearing children produce in total 40 SLN utterances without a verb (61%), most of which consist of one sign, and there is one utterance where no verb is needed (cat.1). All three hearing children produce some signed verbs, but inconsistently over time, and to a small extent only. We see no development here.

The deaf children produce altogether 9 NL utterances, all without a verb (see Table 9.8), all of category 5 (one word/constituent). Since the input also contained hardly any spoken verbs, this was to be expected.

The hearing children produce 220 NL utterances without a verb, which is 75% of the total NL output. Category 5 (one constituent) forms 88% of these utterances. In the remainder a verb is often omitted, namely a copula (7%), an auxiliary verb (3%) or a main verb (3%). The output reflects the input very closely in that it is very simple. In

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21 see Appendix to Chapter 9, Tables A9.30 - A9.35 for full details, pages 296-297

some cases a SLN influence might be interpreted in the omission of (obligatory) verbs, which renders the NL utterances ungrammatical.

Table 9.8 OUTPUT DC+HC: Number and (%) of SLN and NL utterances containing a verb

SLN OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla		0	3 *(7)*	2 *(5)*	12 (22)
Children	Laura	-	2 *(66)*	4 *(50)*	10 (20)	25 (52)
	Mark	-	2 (17)	3 (14)	14 (26)	13 (33)
Hearing	Jonas	-	2 (18)	3 *(60)*	6 *(100)*	0
Children	Alex	0	0	-	1 *(100)*	-
	Sander	-	-	2 (15)	5 *(50)*	3 *(30)*
NL OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla		0	0	0	0
children	Laura	-	-	-	-	-
	Mark	-	0	-	-	-
Hearing	Jonas	0	0	12 (27)	14 (78)	9 (43)
children	Alex	0	2 (14)	9 (17)	10 (26)	10 (44)
	Sander	0	0	1 *(10)*	1 *(20)*	3 (27)

*(%) are between brackets **and** in italics when 10 or fewer SLN or NL utterances at all occur during a particular session; "-" means no SLN or NL utterances are produced*

Even though the hearing children produce only a few SLN utterances, proportionally these contain more verbs than the SLN output of the deaf children. The use of signed verbs may be triggered earlier in hearing children by the use of spoken verbs in NL utterances. However, the deaf mothers also have a slightly higher proportion of signed verbs in the input to the hearing children than to the deaf children, so partly this may be explained by the input that is offered (see section 9.2.1).

Jonas (H) and Sander (H) produce spoken verbs from the age of 2;0, and Alex (H) from age 1;6. In general there is an increase over time of the use of spoken verbs in the output, even though the numbers remain small. Together the hearing children produce 72 NL utterances with a verb. In Table 9.9 we present data that Schlichting (1996:119) found for utterances containing a verb phrase for monolingual Dutch hearing children. We include the data of our hearing children for comparison.

Table 9.9 Percentages of utterances containing a verb in the output of monolingual Dutch children from Schlichting (1996), and of the hearing children in our study

Schlichting		Hearing children of deaf mothers	
mean age 1;11	8	age 2;0	21
mean age 2;4	25	age 2;6	40
mean age 2;10	38	age 3;0	40
mean age 3;3	42	-	

We see a steady increase in the use of verbs, both with the Schlichting children and with the hearing children of the deaf mothers. Our hearing children seem to produce more utterances containing a verb proportionally than the monolingual children up to age 2;6. However, we know that the hearing children also produce many SC utterances, so the comparison should be interpreted with care. It may be that when they produce a Dutch utterance, they are more inclined to use a verb phrase and that utterances *not* containing a verb occur more often in SC utterances, also under the influence of SLN.
In the next subsection we will take a look at the SC production of the children.

SC output[22]
Most of the SC utterances produced by the deaf children are without a verb (mean 89% category Vsln-Vnl-).The deaf children produce no ungrammatical utterances[23] as defined in this study, mainly because most utterances consist of one word/sign or constituents, which we did not analyze further. Carla and Laura together produce 7 SC utterances with a verb, 5 with a signed verb only, one with a spoken verb only, and one with a verb both signed and spoken. Since the number of SC utterances with a verb is so small in the output of the deaf children, we will not further discuss these.
With the hearing children category Vsln-Vnl- is 59%, a much lower percentage than with the deaf children. They produce many one-word/sign/constituent utterances. Jonas at 3;0 increasingly produces SC utterances consisting of two or more signs/words, and the percentages of ungrammatical spoken or signed parts also increase.[24] We find that Sander produces simple SC, although he does produce a few (ungrammatical) longer NL parts. Both children at times omit a copula, auxiliary or main verb in the spoken parts. This may reflect an influence of SLN on the SC utterances without a verb, which was also present in the input. Alex produces only a few SC utterances (n=48 in total), and as these are all one word/sign utterances we will not further discuss them.

22 see Appendix to Chapter 9, Tables A9.36-A9.41 for details, pages 298-299

23 see Appendix to Chapter 9, Tables A9.42-A9.47, pages 299-300

24 see Appendix to Chapter 9, Tables A9.42-9.47, pages 299-300

We present the actual number of utterances of the hearing children in Table 9.10. Since the number of utterances is so small, we emphasize that the following data are to be interpreted with care.

Table 9.10 OUTPUT HC: Number of SC utterances with a verb, produced by the hearing children

Hearing children	1;0	1;6	2;0	2;6	3;0	Total
Vsln+Vnl-	0	0	1	1	4	6
Vsln-Vnl+	0	0	12	23	37	72
Vsln+Vnl+	0	3	8	20	22	118
Total SC+verb	0	3	21	44	63	131

The hearing children produce in total 131 utterances with a verb, with 60 (46%) signed verbs and 125 (95%) spoken verbs. Their SC input with a verb came to 706 utterances, with 460 signed verbs (65%) and 662 (94%) spoken verbs. there is a difference in the percentage of signed verbs in the output of the children compared to that in the input, but the percentage of spoken verbs matches that of the input. This points again to a focus on the spoken modality.
The hearing children produce 6 SC utterances with a signed verb only. This category was small in the input, and the children do not use it very often either. They produce 72 utterances with a spoken verb only (Vsln-Vnl+). This subset forms 54% of all SC output with a verb. In the input of the mothers this category was on average 20% and mainly used by the mothers of Jonas and Sander. The increasing use of this category confirms that the focus of the hearing children is on the spoken modality. The second largest category for the hearing children is Vsln+Vnl+, which is increasingly used, just as it is by the mothers.

In conclusion we find that the deaf children produce most of their utterances without a verb. This is a reflection of the input, but the children leave out more, also typical of acquisition. The utterances are usually fully grammatical. They only produce signed verbs, mostly in SLN utterances but also some in SC. Only a few obligatory verbs are omitted. Over time the children increase the number of signed verbs, both in number and proportionally. At age 3;0 about 35% of their SLN output contains a verb, which is very similar to the percentage of signed verbs in their input. Studies of the children at later ages should shed more light on the presence of signed verbs in their output.
The hearing children do not produce many signed verbs, and we do not see any development over time. Half of the SLN input of their mothers contained a verb, but obviously this is not picked up by the children. They do produce spoken verbs in NL increasingly over time, spoken verbs were presented to them in NL utterances, although many were omitted. They also produce verbs in SC utterances, the majority of which is spoken, or spoken and signed simultaneously. This reflects the emphasis on the spoken modality by the hearing children, which was also found in

other sections. Their mothers' SC input also contained many spoken, or signed/spoken verbs, whereas SC utterances with only a signed verb were rare in the input.
In the next section we will focus on the realization of arguments in SLN, NL and SC utterances.

9.3 Realization of arguments

We know that SLN is a prodrop language, which means that under certain conditions subjects and objects can be omitted (Chapter 2). We will look at the (non-) realization of subjects and objects in the linguistic input and output. For this we will analyze only those SLN and SC utterances that contain a signed verb.
Dutch is not a prodrop language, which means that subject and obligatory objects must be realized. The subject can only be left out grammatically in imperative sentences, or when topic drop occurs (a.o. ANS 1984; Krämer 1995; Scheper et al. in press; Schlichting 1996). Obligatory objects must also be realized, unless topic drop occurs. There are two conditions under which topic drop can occur in Dutch. A structural condition, namely that it concerns the first person and a pragmatic condition that the topic is inferable from the context. The ANS gives the following example (6) for topic drop (1984:968):

(6) In 1981 ben ik hier komen wonen. [Ik] was inmiddels getrouwd en dan wil je wel een wat groter huis (spreektaal).
(In 1981 I came to live here. [I] was married by then, and you would like to have a bigger house) (vernacular).

In parent-child interaction subjects and objects often linguistically refer to referents within the sight of the speaker and addressee (Schlichting1996:56). Schlichting presents examples for subject drop and object drop by adult speakers (our examples (7) and (8)):

(7) *past niet* ([it] doesn't fit) [referring to a piece of a
fits not jigsaw puzzle]

(8) *heb ik om mijn nek geknoopt* (I have tied [it] around my neck)
have I about my neck tied

Utterances such as these are considered grammatical and are expected to occur regularly in mother-child interaction, which often deals with the here-and-now at the ages that we are studying (up to 3;0). The here-and-now character of the interaction makes subject and object drop 'easier' because the participants and/or materials are known and need not always be explicitly mentioned.

Krämer (1995) related the (non-)realization of subjects in child language also to finiteness. She found in young Dutch children that if subjects are realized, they will occur with a finite verb, and more subjects will be dropped with non-finite verbs. We will study the input and the output for spoken subject realization related to finiteness. We will analyze all NL and SC utterances with a verb for the correct (non-) realization of subjects and objects, and look at the finiteness of the verb in relation to subject realization.
In general we will consider here what arguments are realized in SLN, NL and SC utterances in the input and in the output of the children (research question 23 in section 3.5).

Procedures
For these analyses we studied all analyzable SLN, NL and SC utterances with a verb. [25]

- For the SLN utterances we look at whether or not subjects and objects are realized. Subjects can be dropped in SLN. Obligatory and optional objects cannot be distinguished, since these aspects have not been studied yet. For SLN we will give percentages for presence or absence of objects.
- All NL utterances that contain a verb are coded for having a subject or for not having a subject, and for presence or absence of obligatory objects. We will look at whether subject and/or object drop occurs correctly or incorrectly. Utterances are considered correct when the subject is realized, or when the subject is not realized in imperative sentences or when topic drop occurs. Obligatory objects must always be realized, except in the case of topic drop

Following Krämer (1995) we subsequently look at the finiteness of the verb, to see whether or not subjects are realized with finite verbs more often than with non-finite verbs. In the Appendix to Chapter 9 we present a list of all occurring verbs in the input and the output, categorized according to transitiveness, and whether or not objects are obligatory or optional.

- For the SC utterances we have the following procedure: all SC utterances with a signed verb are analyzed for subject an/or object realization in two groups: those with a simultaneously spoken verb, and those without. All SC utterances with a spoken verb are analyzed in two groups, one with a simultaneously signed verb and one without. Additionally we looked at whether or not subject/object realization was correct (i.e. subject and obligatory object must be realized, unless topic drop occurs) and whether subject realization occurred with finite verbs.

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25 See Appendix to Chapter 9, page 301-305 for a list of the studied verbs

9.3.1 Realization of arguments in the input

Realization of arguments in SLN and NL with a verb

There are 122 SLN utterances with a verb in the input to the deaf children (see section 9.2.1). Subjects are dropped in 57% of these utterances (see Table 9.11). Where a transitive verb is used (n=64), objects are dropped in 58% of the cases. Of the 37 objects that are not lexically realized only six are expressed through classifier-incorporation into the verb (see section 2.3.1). Four verbs are spatial verbs, where the object can be expressed through choice of location, e.g. *VINDENbal* 'FINDball', where the verb is made on the real or localized ball. It is thus not often the case that lexical objects are dropped as a result of agreement occurring in the utterance - this occurs with only 16% of the transitive verbs.

In the input to the hearing children there are 29 SLN utterances with a verb and here all but three subjects are omitted. Eight transitive verbs are used with only one lexical expression of the object (*BLOEM PLUKKEN* 'FLOWER PICK').

Table 9.11 INPUT DC+HC: Number and (%) of Subject and Object drop in SLN utterances of the mothers

SLN input of deaf mothers to	Total no. of utterances with a verb	Sdrop [a]
Deaf children	122	69 (57)
Hearing children	29	26 (90)
	Total no. of transitive verbs	**Odrop [b]**
Deaf children	64	37 (58)
Hearing children	8	7 (88)

[a] *Percentages are from total number of SLN utterances with a verb*
[b] *Percentages are from total number of transitive verbs*

The percentages of subject- and object drop are similar in the SLN input to the deaf children (around 57%) and also similar with the hearing children (around 88%). However, the fact that much more subject and object drop occurs with the hearing children is striking. Possibly the mothers make a distinction between SLN and NL in this respect which they feel they must emphasize with the hearing children (Sdrop and Odrop in SLN but not in NL). With the deaf children the need is less urgent, because they are offered hardly any Dutch. We will come back to this aspect in the discussion of the NL utterances with a verb.

Bos (1995) examined this aspect in adult SLN signing. She found that in 39% of adult SLN utterances the subject is not lexically expressed, compared to 63% of the objects (1995:136). She concludes that

> […] subjects often are expressed only lexically, and not in agreement whereas objects tend to be expressed through agreement. This preference for object agreement is mirrored in object-drop: there is more object-drop than subject-drop. (Bos 1995:137)

Compared to the percentages found by Bos, there is more subject-drop in the input to the deaf children (57% compared to Bos' 39%). Object-drop is comparable (58% to Bos' 63%). In section 9.5 we will see whether or not this difference in subject drop can be explained by agreement factors. Subjects can possibly be omitted more often because the discourse involves fewer topic shifts than in the stories told by the adults in Bos' data. The play-sessions also dealt mainly with here-and-now situations, where referents are present.

The NL input to the hearing children contains 137 utterances with a verb. Of these 93 are imperative sentences where no subject is required (68%). In the 44 remaining declarative or interrogative utterances subjects are realized in 23 cases (52%) and these all occur with finite verbs. (Subject) topic drop occurs in 32% (n=14), in more than half the cases with finite verbs. In only 7 NL utterances with a verb (16%) is the subject ungrammatically omitted, 4 times with a finite verb, and 3 times with a non-finite verb. We can say that the NL input to the hearing children mostly conforms to the rules of Dutch with respect to the realization of subject. The influences from the SLN rule of subject drop is apparently limited. There are only three utterances with a verb which take an obligatory object and these are all realized. On the whole it appears that the mothers follow Dutch rules for subject and object realization.

Realization of arguments in SC input with a verb

In Table 9.12 we present the percentages of dropped subjects and objects in SC utterances of the deaf mothers. The grammatical cases of subject or object drop in *spoken* imperative sentences or topic drop contexts are not represented in this table. Only the ungrammatical cases are counted; these are presented as a percentage of all SC utterances with a spoken verb.

Table 9.12 INPUT DC+HC: Numbers and (%) of dropped subjects and objects with signed and spoken verbs in SC utterances of the deaf mothers with the deaf and hearing children

INPUT: SC utt.	Total no. of utterances	DMDC S drop [a]	Total no. of utterances	DMHC S drop
signed V	87	44 (51)	44	38 (86)
spoken V	35	*11 (31)	246	*23 (9)
signed V + spoken V	243	141 (58) *108 (44)	416	245 (59) *79 (19)
	Total no. of transitive verbs	DMDC O drop [b]	Total no. of transitive verbs	DMHC O drop
signed V	46	3 (7)	24	14 (58)
spoken V	7	*4 (43)	23	*3 (13)
signed V+	126	87 (69)	265	117 (44)
spoken V	51	*11 (22)	77	*14 (18)

[a] *Percentages are from total number of utterances with a verb*
[b] *Percentages are from total number of transitive verbs*
** = ungrammatical S- or O drop*

In the category SC utterances with only a signed verb, the deaf mothers produce 87 with the deaf children, of these 46 are transitive signed verbs. With the hearing children 44 utterances have a signed verb, of which 24 are transitive verbs. The mothers drop more subjects than objects with both groups of children unlike the SLN utterances, but they drop more subjects and objects with the hearing children. This is the same as the finding with the SLN utterances, and may be a reflection of an emphasis.

In the category SC utterances in which only a spoken verb is produced, the deaf children are offered 35 of such utterances. In 16 (46%) the spoken subject is realized, mostly with a finite verb (94%). In total the subject is ungrammatically omitted in 11 utterances (31%). The mothers offer 7 transitive verbs, with 4 obligatory realized objects (57%).
With the hearing children the mothers produce 246 SC utterances with a spoken verb. In 172 utterances the subject is realized (69%), mostly with finite verbs (98%). Of those cases where the subject is dropped, 21 are imperatives and topic drop occurs in 30 utterances. In 23 utterances (9%) the subject is ungrammatically dropped. This is comparable with the figures for the NL utterances. 23 Transitive verbs are used with 17 lexically realized objects, whereas with three verbs object topic drop occurs. In 3 cases (13%) the object is ungrammatically left out, which is also comparable to the NL input. In these SC utterances then the mothers realize more subjects and objects with the hearing children than with the deaf children, which is contrary to what we found for the SC utterances with a signed verb. Realized subjects occur mostly with finite verbs, which was also found by Krämer for child Dutch (1995). In these SC utterances with a spoken verb only the mothers clearly follow the syntactic rules of Dutch (realize subjects and obligatory objects).

Lastly we look at those SC utterances where the signed verb is combined with a spoken verb.
The deaf children are offered 243 of these and in 58% the signed subject is dropped and in 44% the spoken subject, in the latter case ungrammatically. This reflects a considerable SLN influence on the spoken part of the utterance. (Spoken subjects are realized in 29 cases (12%), in 53% with a finite verb. In 49 (20%) cases we find spoken subject topic drop which is allowed in Dutch and in the remainder of the utterances no subject is expected.) There are 126 transitive signed verbs with 69% dropped objects. Spoken transitive verbs with an obligatory object total 51, with 11 cases (22%) of ungrammatically dropped objects. There are 20 (39%) realized objects. Object topic drop occurs with 20 verbs (39%).
The signed parts of the SC utterances are very similar to the SLN input to the deaf children, on average 55% percent of the subjects are dropped. The spoken parts seem to be under the influence of SLN syntactic rules, in that there is also a high percentage of subject drop (44%) in those utterances where both a signed and a spoken verb are present. In the SC utterances with only a spoken verb the percentage of subject drop is lower (31%) and we see less influence of SLN here. Object drop occurs often (69%) in the SC utterances with a signed and a spoken verb, but hardly in those SC utterances with only a signed verb (7%). The percentage for dropped objects in the spoken parts is quite high, but higher in utterances with only a spoken verb (43%) than in utterances with both a signed and a spoken verb (22%).

The hearing children are offered 416 simultaneously signed and spoken verbs. In the signed parts 59% of the subjects are dropped, comparable to the input to the deaf children. The mothers offer 265 transitive signed verbs with 117 (44%) dropped objects, which is less than with the deaf children (69%). Spoken subjects are dropped in only 19% of the SC utterances, far less than with the deaf children (44%). The SLN influence on the spoken parts seems to be less obvious here compared to the input to the deaf children. There are 174 realized spoken subjects (42%), the majority of which occur with a finite verb (93%) and there are 164 (39%) subjects dropped in permitted circumstances (imperatives or topic drop). The mothers offer the hearing children 77 spoken transitive verbs with 14 ungrammatically dropped objects (18%). So even though ungrammatical spoken parts also occur in the SC input to the hearing children, the structure that is offered in these spoken parts resembles spoken Dutch more than with the deaf children, especially regarding the realization of subjects.

In sum, we find that in SLN with the deaf children 57% of the subjects and 58% of the objects are dropped. These percentages are respectively higher and slightly lower than those found by Bos (1995) for adult-adult SLN (39% and 63%). With the hearing children these percentages are even higher (about 88%). The Dutch input to the hearing children showed only 16% of (ungrammatical) subject drop, and no obligatory object drop at all. The deaf mothers seem to make a distinction between

SLN and NL with respect to the realization of arguments, which is not apparent in the input to the deaf children.
We find this confirmed in the SC input to the children. With the deaf children the SC input appears to follow SLN rules. We find the same percentages for subject drop and object drop in the signed parts as in SLN. The spoken parts show less subject drop than the signed parts. However, the percentages for (ungrammatical) subject drop in the spoken parts are substantial (31% and 44%) so that we can speak of an influence of SLN rules here. With the hearing children the SC utterances appear to be comparable to the deaf children' input with regard to the signed parts: a high percentage of subject and object drop. But the spoken parts of the SC utterances are clearly much more Dutch-like. We find 9% and 19% of ungrammatical subject drop in SC utterances with a spoken verb only and in the utterances with a signed and a spoken verb, comparable to 16% of ungrammatical subject drop in Dutch. The percentages for object drop (13% with spoken verbs only and 44% with signed and spoken verbs) are comparable to subject drop, but still much higher than in the NL utterances. So only with respect to object drop we see an influence of SLN in the SC utterances in the input to the hearing children. Especially the utterances where both a signed verb and a spoken verb occur are different in the input: SLN-like with the deaf children and Dutch-like with the hearing children.

9.3.2 Realization of arguments in the output

Realization of arguments in SLN and NL with a verb

The deaf children produce 90 SLN utterances containing a verb. The deaf children drop the subject with 48 (53%) of these verbs, which is highly similar to the input (57%) (compare Table 9.11). Objects are omitted in 15 (44%) of the cases where a transitive verbs is used (n=34) – a somewhat lower percentage than in the input (58%).
The hearing children produce 25 SLN utterances with a verb, and in most of these the subject is dropped (88%) which comes very close to the 90% of dropped subjects in the input (see Table 9.11). Five objects (out of nine transitive verbs) are dropped. Compared to the SLN input the hearing children appear to omit the same percentage of subjects. Their production of transitive verbs is too small to draw conclusions upon.
Objects seem to be dropped less often than in the input; however, no conclusions can be drawn because of the low number of instances of transitive verbs.

The NL output produced by the hearing children contains 71 utterances with a verb, in which 38% of the subjects are realized, mostly with finite verbs (85%). There is one imperative sentence where the subject is correctly dropped. 41% of the subjects (n=29) are dropped correctly under topic drop conditions. This leaves 20% of incorrectly dropped subjects (n=14).
Schlichting (1996:94) found that hearing children of hearing mothers at mean age 2;4 and at mean age 2;10 dropped subjects in first position in the sentence respectively in 55% and 30% of the NL utterances. Krämer (1995) found a range of

24 - 39% of subject drop in NL utterances of 7 monolingual Dutch children around age 2-3 years. More subjects were dropped with non-finite verbs than with finite verbs. We find that the hearing children in this study drop subjects with finite verbs in 25%, and with non-finite verbs in 35%. These percentages support the findings of Krämer.
In total 5 NL utterances with a transitive verb with an obligatory object are produced by the hearing children, but no objects were realized. We exclude here 9 sentences in the output of Alex (H) such as *weet je* 'you know' because these can also be considered to be discourse markers. The number of transitive verbs is so low, that we will not further analyze them.

Realization of arguments in SC output with a verb
In Table 9.13 we present the percentages of dropped subjects and objects in SC utterances with a verb in the output of the children (compare to input, Table 9.12).

Table 9.13 OUTPUT DC+HC: Number and (%) of dropped Subjects and Objects with signed and spoken verbs in SC of the deaf and hearing children

OUTPUT SC utt.	Total no. of utterances	DC S drop [a]	Total no. of utterances	HC S drop
signed V	5	n.a.	6	0
spoken V	1	n.a.	72	*10 (14%)
signed V + spoken V	1	n.a	54	34 (63%) *14 (26%)
	Total no. of transitive verbs	DC O drop[b]	Total no. of transitive verbs	HC O drop
signed V	0		4	3
spoken V	0		10	*1
signed V+ spoken V	0 0		26	13 (50%) *13 (50%)

[a] *Percentages are from total number of utterances with a verb*
[b] *Percentages are from total number of transitive verbs*
**= ungrammatical S- or Odrop*
n.a. = not analyzed

The deaf children produce 7 SC utterances in total, with 5 signed verbs, one spoken verb, and one simultaneously signed and spoken verb. We shall not further analyze these.
The hearing children in total produce 131 SC utterances with a verb. Of these there are only 6 utterances with a signed verb; in all 6 no subjects are realized; 3 objects are lexically realized with 4 transitive verbs. These utterances are too few to make a valid comparison to the input.
There are 72 SC utterances with only a spoken verb. Of the subjects 47% is realized, mostly with a finite verb (91%). In 38 utterances the subject is omitted: one imperative and 27 subject topic drop - in these utterances the subject is not ungrammatically left out. In 10 utterances (10%) the subject should have been realized. In general then these SC utterances seem to follow Dutch rules. In total 10

transitive verbs are used, and 7 of these are obligatorily realized, whereas two objects could be left out because of topic drop. Only one object should have been realized and was not. In all the children seem to combine Dutch spoken sentences with signs to support their communication with their mothers. Their output resembles the input in SC.
SC utterances with a signed and a spoken verb also occur (n=54) in the output of the hearing children. In the signed part 15 subjects are realized (28%) against 20 spoken subjects (37%). Even though most of the subjects are omitted in both parts, we see slightly more subjects realized in the spoken parts. Spoken subjects are omitted once in an imperative sentence, 18 times under topic drop conditions (33%), and 14 times incorrectly (26%). This means that slightly more subjects are dropped than in the other SC utterances and in the NL utterances, which might be interpreted as an influence of SLN in these SC utterances. But hearing children in hearing families also omit subject to this extent, so it is not abnormal. The subjects that are realized occur more often with finite verbs (12 times vs. 8 times, 60%). Also, more subjects are left out with non-finite verbs (n=24, 75%) than with finite verbs (n=8, 25%). So even in these SC utterances under the influence of SLN, we find rules for spoken Dutch applied to the spoken parts. In total 26 transitive verbs with obligatory objects are produced, and in 9 cases (35%) the object is realized. Topic drop occurs in 4 cases, and in 13 utterances the object is ungrammatically left out (50%). Also for this aspect we see a possible SLN influence on the realization of spoken arguments.

9.4 Position of verbs

In SLN utterances we should encounter verbs in final position (SOV) (Coerts 1994). SOV can change into O,SV via topicalization of the object (Coerts 1999). With a covert subject (or null subject) and (often) object deletion the order of ((O)VS) can occur, with a copied subject in sentence final position (Bos 1995). This last seems also to be grammatical in two-sign utterances. The status of the final Point as a subject pronoun copy, however, cannot be validated in these simple utterances and will not be further discussed here. Whether or not VOS order is grammatical in SLN, that is where the subject is non-overt and the object and a subject pronoun copy are lexically expressed, has not yet been studied (but see van Gijn (ms)). Native signers seem to disagree when asked for a grammatical judgment (Bos, pc). It is the question whether the signed parts of SC follow an SLN order.

Dutch is considered to be an underlying SOV language, but the order is SVO in main clauses. Topicalization is also frequently found, both in adult and in child language. Krämer (1995) describes topicalization as follows.

> Topicalization of the object will derive an OVS order, and the very frequent topicalization of locations and adverbials of time will derive a Loc-VS order as in 59). Child language also has topicalization, as is shown in 60) and 61).

59) In Amsterdam steelt men veel fietsen
In Amsterdam steal they a lot of bikes

60) Die heb ik al (Hein 2;10)
That have I already

61) Dat heeft tante Lieve ook (Gijs 2;7)
That has aunt Lieve too

Topic drop can also occur, and then a surface order of VS may be derived. (Krämer 1995:45). (See for more details Krämer 1995, pages 40-46).

As discussed in section 8.2.1 in NL interrogative main clauses the verb is moved correctly to initial position (VSO) and in imperative sentences the verbs is also in first position, as in example (10):

(10) *Pak de bal maar!* (go get the ball)
Get the ball interjection !

Here we want to know what the position of the verbs is in SLN, NL and SC utterances, both in the input and in the output (research question 24 in section 3.5).

Procedures
Signed and spoken (parts of) utterances *with* a verb were classified as follows:

1 Verb only (Vonly) - the verb occurs by itself, without other constituents.
Verbs are used in a very simple way; the subject (and possibly the object or other constituents) have been omitted. But in the case of NL imperatives this is allowed, for instance: *ga* 'go' and not 'go you'). Since these utterances offer the children no clue to the verbal system (and linked aspects) of either SLN or NL, **we excluded these utterances from further analysis.**

2 The verb is in initial position (Vi). For SLN this is a grammatically correct position when the subject is covert and (often) the object omitted, e.g. '[DADDY] CLEAN-UP [TABLE] POINTto-daddy' ([daddy] is cleaning up,[the table] +subject pronoun copy). For a discussion of subject pronoun copy in SLN see Bos 1995.
For NL this is the usual position of the verb in interrogative sentences, e.g. *wil je een koekje?* 'do you want a biscuit?' or imperative sentences, e.g. *pak dat boek* 'get the book'. In declarative main clauses this position is usually ungrammatical, because an overt subject or another constituent is required in first position. In the case of topic drop the verb can occur in first position without making the sentence ungrammatical.

3 The verb occurs in second position (V2).
A verb was classified as V2 only in sign/word utterances consisting of at least three constituents. In Dutch the finite form of the verb has to be in second position, with the possibility of a non-finite verb (infinitive or past participle) in another position, usually final. Spoken finite main verbs, auxiliary verbs and copulas occur in second position, whereas this position does not regularly occur in SLN.

4 The verb occurs in final position. There are two subclasses:
- in final position in a 2 sign/word utterance (Vf2)
- in final position in ≥ 3 sign/word utterances (Vf3).

This is considered to be the grammatical position for SLN verbs. In SLN, if the subject or the object of the sentence (either nominal or pronominal) is repeated after the verb, the verb is still considered to be in final position. *Yes*, *no,* head nods and head shakes are disregarded in establishing verb position, as well as discourse markers.
In Dutch the finite verb cannot occur in final position (except in two-word utterances), but non-finite verbs usually are in final position in declarative sentences. Examples are:

a) *ik ga die pop <u>pakken</u>* (I will fetch that doll)
I go that doll fetch

b) *ik heb die toren <u>gebouwd</u>* (I have built that tower)
I have that tower built

In certain elliptical utterances the verb can also occur in final position, as in *even lezen* '[I gonna] read'. The subject and auxiliary or modal are deleted.

5 Other positions

9.4.1 Verb positions in the input

Position of verbs in SLN and NL input

In Table 9.14 we present the number and percentages of different verb positions in the SLN and NL input of the deaf mothers to the deaf and hearing children. As mentioned before, the total NL input to the deaf children is minimal, and as only 3 utterances contain a verb we will not further discuss these.

Table 9.14 INPUT DC+HC: Number and (%) of different verb positions in SLN and NL utterances of the deaf mothers

SLN INPUT	to deaf children n =122	to hearing children n =28
Vonly	70 (57)	21 (75)
Vinitial	22 (18)	3 (11)
V2	2 (2)	0
Vfinal2	22 (18)	4 (14)
Vfinal3	5 (4)	0
Vother	1 (-)	0
NL INPUT	to deaf children n = 3	to hearing children n = 137
Vonly	2	25 (18)
Vinitial	1	81 (59)
V2	0	23 (17)
Vfinal2	0	8 (6)
Vfinal3	0	0

Vfinal2 means a final verb in a 2 sign/word utterance
Vfinal3 means a final verb in a ≥3 sign/word utterance

The largest category of SLN input with a verb consists of Vonly, both with the deaf and the hearing children, but it is larger with the hearing children. These verbs occurring by themselves give the children no clue as to the grammatical structure of SLN. Even though the hearing children are offered signed verbs, the actual number and proportions do not offer the children many clues concerning the position of signed verbs.
In utterances consisting of 2 or more signs the following combinations occurred:

OV	*BOEK LEZEN*	(I am going to read a book)
	BOOK READ	
VO	only when the object is a *wh-q* sign, e.g.	
	ZOEKEN WAT	(what are you looking for?)
	LOOK-FOR WHAT	
SV	*VROUW ZITTEN*	(the woman is sitting)
	WOMAN SIT	
VS	*HUILEN POINTnaar-poppen*	(they are crying)
	CRY POINTto-dolls	
VX or XV	*ZITTEN POINTstoel*	(he sits on the chair)
	SIT POINTchair	

For incorrect or doubtful order we found the following examples:

VSO	*KUSSEN POINTmark POINTpop*	(you [must] kiss the doll)
	KISS POINTmark POINTdoll	
VOS	*KUSSEN POINTpop POINTmark*	(you [must] kiss the doll)

	KISS POINTdoll POINTmark	
VO	*KIJKEN HELICOPTER*	(you were watching the helicopter)
	WATCH HELICOPTER	
SVO	*POINTlaura VERTELLEN 2OP1* *MAMMA POINTlaura*	
	POINTlaura TELL 2ACT-ON1 MOMMY POINTlaura	
		(you now tell mommy)

The majority of the verbs are in utterance-final or in initial position with subject drop; only a few verbs are in second position. In principle then it seems that grammatically acceptable sign order in SLN is presented to the children.

As outlined above, the spoken verbs in the NL input to the hearing children can be finite or non-finite, and this determines whether or not their position is grammatical. The function of the sentence also determines grammaticality. The category of verbs in first position is large, but of all finite spoken verbs (n=106) in NL utterances 95 (87%) are in correct position, either initial in imperative sentences or in topic drop contexts (e.g. *past wel* 'fits'), or in second position in main clauses. Six finite verbs occur incorrectly in first position because the subject is ungrammatically left out (e.g. *hebt gepakt* 'have fetched' (see section 9.3). One subject was left out which did not affect verb-order (*wat zal [ik] tekenen, Jonas?* 'what shall [I] draw, Jonas?').
Of the verbs in final position (in two-word-utterances) two are finite and correct, while there is one incorrect imperative: *even zit* (stem-form) instead of the non-finite form *even zitt**en***. There are 5 non-finite final verbs, 3 of which are correct imperatives (for instance *even wachten*). One non-finite verb occurs in an ungrammatical imperative (i.e. *zoeken meer* 'search more'), which should have been either *meer zoeken* or *zoek [er] meer*.
In conclusion we see that the verb positions in the NL utterances offered to the hearing children are mostly correct and the verb has the correct form.

Position of verbs in SC input
Table 9.15 presents the number and positions of verbs in the first category Vsln+Vnl-, SC utterances with only a signed verb.

Table 9.15 INPUT DC+HC: Number and (%) of signed verb positions in SC utterances of the mothers with only a signed verb (Vsln+Vnl-)

SC INPUT: No. and % of Verb positions in Vsln+Vnl- (signed verbs)	to deaf children n=87	to hearing children n=44
Verb only	17 (20)	23 (52)
Verb initial	14 (16)	6 (14)
Verb second	6 (7)	3 (7)
Verb final (Vf2+Vf3)	42 (48)	12 (27)
other	8 (9)	0

The hearing children are proportionally offered far more signed verbs in isolation (Verb only) than the deaf children. This resembles the SLN input, where the hearing

children also received many more signed Vonly than the deaf children. In that part of the SC utterances consisting of 2 or more signs the position of the verb is mainly initial or final with both groups of children. There are a few other positions (V2), and some exceptional structures in the input to the deaf children. In general the structures here resemble the SLN input.
In Table 9.16 we present the SC utterances with only a spoken verb (Vsln-Vnl+).

Table 9.16 INPUT DC+HC: Number and (%) of spoken verb positions in SC utterances of the mothers with only a spoken verb (Vsln-Vnl+)

SC INPUT: No. and % of Verb position in Vsln-Vnl+ (spoken verbs)	to deaf children n=35	to hearing children n=246
Verb only	0	10 (4)
Verb initial	15 (43)	62 (25)
Verb second	14 (40)	165 (67)
Verb final (Vf2+Vf3)	6 (17)	9 (4)
other	0	0

We see in Table 9.16 that only a few spoken Vonly are used with the hearing children. If a spoken verb is used, it is thus usually in utterances consisting of two or more other spoken words.
The verb positions differ in the input: most frequently V2 position with the hearing children, while with the deaf children verb initial and verb second positions are equally used. With the deaf children the spoken verbs in initial position are all finite but only two occur in an imperative sentence; thus, the majority of initial verbs are in ungrammatical positions (n=11, 73%). Of the verbs in V2 position 87% is finite and so grammatically correct, while the remainder has the wrong form (either infinitive form, stem-form or past participle). The verbs in final position are correct. Altogether 46% (n=16) of the spoken verbs in these SC utterances have the wrong position.
Looking at the input to the hearing children we see that V2 is the preferred position. Of these verbs in second position 95% are finite and correct, 5% is grammatically incorrect because they have the wrong form (infinitive or past participle). Of the verbs in initial position 37% occur in imperative sentences with correct finite or non-finite form, but 14% of these finite initial verbs should have occurred in second position. This is related to missing arguments (see section 9.3.1). Of the final verbs (n=9) 44% occurs in ungrammatical sentences, for instance in a sentence like: *wat is* 'what is' where the subject has been omitted. In total 15% of the verbs in SC utterances with only a spoken verb have ungrammatical positions.
We see that in the SC utterances with the hearing children mainly NL order is followed, while with the deaf children more grammatically incorrect spoken verb positions occur.

In most of the SC utterances with a verb there is a verb both in the signed part and in the spoken part (Vsln+Vnl+). Table 9.17 displays the data on these utterances.

Table 9.17 INPUT DC+HC : Number and (%) of signed and spoken verbs in SC utterances of the mothers

SC INPUT: **Signed verbs**	to deaf children n=243	to hearing children n=416
Vonly	41[a] + 47[b] (36)	51[a] + 81[b] (32)
Vinitial	46 (19)	87 (21)
V2	30 (12)	57 (14)
Vfinal (Vf2 + Vf3)	75 (31)	138 (33)
Other	4 (2)	2 (-)
SC INPUT: Spoken verbs	DMDC n=243	DMHC n=416
Vonly	41[a] + 72[b] (47)	51[a] + 42[b] (22)
Vinitial	63 (30)	96 (23)
V2	15 (6)	138 (33)
Vfinal (Vf2 + Vf3)	51 (21)	88 (21)
Other	1 (0)	1 (0)

[a] *this figure refers to those utterances that consist of a signed verb only and a spoken verb only, without other constituents present*
[b] *this figure refers to signed (or spoken) verbs only that occur in a SC utterances, where in the other part ≥ 2 constituents are present*

From Table 9.17 it is clear that in general the deaf and hearing children receive more or less the same input as far as the signed parts of the SC utterances are concerned. The percentages verbs occurring in the different verb positions are strikingly similar: there are many signed signs which occur alone, most of the signed verbs are in final or initial position (with subject drop).
However, the spoken input is quite different. The deaf children are offered more SC utterances with a spoken part consisting of a verb-only than the hearing children. Also a much larger proportion of verbs in second position (V2) is offered to the hearing children than to the deaf children. Example (11) gives an impression of an ungrammatical spoken part. In this example the second verb *geef* 'give' is in the finite form, while is should have been in the infinitive form *geven* after the modal verb *moeten* 'must'.

(11) [MS 3;0-utt. 48]
KAART GEVEN (you must give the ticket)
kaartje moet geef
TICKET GIVE
ticket must give(finite*)*

We have already seen in section 9.3.1 (Table 9.12) that the deaf children receive ungrammatical spoken input in 45% of the SC utterances with a signed and spoken verb, compared to 19% with the hearing children. The findings here support the idea that the hearing children are offered mainly Dutch grammatical rules in SC utterances,

whereas the deaf children are offered either SLN-like SC utterances, or grammatically incorrect Dutch utterances.

9.4.2 Positions of verbs in the output

Position of verbs in SLN and NL output

In Table 9.18 we present the number and percentages of different verb positions in SLN and NL utterances of the deaf and the hearing children. The data are pooled over time.

Table 9.18 OUTPUT DC+HC: Number and (%) of different verb positions in SLN and NL utterances of the deaf and hearing children

SLN OUTPUT	Deaf children n = 90	Hearing children n = 25
Vonly	34 (38)	21 (84)
Vinitial	8 (9)	2 (8)
V2	11 (12)	0
Vfinal2	29 (32)	2 (8)
Vfinal3	8 (9)	
NL OUTPUT	Deaf children n = 0	Hearing children n = 71
Vonly		17 (24)
Vinitial		24 (34)
V2		10 (14)
Vfinal2		17 (24)
Vfinal3		2 (4)
exceptions		1 (2)

As we expected from the MLU data in section 9.1.2, the deaf children produce more verbs in SLN utterances consisting of ≥ 2 signs/constituents (41%) than the hearing children (8%). The hearing children produce mainly signed verbs occurring alone. In the input to the deaf children the mothers produced 22% of the verbs in utterances consisting of ≥ 2 signs/constituents (see Table 9.14), compared to 14% with the hearing children. The signed verbs in the output of the deaf children occur predominantly in final position, and sometimes in initial position (with subject drop). The deaf children also produce verbs in second position (see examples (12) and (13)), although these were hardly ever offered to them in the SLN input.

(12) [Laura 2:6-utt. 17]
POINTboek NAAIEN POINTlaura (I have sewn that)
POINTbook SEW POINTlaura
(object verb subject)

(13) [Mark 2;6-utt. 13]
HOEK ZOEKEN POINTnaar-doos
CORNER SEARCH POINTto-box
(object - verb - X)

([I] am going to look for the corner [piece of puzzle] in there)

The hearing children mainly produce signed verbs without other signs/ constituents present. There are four occurrences of multi-utterances with a verb, in initial or final position, which are correct positions in these utterances.

In the NL output of the hearing children the verb is not predominantly in second position, despite their apparent focus on Dutch. Verbs occur most often in initial position (see (14) and (15), which reflects the input, or in final position, like in example (16) and (17). These are typical for Dutch monolingual children at this age (see Gillis and De Houwer 1998). The verb is acquired in final position (non-finite) first by monolingual Dutch children and later in second position (finite) are acquired. Auxiliaries and modals first appear in second position, lexical verbs later.

(14) [Jonas 2;0-utt.2]
kan niet
can not

The subject is dropped here. The utterance should have been *dat kan niet* 'that's not possible'.

(15) [Alex 2;0-utt. 1]
zal ik die?
shall I that?

In example (15) the lexical verb is left out, but the auxiliary is in the right position in an interrogative sentence, which should read *zal ik die pakken?* 'shall I fetch that one?'.

(16) [Alex 2;0-utt.11]
mama lezen — non-finite form is used,
mommy read — no auxiliary – "mama *moet* lezen"
(mommy must read)

(17) [Alex 2;0-utt.63]
met oma praten — [ik wil (I want)] is left out
with granny talk

We found one typical example for word order in a subordinate clause (see (18)).

(18) [Jonas 3;0-utt. 90]
even kijken de laatste man goed is
just look the last man alright is

In this example the utterance should be *even kijken **of** de laatste man goed is* 'let's see if the last man is alright'. The conjunction *of* 'whether' is left out in this sentence, the verb is in last position. This is the correct position in a subordinate clause.
In sum we can say that in SLN the deaf children adhere to SLN verb positions, and so do the hearing children in the few SLN utterances they produce. In NL the hearing children have many verbs in initial position as a result of incorrect subject drop. But they produce many correct verbs in second position. The NL input they receive is also mostly correct. The hearing children are no different from monolingual Dutch children in their production.

Position of verbs in SC output
The 7 SC verbs produced by the deaf children were either signed alone (n=5) or in final position. We will not further discuss the SC output of the deaf children, but of the hearing children only.
As we saw earlier (section 9.2.2) the hearing children show a predominance of spoken verbs in their output. 95% of the SC utterances with a verb have spoken verb. This mirrors the input and emphasized the importance of the spoken modality.

In category Vsln+Vnl- (n=6) two of the verbs occur by themselves, two in initial position and two in final position. These numbers are actually too small to warrant further discussion. In the input to the hearing children this category was also quite small (see Table 9.15), where most of the signed verbs were offered in isolation. In the few SLN utterances and SC utterances there were altogether 31 signed verbs. The hearing children show only a little evidence that they are learning the rules of SLN order.

Category Vsln-Vnl+ in the output of the hearing children is presented in Table 9.19.

Table 9.19 OUTPUT HC: Number and (%) of spoken verb position in SC utterances of the hearing children

SC OUTPUT: No and % Verb position Vsln-Vnl+ (spoken verbs)	Hearing children n=72
Verb only	7 (10)
Verb initial	27 (37)
Verb second	33 (46)
Verb final (Vf2+Vf3)	5 (7)

When spoken verbs occur without accompanying signed verbs, the verbs are predominantly in initial position (90% correct in interrogatives or imperatives, or with topic subject drop) or in second position - NL verb positions. A small percentage of spoken verbs occurs in final position.

There are a few exceptional utterances, such as example (19):

(19) [Jonas 2;0 - utt. 17]

neg	(don't say: what are you saying)
nee, zegge jij	
neg	
no, say you	

Jonas' mother could not see her son's face because he was looking down and she was often asking him what he was saying, to which he was objecting.

In Table 9.20 we present the number of utterances in the different categories in SC utterances with a verb in both parts (Vsln+Vnl+) in the output of the hearing children.

Signed verbs occur more often in isolation than spoken verbs. This confirms our findings that the hearing children focus more on the spoken forms. Initial signed verbs are rare, but spoken verbs occur in initial position more often – and four of these are ungrammatical. Compared to the verb position in NL utterances, the spoken verbs in these SC utterances occur more often in final position, and less often in second position. This suggests some influence of SLN on the spoken parts of these SC utterances.
In the input we found that the mothers tend to put the spoken verbs in second position or in final position, but sometimes with these verbs incorrect inflection was used (see section 9.4.1 example (11)). This is not found in the output of the children, they use second or final positions with the correct grammatical forms, i.e. finite forms in second and non-finite forms in final position.

To summarize the output of the children we can conclude that the deaf children mainly produce verbs in SLN utterances, these occur predominantly in final position or initially with subject drop. In general SLN rules are followed, which we also concluded for their SLN input.

Table 9.20 OUTPUT HC: Number and (%) of signed and spoken verbs occurring in SC utterances

SC OUTPUT	Hearing children
Signed verbs	n=54
Vonly	28 (52)
Vinitial	2 (4)
V2	3 (6)
Vfinal Vf2	15 (28)
Vf3	5 (9)
Other	1 (2)
Spoken verbs	
Vonly	18 (33)
Vinitial	8 (15)
V2	10 (19)
Vfinal Vf2	13 (24)
Vf3	4 (7)
Other	1 (2)

The hearing children produce a few signed verbs, which occur by themselves and were thus coded as SLN. However, these on their own provide no evidence that the children are acquiring the verbal system in SLN. The signed verbs that are produced in SC utterances occur in final position, which indicates that the children are aware of the correct verb position in SLN being final. In the NL utterances produced by the hearing children the spoken verbs are either in initial (20% incorrect) or correct final and second position. This is similar to output by monolingual Dutch children. The NL input of the mothers also showed correct verb positions, although some ungrammaticalities occurred.
The spoken verbs in SC utterances produced by the hearing children occur often in second and initial position and some in final. These SC utterances then seem to follow Dutch rules for verb position, and are similar to the NL utterances. In the SC utterances where both a signed and a spoken verb occur, we can detect a small influence of SLN rules, in that spoken verbs occur more often in final position than in the NL utterances, or in SC utterances with only a spoken verb.

9.5 Verb Inflection

In this section we will look at the production of inflection in signed and spoken verbs, in particular we will consider if the inflection is appropriate for the signed and spoken verbs in SLN, NL and SC utterances (see question 25 in section 3.5).
Based on the literature (see Chapter 2), we expect agreement and spatial morphology on the verbs as well as classifier use in the SLN input at all points in time, and in the output from age 2;0 onwards (Woll 1998). For Dutch we might expect the deaf mothers to offer fewer morphological markers than native speakers would use (Schermer 1990; Ebbinghaus and Hessmann 1990; 1996). We cannot predict what pattern the deaf children will show; their development in a spoken language is

always delayed (see section 2.3.1). Monolingual Dutch hearing children of hearing parents produce infinitive forms of verbs from the beginning of word production. Finite singular forms can be expected to be produced 100% correct between the ages of 2;0 and 2;6 (2nd and 3rd person singular); 1st person singular between 3;0 and 3;6 (Bol and Kuiken 1988:59). The period 2;0-3;0 is an important period for the acquisition of the inflectional verb system in both Dutch and SLN.

Method

We look at all signed and spoken verbs as they occur in all utterances (see section 9.2) in the three language modes.

For **signed verbs** we looked at whether or not the verbs were inflected in various categories (see Padden 1988; Bos 1993, 1994)

1) The verb is in citation form (no inflection)
   The citation form of a sign is understood to be the least complex form that represents the whole paradigm and from which the other forms can most directly be derived (Appel et al. 1992:78)

   • Citation form — *PAKKEN BOEK* (take the book)
   TAKE BOOK

2) The verb is marked for location

   • Location — *POINTjij PAKKENboek* (you take that book)
   POINTyou TAKEbook

   The sign *PAKKEN* 'TAKE' is made **on** the book.

3) The verb is marked for subject or direct or indirect object

   • subject/object — *2KIJKEN1* (you look at me)
   2LOOK1
   Subject (2=you) and object (1=me) are marked on the verb

   • subject/indirect object — *BOEK 1GEVEN2* (I give you the book)
   BOOK 1GIVE2
   Subject (1=I) and indirect object (2=you) are marked on the verb

4) The verb has classifier incorporation

   • classifier-incorporation — *BAL 1GEVEN(C-CL)2* (I give you the ball)
   BALL 1GIVE(C-CL)2
   The C-classifier is incorporated into the verb, and represents the direct object. The handform is a realization of a phoneme in sign languages. The unmarked handform of the verb GIVE is changed into a C-handform,

which is the classifier that represents the ball (or direct object) in the example above.

5) The verb is inflected for manner or aspect

• manner	*LOPEN-ALS-BEER*	(he walked like a bear)
	WALK-LIKE-BEAR	
	The movement of the verb is changed into an imitation of the walk of a bear. Body movement can also play a part here.	
• aspect: durative	*KIJKENvoortdurend*	(to keep looking)
	LOOKcontinuously	
frequentative	*KIJKENsteeds-opnieuw*	(to look again and again)
	LOOKagain-again	

6) Negative verbs
It is doubtful whether or not these negative verbs can be considered as morphologically marked. Negative verb incorporation, of which only a few forms exist, seems not to be not productive in SLN. These forms are probably lexically encoded as negatives (Bos pc).

For **spoken verbs** we distinguished the following five categories:

1) The verb is in the infinitive form (non-inflected)
We include here the CDS imperative form, which is quite common in mother-child interaction.

• CDS imperative	*Mark bal pakken*	(Mark fetch ball)
	Mark ball fetch	

2) The verb is in imperative form. This is usually the verb-stem, as is shown in the following examples

• imperative	*pak*	(take)
	hou op	from the verb 'ophouden' (stop)

3) The stem of a verb is used, e.g. *zit* 'sit'. From the context it is clear that these forms are not imperatives but stem-forms as described by Ebbinghaus and Hessmann (1996) (see also section 9.4). They do not give a definition, but paraphrase "unmarked forms […] are often identical to the stems" (1996:35).

4) CDS forms. In Dutch typical Child Directed Speech (CDS) forms are found that in form resemble imperatives or stem-forms. These forms are used as a comment on an action.

•	CDS form	*aai aai* (stroke) *spring spring* (jump)	while stroking a cat, while jumping up and down.

5) The verb is in finite form (inflected)
   Finite forms can occur with main verbs, auxiliaries and copulas
   - 2nd/3rd person singular *-t* (or irregular forms)
   - plural: correct form is used (plural form is often identical to infinitive *-en*)
   - past tense *-de(n)* or *-te(n)*, or irregular forms

5) Past participle of a verb (inflected, non-finite)

9.5.1 Verb inflection in the input

Based on what we have already found (Chapters 7, 8 and 9) on the SLN and NL input, we might expect that the signed verbs will be similarly inflected in the input to the deaf and hearing children, whereas the NL input will contain more finite forms with the hearing children. We can expect this to be also the case in the signed and spoken parts of the SC utterances.

Figures 9.VIa and 9.VIb shows the percentages of the various forms of all signed verbs in the SLN and SC input of the mothers. The data are pooled for the mothers with the deaf children and with the hearing children because little change could be observed over time. Where development is observed, this will be discussed.
The signed input to the deaf and hearing children appears to be very similar, in both language modes. Signed verbs in citation form are used in more than 72% of the SLN utterances and in 85% of the signed parts of SC utterances with the deaf and hearing children respectively. There is hardly any change over time in the use of citation forms in either language mode.
Verbs are marked for location and manner/aspect similarly in the SLN and the SC input to both groups of children. Slightly more classifier incorporation occurs in the SLN input to the hearing children (7%) than to the deaf children (3%). With the hearing children we also observe some subject/object marking on the signed verbs, which does not occur with the deaf children yet. More negative verbs are used with the deaf children than with the hearing children. There is no consistent development the use of inflections in the input of the mothers with most children, except with Laura (D) at age 3;0 where we observe an increase in the use of verbs inflected for manner.

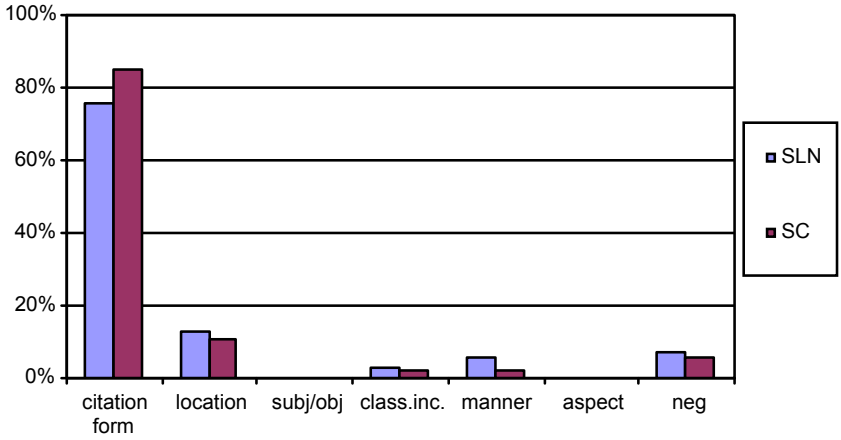

Figure 9.VIa INPUT DC: Signed verb forms in SLN and SC input of the deaf mothers to the deaf children.
NB Percentage can be over 100% because classifiers can be incorporated in verbs inflected for other aspects. These verbs are counted twice.

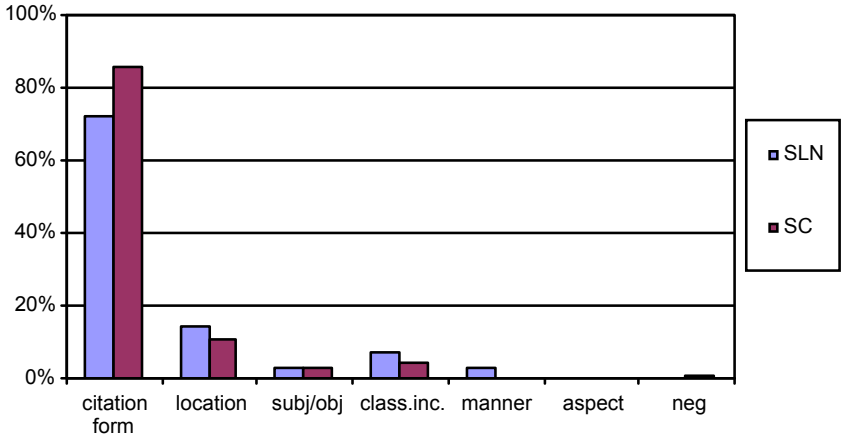

Figure 9.VIb INPUT HC: Signed verb forms in SLN and SC input of the deaf mothers to the hearing children.
NB Percentage can be over 100% because classifiers can be incorporated in verbs inflected for other aspects. These verbs are counted twice.

In section 9.1.1 we found that the mother of Mark showed a decreasing SLN-MLU after age 2;0. Earlier we suggested that this may be caused by the use of fewer signs, but more morphology per utterance. However, this turns out not the be the case.
In general we find only very few morphological markers on verbs in the signed input. Since we have found no literature on the structure of signed input we cannot

compare the input of the deaf mothers to input in other sign languages. The mothers offer the children mainly the citation form of verbs, which is perhaps a characteristic of Child Directed Signing. We think there may be a connection between the lack of morphology in the input and the language level of the children. We will come back to this issue in the next section.
In section 9.3.1 we found more subject drop in the SLN of the deaf mothers (57%) than Bos' had found for adult signers (39%). One explanation would have been that the deaf mothers use more inflected verbs than the adults. However, the signed verbs in the input are so seldom inflected that this cannot explain the difference. The fact that the mothers drop more subjects can only possibly be explained by the here-and-now character of the interaction.

The various forms of spoken verbs in NL and SC input to the deaf and hearing children are shown in 9.VIIa and 9.VIIb respectively. In the input of the deaf children the three verbs in NL utterances are not presented here (see section 9.2.1), only the spoken verbs in the SC input are shown.

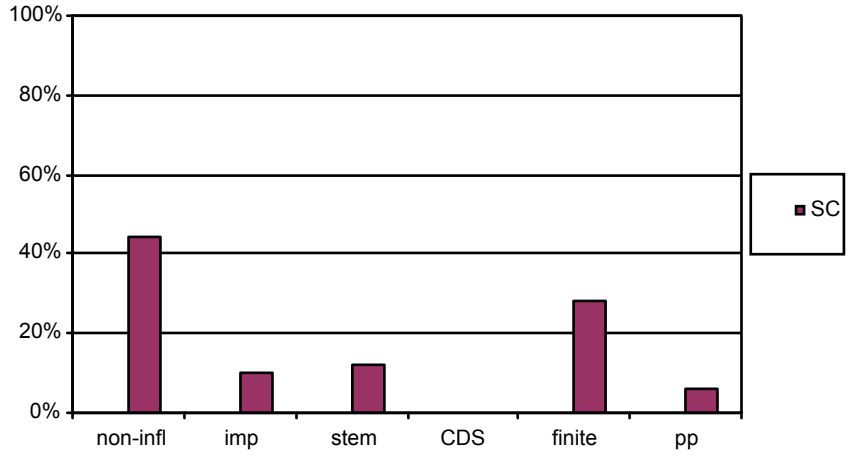

Figure 9.VIIa INPUT DC: Spoken verb forms in SC input of the deaf mothers to the dear children (NL too few to be analyzed)

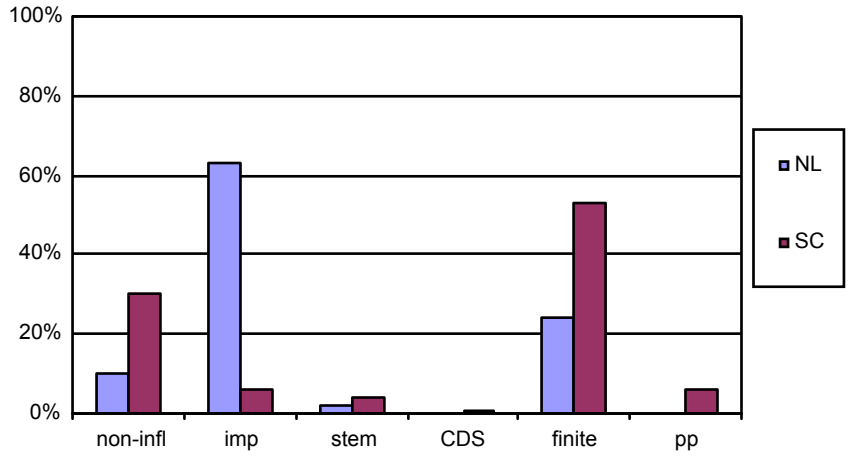

Figure 9.VIIb INPUT HC: Spoken verb forms in the NL and SC input of the deaf mothers to the hearing children

Verbs in the non-inflected form hardly occur in the NL input to the hearing children. Most of these occur by themselves or in imperatives like *even kijken* 'let's look'. They occur more often in the SC input. A clear difference between the NL and spoken SC input is the occurrence of many imperative forms in NL with the hearing children (see section 8.2.1), whereas these forms occur less often in the SC input to the deaf and hearing children. This can be attributed mainly to the mother of Alex (H), who uses more imperative forms with her son until the age of 2;6 than the other mothers (see also Chapter 8).
Stem forms and non-inflected forms are used slightly more often with the deaf children in SC than with the hearing children. This might suggest more sign-like structures (see sections 2.2 and 9.6) according to Ebbinghaus and Hessmann (1996). They described these forms in the German Sign Language (GSL) production between deaf partners in conversation. Ebbinghaus and Hessmann remark that 57% of the verbs in their sample consisted of infinitives and stem-reduced forms - in our data we found 56% with the deaf children and 34% with the hearing children. The input to the deaf children resembles the findings for GSL. The fact that with the hearing children these forms occur less often again is an indication that more NL-like structures are used with them compared with the deaf children.
CDS forms like *aai* 'stroke' are only used with the hearing children, bur occur rarely.
Finite forms are offered in SC to both the deaf and the hearing children, but to a much larger degree to the hearing children. They are also offered finite forms in NL utterances, but much less so. The percentages for finite forms include auxiliaries and copulas. Over time the mothers show an increase in the use of finite forms with Jonas, Alex and Sander, although at 3;0 there is a decrease with Sander.

Auxiliaries and copulas are not used to the same extent with the deaf and with the hearing children. Figure 9.VIII shows the percentages of auxiliaries and copulas of all SC spoken verbs offered to the deaf and hearing children, and of the NL verbs with the hearing children. More auxiliaries and copulas are used with the hearing children in SC, which supports the idea that more Dutch-like SC is used with them, and more SLN-like SC with the deaf children.

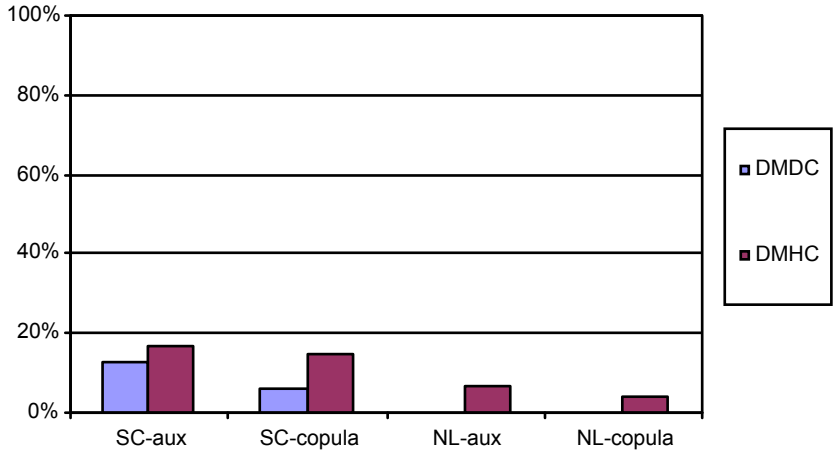

Figure 9.VIII INPUT DC+HC: Percentages of auxiliary verbs and copulas in the SC and NL input to the deaf and hearing children

Past participles occur to the same extent in the input to the deaf and to the hearing children. Wijnands (forthcoming) found the following percentages for finite verbs and past participles in the Dutch input of two hearing mothers to two hearing children between the ages of 1;9 and 2;5 (8 recordings of approx. 45 minutes). These verb forms also included copulas and auxiliaries. We include Wijnands' data in Table 9.21 together with data of our deaf mothers with the deaf children and with the hearing children.

Table 9.21 Percentages of verb forms in the input, found by Wijnands (forthcoming) to hearing children and in the input of the deaf mothers to the deaf children (DC) and the hearing children (HC)

Mothers of:	finite verb % in NL	finite verb % in SC	past.part. % in NL	past.part. % in SC
Bram	51	-	5	-
Sarah	62	-	4	-
DC	0	28	0	6
HC	24	53	0	6

The percentages of finite verbs in the spoken SC input of the deaf mothers to the deaf children are clearly lower than those found for hearing mothers with their hearing children. With the hearing children in our study the percentages are similar. The percentages for past participles are small at this age and similar for all mothers and occur in our data only in SC utterances.

In sum we found that the deaf mothers use a high percentage of uninflected signed verb forms at all ages with both groups of children. Signed verbs are occasionally inflected spatially and for manner, and also some subject/object marking and classifier use can be observed. With the deaf children spoken finite verbs are used only to a small extent, which supports the findings in section 9.2.1 that the SC input to the deaf children is more SLN-like than Dutch. We can see no development over time either in signed or spoken verbs with regard to more complex morphology being used with the deaf children.
With the hearing children much more inflection on spoken verbs is offered than with the deaf children, indicating a more obvious use of Dutch syntactic rules. The use of finite forms increases as the children grow older.
In general then we see the beginning of SLN verb inflection in the input to both groups of children, and convincing evidence of NL verb morphology and syntax only in the input to the hearing children and on a level comparable to input in hearing families.

9.5.2 Verb inflection in the output

The percentages of the various forms for all signed verbs in the SLN and SC output of the deaf and hearing children are presented in Figures 9.IXa and 9.IXb respectively.

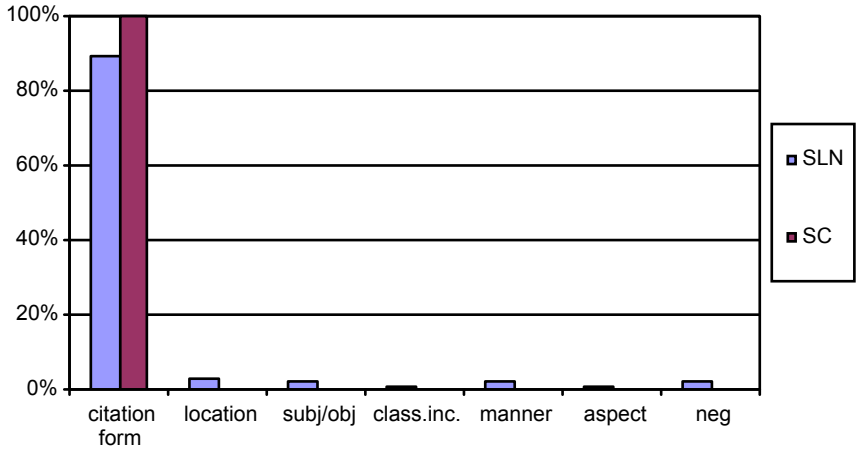

Figure 9.IXa OUTPUT DC: Signed verb forms in the SLN and SC output of the deaf children

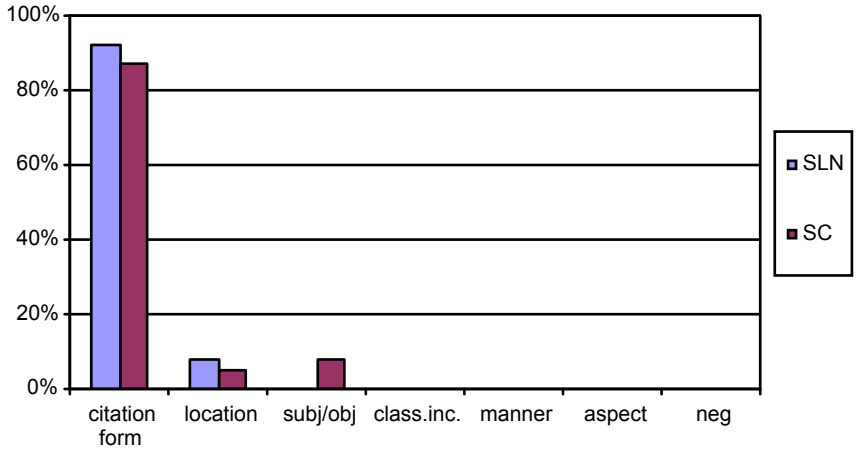

Figure 9.IXb OUTPUT HC: Signed verb forms in the SLN and SC output of the hearing children

The deaf children produce mainly signed verbs which are in citation form (89%). They start producing all the different verb-inflections from age 2;0 onwards, which is according to expectation (Woll 1998). These inflections occur only in SLN, but it must be remembered that they produce very few SC utterances (see section 5.3.2). First location is marked on the verb (2;0) then at 3;0 subject/object marking and manner appear, as well as some classifier incorporation. They produce a few negative verbs at age 3;0. Mark at age 3;0 produces one auxiliary *OP1* 'ACT-ON' as described by Bos (1995). All the different verb forms are present in the SLN and SC input (compare Figure 9.VIa).
The hearing children produce 92% of uninflected signed verbs in SLN, and 87% in SC. In SLN and SC they produce some verbs marked for location (at age 2;0), and in SC we see also some subject/object marking (from age 2;6). Sander produces one auxiliary (citation form) at age 2;6: *HALEN KOPEN 'FETCH BU'*, meaning "I will go and buy it". the can be expected at this age. The input also included classifier incorporation and manner marking which the hearing children do not seem to produce. Assuming no sampling error, the hearing children seem therefore to lag behind a little compared to the deaf children in their acquisition of the (signed) verb inflection system.

In the next Figure 9.X we show the different spoken verb categories produced by the hearing children, pooled over time. The deaf children produce no spoken verbs.

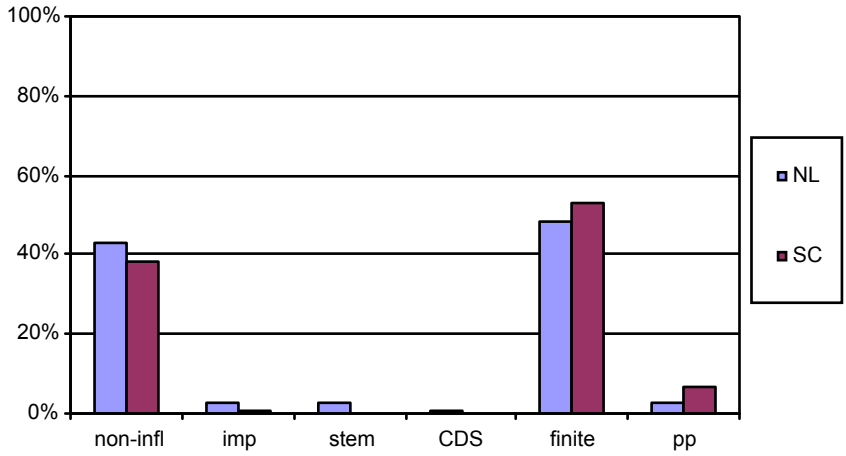

Figure 9.X OUTPUT HC: Different verb categories in the NL and spoken SC output of the hearing children

The hearing children produce many non-inflected forms, more than appeared in the NL and SC input. Many infinitives occur alone or in imperative sentences (e.g. *even kijken* 'let's look'), but the majority is correctly used with an auxiliary in the finite form. They seem to make fewer mistakes than the mothers, although some incorrect forms are imitations of the forms used by the mothers.
Imperative forms occur rarely in the output of the three hearing boys. Stem-reduced forms are only produced by Jonas. There is one cds-form produced (Alex). Past participles are produced from the age of 2;6 on by Jonas and Sander (5%), comparable to Wijnands' data (forthcoming). Finite forms occur slightly more proportionally than in the NL input, but the children produce a higher percentage of finite forms in SC than their mothers (compare Figure 9.VIIb). Two children in the Wijnands' study, Bram and Sarah produced 47% and 57% of finite verbs respectively, at ages between 1;9 and 2;5. We see a steady increase in the use of finite forms as they grow older, although this is not so clear with Jonas. On the whole then, the spoken verb production of the hearing children in interaction with their mother is comparable to that of monolingual hearing children.

Figure 9.XI shows the distribution of main verbs, auxiliary verbs and copulas over all spoken verbs in the NL and spoken SC output of the hearing children.

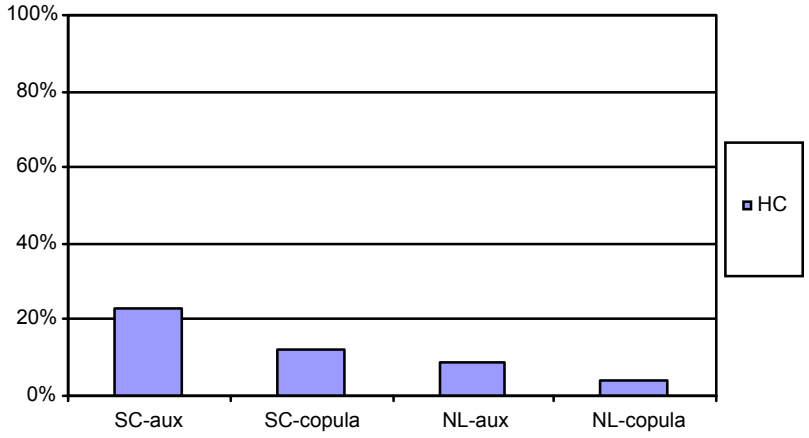

Figure 9.XI OUTPUT HC: Percentages of auxiliary verbs and copulas in the SC and NL output of the hearing children

The children produce more auxiliaries and copulas in the SC utterances than their mothers. This indicates more influence of NL rules in the SC production of the hearing children than in their mothers' input of SC.

Summarizing we can say that the deaf and hearing children mainly use uninflected signed verbs, but that the beginning of spatial and subject/object inflection can be observed in the output of all children. The deaf children show also the other forms of inflection. The input to the deaf and hearing children was comparable, but the deaf children seem to be further in their development. Compared to children acquiring BSL or ASL the inflection is age-appropriate.
The hearing children use age-appropriate inflection for the spoken verbs, comparable to the language production of monolingual Dutch hearing children. They produce a higher proportion of auxiliaries and copulas in SC than their mothers. They show more influence of Dutch syntactic rules in their SC production. The percentages of finite forms are comparable to the NL input but higher again in the SC output and seems to develop in the same way as with monolingual Dutch hearing children. We can conclude that the SC output of the hearing children strongly resembles their Dutch output, but that more verb forms are presented in SC. This confirms the findings reported in section 9.1.2, that the most complex language is produced in the spoken parts of the SC utterances of the hearing children.

9.6 Use of sentence and morphological marking

In the previous section we considered morphological marking on the verb. In this section we will consider morphological markers in the noun phrase and sentence markers. Firstly we will consider the non-manual grammatical interrogative markers *q*, *wh-q* and the negation marker *neg* used in SLN and signed SC utterances, in input and output (research question 26 in section 3.5).
In Dutch the morphological marking in the noun phrase is quite complex and it is known that generally deaf adults have problems with morphology in spoken languages. During the filming sessions and in interaction with the mothers we observed that the mothers used hardly any diminutive markers in Dutch, whereas hearing mothers use many diminutives with their children during the early years (Schaerlaekens and Gillis 1987). It has also been observed that deaf adults have problems with the production of inflection on adjectives. Here we will consider plural and diminutive markers, and markers on adjectives used (correctly) in NL and SC utterances, both in the input and the output (question 27).

Method
Sentence markers in SLN and SC
In SLN the following non-manual sentence markers have been described by Coerts (1992):
- yes-no-question (*q*) : eyebrows up, head forward (o.c.: 109)
- wh-question (*wh-q*): eyebrows down, chin up (o.c.: 112)
- negation (*neg*): side-to-side headshake (o.c.: 116)
- topicalization (*t*): eyebrows up (o.c.: 117)

We will describe the use of the non-manual markers *q, wh-q* and *neg*. Because of the age of the children the non-manual marker *t* for topicalization was not to be expected in either input or output, and indeed was not observed in our data. We will therefore not discuss it further.
From a study by Schnitzer-Reilly and Bellugi (1996) we know that mothers start using non-manual markers in ASL in a grammatical way with their children from the age of 2;0 on. Schnitzer-Reilly and Bellugi describe the conflicting roles that the face plays in early interaction between mothers and children: "not only do facial signal affective and communicative information, but specific facial behaviors also function as obligatory grammatical markers." (1996:219).
We also know from descriptions of contact signing (Lucas and Valli 1992) that non-manual markers are often left out during simultaneous signing and speaking. Under the influence of voice with speech, the non-manual markers (especially facial expressions and oral components) are suppressed, because these are not used in spoken language. For these reasons we wish to look at the occurrence of grammatical non-manual markers in the input of the deaf mothers in SLN and SC.

During the transcription process we noted whether or not the appropriate non-manual features were produced during the relevant structures by the mothers. No narrow transcription was made, however. In general we coded whether or not the characteristics, as described below, were present. We looked at all interrogative and all negated sentences (see also Chapter 8) in the following way:

interrogative	a) *yes/no*-question	- is *q*-marker present?
	b) *wh*-question	- is *wh-q* marker present?
negation	a) lexical negation	- is a lexical negation sign present? e.g. *NIET* 'NOT', *NOOIT* 'NEVER'
	b) non-manual negation	- is the negative non-manual marker present (head shake)?

Morphological markers in Dutch and SC

From studies done on contact signing (Schermer 1990; Lucas and Valli 1992; Ebbinghaus and Hessmann 1996) we know that many morphological markers in the spoken modality are omitted by deaf adults. We expect this to be true also for the spoken input to the deaf children. However, it is not clear what occurs in the input to the hearing children and therefore no prediction can be made. For the output of the deaf children we expect no morphological markings, and for the hearing children age-appropriate markings.

We coded all nouns, adjectives and adverbs in analyzable NL and spoken SC utterances in the following way:

Nouns:

N	uninflected noun	:	*boot*	(boat)
N-en	plural -en	:	*bot-**en*** (boats)	
N-s	plural -s	:	*kikker-**s***	(frogs)
N-dim	diminutive marker	:	*boot-**je***	(boat-dim)
N-dim-s	plural diminutive marker	:	*boot-**je**-s*	(boat-dim-s)
Ns	special form: stem-reduced			

Deaf adults can produce an ungrammatical singular form of a noun (in Dutch), where the endings '-en' or '-je' of a lexeme are mistakenly interpreted as a plural marker *-en* or a diminutive marker *-je*. It could also be the case that such endings as *-en* and *–je* are more difficult to pick up in speech-reading. See example (20)

(20) *kuik* in stead of *kuiken* (chicken)
meis in stead of *meisje* (girl)

Adjectives:

Adjectives have inflection according to the gender of the noun and type of article. This results in correct inflected forms (21) and inflected forms (22). We have observed that deaf adults often produce incorrectly inflected forms as in (21a) or incorrectly uninflected forms as in (22a).

A uninflected adjective

(21) *dat is een mooi pak* (that is a beautiful suit)
that is a nice suit

(21a) **dat is een mooi-e pak* (*that is a beautiful suit)
that is a *nice suit

A-e inflected adjective

(22) *dat is een mooi-e boom* (that is a beautiful tree)
that is a nice tree

(22a) **dat is mooi boom* (*that is beautiful tree)
that is *nice tree

If the morphological markers we have described are infrequent in the input, they will be acquired by the children later and with more difficulty. Moreover, if the deaf mothers omit these markers and thus produce 'ungrammatical' Dutch, the children receive wrong evidence for the application of these markers. We will look at the frequency of these markers in the NL and spoken SC input of the mothers, and whether or not they are grammatically used.

9.6.1 Morphological markers in the input

Sentence markers in SLN and signed SC input

We will first present the occurrence of the interrogative non-manual markers *q* and *wh-q* in SLN and SC utterances. Table 9.22 shows the data for the realization of these markers pooled over time.

Table 9.22 INPUT DC+HC: Number and (%) of the non-manual markers 'q' and 'wh-q' in SLN and signed SC interrogative utterances of the deaf mothers to the deaf and hearing children, pooled over time

	Deaf mothers	SLN	SC
Deaf children	Mother of Carla	7 (50)	19 (59)
	Mother of Laura	14 (56)	48 (74)
	Mother of Mark	24 (73)	44 (92)
Hearing children	Mother of Jonas	4 (57)	50 (51)
	Mother of Alex	1 (100)	32 (46)
	Mother of Sander	2 (50)	66 (51)

The numbers of interrogatives in SLN are so much smaller than in SC it is difficult to make strict comparisons using percentages.

For the mothers of Carla (D) and of the hearing children the percentages of non-manual markers are more or less similar in SLN and in SC. The mother of Laura (D) and Mark (D) seems to have a higher percentage in SC, and with Mark also in SLN.

In the input to the deaf children there is a general increase in sentence markers. Altogether with Laura and Mark the proportion is always quite high. With Jonas (H) the occurrence of markers is inconsistent, at age 2;0 his mother offers him non-manual markers with 39% of the interrogative utterances, at age 2;6 with 66% but this percentage drops to 54% at age 3;0. With Alex (H) there is a high percentage at age 2;0 (73%) but afterwards it drops to 30%. Only with Sander (H) we see a consistent increase in the use of interrogative sentence markers, up to 78% at age 3;0.
Schnitzer-Reilly and Bellugi (1996) found that before the age of two of their child, deaf mothers produce markers with approximately 20% of interrogative utterance, and after the age of two 80%. They explain these findings as follows.

> It appears that mothers consider affect to be the primary communicative system for the face up until the end of the child's second year. Then, at two, a dramatic shift occurs in the role of facial expression to include not only affect, but linguistic information as well. (Schnitzer-Reilly and Bellugi 1996:229)

So before age 2;0 of the child the mothers stick to a uni-functional facial expression (affect and communication). Schnitzer-Reilly et al. furthermore state that the use of wh-q markers by the mothers occurs sometime after their child demonstrates productive competence with *manual* wh-signs. We will discuss this further in section 9.6.2.
In our data we do not find clear evidence for a shift in the input at age 2;0. With Carla there is a shift at age 3;0 but with Laura after age 1;6. With Mark we find a consistent use of the markers at all ages. With the hearing children we see an increase at age 3;0 with Sander, but no consistent use with Alex and Jonas. It is clear that the use of markers is less with Carla and the hearing children. With Carla (D) and the hearing children we found that the spoken parts of the SC input were with voice (see section 6.1.1). With Laura and Mark this was not the case, or much less. The use of voice might interfere with the use of the face for grammatical markers. However, at age 3;0 Carla's (D) and Sander's (H) mother do not use their voice less often but they do show an increase in the use of markers. We have no explanation for this fact at this point.

The non-manual negation marker is mostly used with the hearing children simultaneously with a negation sign or word. With the deaf children the mothers also use the *neg* marker as sole negator. The few instances when no *neg* marker was used were all utterances where the verb *KUNNEN-NIET* 'CAN-NOT' was used; this verb is negative in itself, but simultaneous use of the *neg* marker is obligatory (see also section 9.3.1). We have no explanations for these exceptions, except for the fact that in three out of four occurrences the *child* was shaking its head and simultaneously signing while looking at the mother. The fourth example of the sign *KUNNEN-NIET* 'CAN-NOT' was dislocated into the visual field of the child by the mother, as the

child was looking at a picture in a book so the child could not see the nonmanual negation.

Morphological markers in NL and spoken SC input
We found very few instances and percentages of morphological markers in NL and spoken SC. We therefore decided to pool the data of the two language modes. We present the results for the morphological markers in NL and SC utterances of the mothers in Table 9.23.

Table 9.23 INPUT DC+HC: Number and (%) of morphological markers on nouns (N) and adjectives (A) in NL and spoken SC utterances of the deaf mothers pooled over time

INPUT	to deaf Children		to hearing Children	
N	500	(96)	861	(93)
N-en	13	(3)	57	(6)
N-s	2	(-)	3	(-)
N-dim	3	(-)	4	(-)
N-dim-s	0		2	(-)
N-stem	0		4	(-)
Total N	522		931	
A	496	(98)	907	(97)
A-e	9	(2)	28	(3)
Total A	505		935	

Both with the deaf and with the hearing children most nouns in NL and spoken SC utterances are in the singular and correct form. That means that the mothers do not often talk about a number of referents from the environment. The reason for this is unclear, but since it is found in all four mothers it is unlikely that it is a sampling error. Plural noun forms do not occur very often, but are used correctly in 76% of the cases with the deaf children, and in 88% with the hearing children. With the deaf children there are 4 singular forms incorrectly used where plural forms should have been used and with the hearing children 8 incorrect forms. These are given below.

Input to deaf children:

Mother of Laura:	*veel pop*	(many doll)	indicating various dolls
	veel auto	(many car)	indicating various cars
	schoen uit	(shoe off)	meaning both shoes
Mother of Carla	*vier hoed*	(four hat)	

Input to hearing children:

Mother of Sander:	*veel konijn*	(many rabbit)
	zes kuiken	(six chicken)
	veel gekookt ei	(many boiled egg)
	nog meer pop (more doll)	indicating more dolls

Only 3 to 6% of the nouns in the spoken input of the deaf mothers are inflected, mainly for plurality. There are hardly any diminutives. These figures confirm the findings of Ebbinghaus and Hessmann (1996:35) that no more than 4% of all nominal forms were inflected in their data. They state that "the unmarked forms of nouns and adjectives are often identical to the stems". They defined 56 (3%) out of their 2035 nouns as stem-reduced, where we found 4 out of 1508 (0.3 %). It is not known to what extent these stem-forms occur as the non-manual component in SLN as used between deaf adults (but see Schermer 1990), so we cannot compare the input in our study. Two mothers in our study used such stem-forms with the hearing children. These are presented below.

Mother of Jonas (2;0)	*kleer*	instead of	*kleren* 'clothes'
Mother of Sander (1;6)	*toor*	instead of	*toren* 'tower'
	kuik	instead of	*kuiken* 'chicken'
" (3;0)	*meis*	instead of	*meisje* 'girl'

Table 9.23 shows that only 2% and 3% of the adjectives are morphologically marked. Ebbinghaus and Hessmann found 3% of inflected adjectives in their GSL data, which is comparable to the findings here. With the deaf children the mothers produce 9 uninflected forms that should have been inflected, e.g. *ander vrouw* 'another woman' instead of *ander-**e** vrouw* or *mooi ketting* instead of *mooi-**e** ketting* 'nice necklace'. With the hearing children adjectives like these occurred 18 times. This means that the morphology for adjectives was presented not only infrequently, but also incorrectly in 50% of the cases with the deaf children, and in 39% with the hearing children.

We can draw the conclusion that the deaf mothers hardly use morphology for spoken nouns and adjectives. These findings confirm earlier studies on these aspects in other languages (Lucas 1990; Lucas and Valli 1992). Apparently the deaf mothers do not adapt their spoken Dutch for these aspects to the hearing status of their child: the use of morphological markers on nouns and adjectives/adverbs is strongly reduced in the input to both groups of children. The lack of such markers can thus be considered to be a characteristic of their language production, which is also sometimes incorrect in this respect according to Dutch rules.

Summarizing our findings on the use of sentence markers in the input we see that non-manual markers *q, wh-q* and *neg* are used in a grammatical way from the age of 2;0 onwards with the deaf children Laura and Mark. With Carla (D) and the hearing children no increase in the use of these markers can be observed. This may be

attributed to the overall characteristics of the input to these children: the mothers use voice with them while signing, and this factor may prevent the use of non-manual grammatical markers more in SC utterances than when no voice is used.
For Dutch we found that spoken nouns only incidentally carry plural or diminutive markers. With spoken adjectives mainly the stem form is used. Inflected forms are thus not offered often to the children, and in the input to the deaf children half of the adjectives is incorrectly used, with the hearing children less. The little evidence of these forms in their spoken input may influence the production of these forms in the children.

9.6.2 Morphological markers in the output

Sentence markers in SLN and signed SC output

Table 9.24 shows the results for the realization of non-manual markers *q* and *wh-q* in the SLN and SC utterances of the children.

Table 9.24 OUTPUT DC+HC: Number and (%) of the non-manual markers 'q' and 'wh-q' in SLN and signed SC interrogative utterances of the deaf and hearing children, pooled over time

	Children	SLN	SC
Deaf children	Carla	5 (0)	0 (0)
	Laura	2 (0)	0 (0)
	Mark	12 (0)	1 (0)
Hearing children	Jonas	0 (0)	1 (33)
	Alex	1 (0)	0 (0)
	Sander	2 (0)	2 (40)

The deaf children and Alex (H) produce no interrogative markers, even though they produce interrogative sentences with wh-question signs or words (see also Chapter 8 and below). Sander produces two *yes/no* markers at age 2;0 and Jonas one *wh-q* marker also at age 2;0.
Schnitzer Reilly and Bellugi (1996) found that deaf mothers' use of grammatically correct wh-q markers occur some time after their child demonstrates productive competence with interrogative manual signs. We found the following number of manual *wh-q* signs (like *WHAT*, *WHERE* etc.) in the SLN and signed SC production of the children (see Table 9.25).

Table 9.25 OUTPUT DC+HC : Number of wh-q signs produced by the children

OUTPUT	wh-q signs	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	0	0	5	0
Children	Laura	0	0	1	1	0
	Mark	0	3	4	4	2
Hearing	Jonas	0	1	0	0	1
Children	Alex	1	0	1	0	0
	Sander	0	0	3	1	3

Carla's (D) and Sander's (H) mothers begin using the markers when their children are 3;0, which seems consistent with the children's use of signs like *WHERE* and *WHAT*. Jonas (H) and Alex (H) hardly produce manual question signs, and their mothers show no increase in the use of non-manual markers. Laura (D) and Mark (D) start producing wh-q signs from age 2;0 and in their mother's input interrogative sentence markers were always present, so we find no explanation here for the non-production of the non-manual markers.. We see that the findings of Schnitzer and Bellugi (1996) are only supported by the results of Carla (D) and Sander (H). However, more data of the children at smaller time intervals between the ages of 2;0 and 2;6 and between 2;6 and 3;0 need to be studied in order to confirm their findings.

Negative markers are used by the deaf children and somewhat less by the hearing children (see Table 9.26). However, the way the negative marker is used differs greatly between the deaf and the hearing children. The deaf children mainly negate utterances by using the non-manual negation marker, but they also produce manual negation signs with a simultaneous marker. This reflects their input. Carla and Mark produces negative signs like *NIET* 'NOT' from age 2;0 on, Laura from age 1;6. Mark produces one negative verb with the appropriate headshake at age 2;6. There were no negation signs produced without a negation marker.

Table 9.26 OUTPUT DC+HC : Number and (%) of negation markers, with and without a negation sign or word, pooled over time. Percentages are from all negated utterances in SLN and SC.

	neg-marker only	neg-marker + negation sign/word	negation word only
Deaf children	34 (74)	12 (26)	0
Hearing children	3 (5)	33 (54)	25 (41)

The hearing children, however, almost always produce a negation word while shaking their head, more like hearing speakers when shaking their heads together with a negative spoken sentence. Words like *nee* 'no' and *niet* 'not' or *geen* 'no' appear in the SC language production of Jonas at 2;0, and with Alex and Sander at 2;6. Only

Jonas at age 3;0 produces one negative sign *NIET* 'NOT' together with the negation marker. No other negation signs are produced by the hearing children. They do produce some spoken negation words in NL utterances, Jonas from age 2;0, Alex from age 2;6 and Sander from age 3;0. These were all produced without an accompanying head shake. Since no negation markers as sole negators (so without a negation sign) were observed in their signed input, the children's output resembles the input in this respect.

In sum we can say that the children begin to produce wh-q signs from age 1;6 (Mark (D) and Jonas (H)) from age 2;0 onwards, but these appear without the appropriate non-manual sentence marker. In the input we saw individual variation with regard to the presence of these markers, and only with Laura (D) and Mark (D) were they consistently present with the interrogatives. In research with ASL these markers appear around age 2;6 in the language production of children. It is not clear that the lack of consistency in the input is the reason why the children do not produce these markers yet. Further studies at a later age of the children should reveal more information.

Negation markers are produced by the deaf children from age 1;6 or 2;0 on, and in a way similar to their input. The hearing children, however, do not use negation markers – they do produce head shakes, but these are always linked to *spoken* negation words. Their mothers always linked the negation marker to either a negation sign or a negation word, they were not offered as sole negators. In this respect the hearing children do reflect the input of their mothers, and they show once again that they seem to be focused on the rules for spoken language, even in their SC utterances.

Morphological markers in NL and spoken SC output
The results for the morphological markers in NL and spoken SC produced by the deaf and hearing children are presented in Table 9.27.

Table 9.27 OUTPUT DC+HC: Number and (%) of markers on nouns (N) and adjectives (A) in NL and spoken SC utterances, pooled over time

	Deaf children	Hearing children
N	52 (98)	325 (90)
N-en	1 (2)	14 (4)
N-s	0	5 (1)
N-dim	0	12 (3)
N-dim-s	0	4 (1)
N-stem	0	0
Total N	53	360

	Deaf children	Hearing children
A	8 (100)	213 (93)
A-e	0	17 (7)
Total A	8	230

It is clear that the deaf children use no morphology in their spoken output, but produce uninflected nouns and a few adjectives only. Since these forms hardly occurred in the input either, these findings are not surprising, but access is also of course a condition for acquisition.
The hearing children do produce different morphological markers; these occur from the age of 2;6 onwards. They produce plural markers on nouns from the age of 2;0 on, and diminutive markers only at age 1;6 (Alex) and 2;0 (Jonas and Sander). Diminutive markers were not present in their input. These must have been encountered in interaction with persons other than their mother.[26] The use of the *e*-inflection on adjectives is especially interesting. They occur at age 2;0 (Sander) and later (all hearing children). These findings are comparable to those found for monolingual hearing children (Bol and Kuiken 1988). We see that the language output of the children is actually a little more complex than that of the mothers. Also, we find no stem-forms in the output of the children such as found in the input of the mothers, which is considered a characteristic of deaf persons' speech.

In sum we find that the deaf children produce no morphological markers at all in NL and in the spoken parts of SC utterances. The hearing children are starting to produce spoken plural markers, diminutive markers and inflection on nominals and adjectives from the age of 2;0 onward, which is the normal age for these markers. The children produce morphological markers that were not present in the input (diminutives), but of course they may have encountered these in the interaction with hearing persons speaking Dutch with them.

9.7 Use of different sign and word types

Lucas and Valli (1992) and Ebbinghaus and Hessmann (1990;1996) described how the spoken language of deaf people is reduced in morphology and syntax (see also Mogford and Bishop 1988). We have shown that this reduction can also be observed in the language used by deaf mothers with their deaf and hearing children. We do not know whether or not deaf adults in the Netherlands also produce such reduced spoken Dutch, but we may assume that the same phenomena occur as have been established in Germany and the USA. Especially in language contact situations

26 All hearing children have other hearing members in their family. Jonas' father is hearing, Alex and Sander both have hearing older siblings (see section 4.1).

where contact signing is used (Lucas and Valli 1992), or as we call it, Simultaneous Communication, we can expect that word types that are usual in spoken language are not usual or are used differently. In previous sections we have examined verb morphology, noun phrase and sentence markers. In this section we want to describe the use of other sign and word classes such as different types of function words, both in the input and the output (see research question 28 in section 3.5).

Different sign types in SLN signed SC
Method
The following classes of signs in all analyzable SLN and signed SC utterances are examined and defined as follows:

• *Deictic signs:*	
- personal pronouns	a point directed towards or made on a person
- possessive pronouns	no distinction on formal grounds from personal pronouns, only on contextual grounds
- demonstrative pronouns	a point directed towards an objects or indicating direction or place
• Finger-spelled signs	all use of finger-spelled signs as described in the Dutch finger alphabet (Janssen 1986)
• Numerals	*ONE, TWO*, etc. or *FIRST, SECOND* etc.
• Conjunctions	the occurrence of conjunctions in SLN has not been studied so far, but under the influence of Dutch signs for NL *omdat* 'because', *en* 'and', *want* 'for' etc. are sometimes used
• Discourse markers	*LET-OP* : a raised 1-hand to draw attention *OH* : an open hand before an open mouth, with eyes opened wide and eyebrows up (surprise) *POINTto-person*: in form undistinguishable from a pronoun, but contextually clearly identifiable as a discourse marker; the meaning is something like 'right-you-are'.

Different word types in NL and spoken SC utterances
We looked at the use of function words and numerals in the NL and spoken SC utterances in the input to the deaf and to the hearing children.

Method
We considered the following function words:

• personal pronouns	*ik, jij, zij/hij, wij, jullie, zij* (I, you, she/he, you, they)
• possessive pronouns	*mijn, jouw, haar, zijn, ons, jullie, hun* (mine, your, her, his, our, your, their)
• demonstrative pronouns	*deze, dit, dat, die* (this/these, that/those)
• articles	*de, het, een* (the, a)

• prepositions	*bij, met, op, tussen, van* (near, with, on, between, of) etc.
• numerals	*een, twee, drie* etc. (one, two, three etc.); *eerste, tweede, derde* etc. (first, second, third etc.)
• conjunctions	*en, maar, omdat, want*, etc. (and, but, because, for)
• discourse markers	*hé, oh, nou* 'well', *zeg* 'say' *eh*, etc.

We analyzed and counted the words in all analyzable NL and spoken SC utterances and pooled the data over time. Words like *ja, nee, boem* etc. were excluded from this analysis.

9.7.1 Different sign/word classes in the input

Different sign classes in SLN and signed SC input

In section 7.1.1 we discussed the use of deictic signs or *POINTS* in relation to the use of representational signs. We found that the mothers use a higher percentage of deictic signs with the deaf children than with the hearing children.[27] In this section we want to pay attention, among other things, to the function of these Points - they can be used as personal pronouns, as possessives or as demonstrative pronouns. Table 9.28 presents the data for the different types in NL and spoken SC utterances in the input of the mothers.

Table 9.28 INPUT DC+HC: Number of various sign types in the SLN and signed SC input of the deaf mothers.

SLN input	to deaf children	to hearing children
Demonstrative pronouns	114	11
Personal pronouns	30	5
Possessive pronouns	0	0
Fingerspelling	0	0
Numerals	4	0
Conjunctions	0	0
Discourse markers	22	2
Total	170	18
signed SC input	to deaf children	to hearing children
Demonstrative pronouns	401	658
Personal pronouns	162	153
Possessive pronouns	0	0
Fingerspelling	14	22
Numerals	45	85
Conjunctions	1	2
Discourse markers	38	64
Total	661	984

27 In section 7.1.1. POINTS alone were also included. Here we analyzed all analyzable utterances (see Chapter 4).

Overall the signed input to the deaf and hearing children looks very similar both in SLN and in signed SC with respect to these various sign types. In signed SC personal pronouns (i.e. *POINTto-me* or *POINTto-you*) seem to occur proportionally slightly more often with the deaf children than with the hearing children. When the total number of deictic signs is considered (demonstrative and personal pronouns) the proportion of personal pronouns in signed SC is larger with the deaf children (29%) than with the hearing children (19%). This difference reflects probably the emphasis on signing with the deaf children.
Of the other categories analyzed finger-spelled signs (predominantly proper names) and conjunctions occur only rarely in the input to the children. Numerals and discourse markers occur proportionally to the same extent with the deaf and with the hearing children.
On the whole we find no difference in the use of sign classes between the input to the deaf and to the hearing children, except that for the deictic signs the ratio of personal pronouns versus demonstrative pronouns is larger with the deaf children than with the hearing children.

Different word classes in NL and spoken SC input
Table 9.29 shows the occurrence of function words and numerals in the input to the deaf and hearing children. The percentages of the different categories of function words are from the total number of function words.
For NL we cannot make a comparison between the input to the deaf and to the hearing children. We can compare the NL input of the hearing children to the spoken SC input and we see quite different percentages for the different categories in the two language modes. Proportionally we see more personal pronouns, prepositions and numerals in SC, and more conjunctions and discourse markers in NL.
The spoken SC input to the deaf children differs from that offered to the hearing children, in that the mothers realize fewer articles, demonstrative pronouns and conjunctions, but more personal pronouns, prepositions and numerals to the deaf children. These last three categories are also larger in the spoken SC to the hearing children than in the NL utterances. Spoken personal pronouns may well be 'linked' to Points in SC utterances – we saw in the previous discussion that in SC the mothers used slightly more Points (personal pronouns) in the signed parts of the SC utterances to the deaf children. The simultaneous use of signed Points and spoken personal pronouns may explain the higher percentage of spoken personal pronouns in the SC input to the deaf children.

Table 9.29 INPUT DC+HC: Number and (%) of function words in analyzable utterances in NL and spoken SC input of the deaf mothers*

NL input	to the deaf children	to the hearing children
Articles	0	9 (13)
Demonstrative pronouns	0	11 (16)
Personal pronouns	0	6 (9)
Possessive pronouns	0	0
Conjunctions	0	28 (40)
Prepositions	0	4 (6)
Numerals	0	2 (3)
Discourse markers	2	10 (14)
Total	2	70
spoken SC input	to the deaf children	to the hearing children
Articles	5 (3)	147 (17)
Demonstrative pronouns	24 (14)	174 (21)
Personal pronouns	46 (26)	137 (16)
Possessive pronouns	3 (2)	1 (-)
Conjunctions	3 (2)	67 (8)
Prepositions	48 (27)	151 (18)
Numerals	36 (20)	104 (12)
Discourse markers	12 (7)	69 (8)
Total	177	850

[a] *These percentages are from the total of function words*

Prepositions may be used more often as predicates (e.g. *tafel op* as in 'put it on the table') in spoken SC with the deaf children than with the hearing children, and more in SC than in the NL utterances. We have not further looked into this matter. Conjunctions like *en* 'and', *maar* 'but' or *of* 'or' are used far more in NL with the hearing children than in spoken SC. This may be an effect of SLN in the SC utterances. Although we do not know whether or not conjunctions occur in SLN, we know from some studies that sign languages employ other means than lexical conjunctions to co-ordinate or sub-ordinate clauses. In SLN sign conjunctions do exist (e.g. *OMDAT* 'BECAUSE') but these are usually loan-signs from Dutch and are used in sign supported Dutch to represent the spoken conjunctions. This might explain the slightly higher percentage of conjunctions in the spoken SC input to the hearing children.
We can conclude that the spoken SC input to the deaf and hearing children differs a great deal with regard to the realization of function words and numerals.

9.7.2 Different sign/word classes in the output

Different sign classes in SLN and signed SC output

In section 7.1.3 we described how the deaf children produced more deictic signs than the hearing children. We see in Table 9.30 that in SLN the deaf children produce both more demonstrative and personal pronouns in comparison to the hearing children.

The deaf children produce 21% of personal pronouns within the group of deictic signs. This is higher than the percentage in the SC output, and in the output of the hearing children. It may be that they use Points differently in SLN from the hearing children, and are really acquiring the pronominal system. In contrast, the hearing children seem to use Points more like hearing people do, that is to support their spoken language. However, because the number of these sign types are so few in the SLN output of the hearing children, we have to be careful in interpreting these figures. Pronouns are increasingly produced in SLN from age 2;6 on by the deaf children, as are numerals. Compared to the input the deaf children show very similar percentages of these various sign types.

In signed SC we find no differences between the output of the deaf and hearing children except that the hearing children produce signed discourse markers which the deaf children do not. There were no differences in the input which might explain this. Fingerspelling does not occur in the output. Use of the finger alphabet is connected to the spelling of Dutch words, which we would not expect children to be able to do at this age.

In sum we find little difference between the signed SC output of the deaf and hearing children with regard to the use of these sign types. In the input also we found similar SC regarding these aspects to both groups of children. But in the SLN output there is an indication that the development of the hearing children is different from that of the deaf children, with respect to these sign classes. It will be interesting to follow their development at later ages.

Table 9.30 OUTPUT DC+HC: Number and (%) of various sign types in the SLN and signed SC output of the children. Percentages are of total of these types.

SLN output	deaf children		hearing children	
Demonstrative pronouns	191	(69)	5	(42)
Personal pronouns	50	(18)	1	(8)
Possessive pronouns	0		0	
Fingerspelling	0		0	
Numerals	25	(9)	5	(42)
Conjunctions	2	(-)	0	
Discourse markers	10	(4)	1	(8)
Total	278		12	
signed SC output	**deaf children**		**hearing children**	
Demonstrative pronouns	38	(88)	176	(82)
Personal pronouns	2	(5)	14	(6)
Possessive pronouns	0		0	
Fingerspelling	0		0	
Numerals	3	(7)	15	(7)
Conjunctions	0		0	
Discourse markers	0		10	(5)
Total	43		215	

Different word classes in NL and spoken SC output
We present the number and percentages of function words and numerals in the NL and spoken SC output of the deaf and hearing children in Table 9.31.

The deaf children do not produce any function words (yet), so we may assume that it is characteristic of their spoken output that they only use nominals and verbs at these points in time, as we might expect from their MLU (see sections 9.1 and 9.2).
In the output of the hearing children we find that articles are occasionally present from age 1;0 on – this seems early compared to the average age of 2;1 found by Schaerlaekens and Gillis (1987:124). These early forms are, however, often proto-articles like a schwa-sound before a noun instead of a fully pronounced *een* 'a' (indefinite pronoun). The children proportionally produce fewer articles than their mothers, both in NL and in spoken SC. Demonstrative pronouns are in the output from age 1;0 on and are used more in NL than in SC, and also more than in their input. However, Sander does not produce any in NL, only in SC. Personal pronouns appear around age 2;0. No possessive pronouns are produced by the hearing children, and these were also absent in the input. There are no conjunctions in NL, but they do occur in SC and in the same percentage as in the input; they appear from age 2;6 on. Prepositions and discourse markers first appear after age 1;6 and numerals occur around age 2;0. Prepositions occur to the same extent in NL and spoken SC, but numerals are more often produced in SC. This can be explained by the fact that the children are usually pointing at different objects while counting; such utterances would be considered SC.

Table 9.31 OUTPUT DC+HC: Number and (%) of function words in analyzable NL and spoken SC utterances of the deaf and hearing children.

NL output	deaf children	hearing children	
Articles	0	8	(8)
Demonstrative pronouns	0	36	(36)
Personal pronouns	0	30	(29)
Possessive pronouns	0	0	
Conjunctions	0	0	
Prepositions	0	15	(15)
Numerals	0	6	(6)
Discourse markers	0	6	(6)
Total	0	101	
spoken SC output	deaf children	hearing children	
Articles	0	16	(8)
Demonstrative pronouns	0	53	(26)
Personal pronouns	0	32	(16)
Possessive pronouns	0	0	
Conjunctions	0	19	(9)
Prepositions	2	27	(13)
Numerals	4	44	(21)
Discourse markers	0	15	(7)
Total	12	206	

Bol and Kuiken (1988:60) found the following ages for the acquisition of the different word types in monolingual Dutch children:

articles	1;6 – 2;0	possessive pronouns	2;6 – 3;0
demonstrative pronouns	1;6 – 2;0	conjunctions (and)	2;6 – 3;0
personal pronouns	1;6 – 2;0	prepositions	2;0 – 2;6

The hearing children in our study acquire the different types at the same ages as monolingual hearing children do. Unfortunately we have no information on the amount of these function words in the output of hearing children of hearing parents, so we cannot compare the quantities.

We can conclude that the acquisition of the hearing children with respect to these word types is similar to that of Dutch hearing children of hearing parents. It is, however, different from the spoken input of their mothers – the children produce fewer articles, and more demonstrative and personal pronouns and prepositions.
There is again evidence that the spoken part of their SC output is influenced to some extent by signing. In the SC output of the hearing children they produce fewer demonstrative and personal pronouns than in NL. This could be an influence of the use of POINTS in the signed parts of SC, because the need to explicitly name an indicated object or person is then smaller.

9.8 Summary

In this chapter we have looked at many different aspects of structure of input and output in the three language modes. When considering the general complexity (MLU and MLUL10) of the signed input we see both an increase in the SLN input and in the signed part of SC for all children. The signed SC has a higher MLU than the SLN for all children. This suggests that this is the main form of communication, but it may also be a result of influence on Dutch in that words are also translated into signs where they would be omitted in SLN. The MLU in Dutch input does not increase over time, nor does the MLU of the spoken part of SC; for the hearing children it even decreases. The MLU of the spoken input for the deaf and hearing children is lower than would be expected in hearing families. The MLU of the SC utterances is greater than the MLU of SLN or NL.
The deaf children show an increase in their MLU in SLN so that it reaches 1.8 to 2.3 signs at age 3 years. The hearing children show almost no increase except Sander. Development takes place between 2 and 3 years. The signed part of SC also develops for all children. The deaf children do not develop their spoken output - it stays at the level of one word. The hearing children on the other hand develop rapidly. Their NL output has a smaller MLU than would be expected from Dutch monolingual children, this is not the case for the spoken part of SC.
In the acquisition literature it is usually seen that the input is slightly ahead in terms of complexity of the output. Here we see that the signed input is only clearly ahead of that of the children in the SC input. In the spoken part the mothers are ahead of

the deaf children; the deaf children show no progress over the two years which cannot be related to input only. They also have an access problem to the spoken input. The mothers' spoken input to the hearing children does not increase and yet the hearing children show a great increase in their spoken MLU. The mothers' MLU is just greater than that of the children. The hearing children are clearly learning Dutch from other sources (for instance Jonas from his father, Alex and Sander from their older siblings), so the influence of the mothers' input is not clear.
The deaf and hearing children show clear differences in their MLU development, partly as a reflection of their input. The deaf children are clearly developing in sign: SLN and signed parts of SC, whereas the hearing children are showing the most development in Dutch and the spoken parts of SC. They develop less quickly in sign than the deaf children. This is again an indication, as we have already suggested, that the SC is different for the two groups of children in input and output. This differentiation seems to take place after the age of two years, which might be related to the development of visual attention as described in Chapter 6.

The analysis of verbs showed that there are many utterances which have no verb in all three language modes but these decrease over time. In SLN and the signed part of SC the absence of a verb does not necessarily result in an ungrammatical utterance. In Dutch and the spoken parts of SC the absence of a verb was only ungrammatical in about 5% of the cases. The spoken parts of SC miss auxiliaries or copulas, probably under the influence of SLN. In general the linguistic evidence about verbs to the children is limited. In SC utterances if a verb is present it is most often present in both the signed and spoken part. Then we see a clear distinction between the deaf and hearing children in that the deaf children have more utterances with a signed verb and no spoken verb and the hearing children have more often a spoken verb and no signed verb.
The children produce an increasing number of signed verbs over time. 35% of utterances of the deaf children have a verb at age 3;0. The hearing children increase their production of spoken verbs; there are no clear differences with hearing children in hearing families.
The children have higher proportions of utterances without a verb than in the input. The hearing children have more SC utterances with a spoken verb and no sign verb than the mothers, which indicates their bias to the spoken language. The difference in the input in terms of use of verbs between the deaf and hearing children is reflected in the output. SC reflects the bias of the deaf children to signing and of the hearing children to the spoken language.

In those utterance with a verb the omission of subjects and objects were analyzed. In SLN both subjects and objects can be omitted whereas in Dutch this is only possible under very restricted circumstances such as in imperative utterances or with topic drop. In SLN the mothers dropped equal amounts of subjects and objects unlike the data reported for adult-adult SLN, where less subject drop occurs. This may be a result of the here-and-now character of the interaction. In Dutch and the spoken parts

of SC more subject and object drop occurred with the deaf children than with the hearing children. This resulted in more ungrammatical Dutch (31%) for the deaf children than for the hearing children (9%). In SC utterances where both verbs where realized, the signed subject was often omitted. This emphasizes again that SC is looking more SLN-like for the deaf children and more Dutch-like for the hearing children.

In SLN the children drop subjects to a similar extent as in the input, although it could be argued that this is related to general acquisition principles (see Chapter 2). In Dutch the hearing children drop subjects to an extent which would be expected for hearing children in hearing families at this age. The input does not clearly have an influence here. The deaf children show similar proportions of subject and object drop input in their utterances as in the input. The hearing children follow the Dutch rules to some extent. Interestingly they drop more spoken subjects in SC where the verb is expressed in both modes. This may indicate a slight influence of SLN on their production in the simultaneous mode.

Dutch and SLN have different rules for verb position in utterances. There were a large number of utterances in all three modes in which there was only a verb. In those utterances which could be analyzed for verb position the verb was most often in final position for SLN, as is to be expected in adult SLN. In Dutch the verb was in first position, mostly grammatically, or in second position. There was little ungrammaticality (13%). These results were reflected in the signed and spoken parts of SC, except that the deaf children had more ungrammatical verb positions in the spoken part than the hearing children.

All the children follow in general the order of SLN utterances as in the input in the SLN utterances and SC utterances with a signed verb. The hearing children do not follow the input order in their Dutch and spoken parts of SC utterances but behave as monolingual Dutch children in hearing families in that they initially place the verb in final position in an non-finite form and later produce the verb in second position. The hearing children produce more verbs in final position in the SC utterances that have both a spoken and signed verb than in other contexts, which may reflect an influence of SLN in the simultaneous mode. This is unlike the input.

The form of the signed verbs produced is predominantly the citation form and in this period there is no clear increase in morphological inflection of whatever type. In Dutch the finite forms are common, although they are used more with the hearing children as are auxiliaries and modals. The input to the hearing children is similar to what hearing children in hearing families receive. The mothers produce more stem forms with the deaf children. There is no clear development here either.

In the signed output the deaf children and hearing children both mainly produce citation forms as in the input. They are starting to produce inflected forms around two years but the deaf children have a greater range of types of inflection. The forms that the deaf children produce were all present in the input. The input is not different in the variety provided so that the slower acquisition of the hearing children reflects their greater orientation on spoken language. The hearing children produce spoken verb morphology as could be expected from children in hearing families; the input

was also not different. The output of the hearing children in their NL utterances is very similar to the spoken parts of SC utterances, although the SC utterances are more complex. This is their main communication mode with their deaf mothers.
In SLN non-manual markers are used as grammatical markers of questions and negatives. These all increased with time in the input. The increase in the use of the question markers did not occur with all children at age two years as might be predicted on the basis of the literature. There was no relation with the children's production of their first wh-question signs. The mothers used the non-manual negative marker on its own with the deaf children but only with a negative lexical sign with the hearing children, this is less SLN-like although not ungrammatical. The children produce almost no non-manual question markers despite the input. The deaf children produce non-manual negation markers. They also produce negative signs between age 1;6-2;6. They produce the non-manual markers without a manual sign as in the input; the hearing children do not. They also do not use negative signs.
The deaf children use negative words with a head-shake in SC but not in their Dutch output. This indicates an influence of SLN. The deaf children do not produce negative words at all.
A brief examination of other word classes showed that there were different forms present in the input such as fingerspelling or discourse markers but these were barely produced by the children. The deaf children produced more personal pronouns than the hearing children and these were also more present in the input they received.
For a consideration of all of these aspects we see that the input to the deaf and hearing children looks structurally different in that in SC, which is the main mode to both deaf and hearing children, the structure of SC utterances starts to look different as the children get older. This is reflected in the output: the hearing children are much more oriented to spoken language although they are also learning some SLN. The deaf children are solely oriented towards SLN.

10 DISCUSSION AND CONCLUSIONS

In this thesis we have explored the input and output of four deaf mothers and their three deaf and three hearing children in interaction when the children were between ages 1;0 and 3;0. We have looked at quantitative and qualitative aspects and how these developed over time. We also compared the input and output of the deaf mothers with the deaf children to that of the deaf mothers with the hearing children. From the results of this study it has become clear that Simultaneous Communication is an important but varying concept. This issue of its status will be addressed immediately in 10.1, since it affects the rest of the discussion. In section 10.2 we look at the relationship between input and output in terms of quantity and quality. In section 10.3 we focus on the differences between the deaf and hearing children also in terms of input and output. In section 10.4 we consider the implications of this research for deaf families but also for hearing parents with a deaf child. Finally we make a number of suggestions for future research.

10.1 The status of Simultaneous Communication (SC)

In deciding how to describe the complex nature of the input and output in deaf families a methodological decision was taken (see section 5.3) to separate out utterances in which a combination of speech and signs occurred. This decision was taken with the awareness that it might not be correct to create a priori a third system (SC), as suggested by Romaine (1995) but it was considered necessary in order to arrive at a more detailed description of the form of the input and output. In this section we will discuss the status of the SC utterances on the basis of the evidence found in this study and reflect on the issue of the third system.

From the description of the input and output of the deaf mothers and the deaf and hearing children, we see differences emerge in the multilingual nature of both input and output. We found mainly SLN and SC in the input to the deaf children, whereas the deaf children themselves mainly produced SLN. The input to the hearing children contained SC, Dutch and SLN, and the children produced all three language modes, although Alex started later with SLN. Although in both groups of children SC was the main form of the input, a consideration of the structure of the SC utterances showed however considerable differences.

In the input to the deaf children the structure of SC very closely resembled SLN syntax. For instance, the verbs in SC were most often put in SLN verb position (initial with subject drop, or final), and the inflection of the verbs in SC was similar to SLN verb inflection. Copulas and auxiliaries were frequently missing in the spoken part. The spoken input to the deaf children was very simple, and consisted mainly of nouns, adjectives and verbs, with only few instances of function words.

Verbs in SC were most often offered in signs, whereas those spoken verbs that did occur were mainly produced together with signed verbs. These spoken verbs also often occurred in an uninflected form, or in a stem form. This parallels the findings of Ebbinghaus and Hessmann (1990; 1996) for GSL. They claim that such forms are an integral part of the sign language and are not loanwords from the spoken language.
There were instances of SC utterances in the input to the deaf children in which the proposition was made up both by a spoken part and a signed part (category *ss* in Chapter 6). These utterances form some evidence for a third system as described by Romaine (1995), because syntactic features of both SLN and NL were present in the same utterance, such as for instance Dutch word order, but together with SLN verb inflection. However, these *ss* utterances make up only 10% (median) of the SC input to the deaf children; for 90% of the SC input there is no reason to think that this might be a separate system. Apart from these supplementary SC utterances we conclude, on the basis of the evidence found in Chapters 6 and 9, that what we have separated out here as SC utterances in the input to the deaf children are in fact SLN utterances. We must also conclude that the mouthing of spoken parts is important in SLN.
The deaf children produce mainly SLN utterances, no Dutch and hardly any SC utterances. We also know that the children miss a great deal of the spoken input in the context of SC. Only Carla produces a very few *ss* utterances. There is no evidence that they are producing a third system. Again we conclude that the SC utterances that the deaf children produce are SLN.

The picture with the hearing children is more complicated however. The SC input to the hearing children was in some aspects similar to that of the deaf children. This could be seen in particular in those utterances in which no verb was present; they had a SLN-like structure. SC utterances with only a spoken verb were Dutch-like (see section 9.4.1). However, in SC utterances with both a signed and a spoken verb and especially in those utterances where the semantic content was distributed over the two channels (*ss*), we found that both SLN and Dutch syntactic features were present. Often words were left out in the spoken parts apparently under the influence of SLN, for example a great deal of subject drop occurred and auxiliaries and copulas were omitted. The inflection of spoken verbs was also sometimes incorrect. In these SC utterances we see structural evidence for a 'third system'. Sometimes SLN structure was followed, with a relexification in the spoken parts, sometimes not. The sign and spoken channels were used in combination to express the whole proposition (*ss* in Chapter 6) in as much as 29% (median) of the utterances. These utterances showed syntactic features characteristic of both languages (Chapter 9).
In the output the hearing children also use such *ss* combinations. In those SC utterances where both a signed and a spoken verb occurs, an influence of SLN is apparent in that the verb is often in final position (section 9.4.2). The hearing children are acquiring syntactic SLN structures from the SLN and signed SC input

of their mothers. They produce these more complex structures mainly in SC contexts; their SLN output is simple (MLU ≤ 1.5, section 9.1.2). This suggests that they consider the SC input as a third system, namely signs and words are to be produced together, probably under the influence of the input they are receiving. The children's SC output does, however, seem more Dutch-like than their mothers' input, although it is not Dutch in structure. The children's SC is therefore to be seen as a third system, but a slightly different one from that of their mothers.

The SC that we found in the input and the output with the hearing children is not strictly signed Dutch. In a strict signed Dutch system the structure of Dutch would be followed with no omission of subjects or copulas etc. Word order would also follow Dutch syntactic rules. Such signed systems have been devised for teaching purposes in many countries, that is to teach the structure of the spoken language (see sections 2.2.1 and 2.2.3). It is not clear, however, that in the Netherlands such a strict signed Dutch system exists. What we see here is a considerable influence of SLN in terms of structure. In previous research it has already been observed that hearing Dutch teachers produce a mixed system that reflects an influence of SLN (Keppels and Jansma 1994). The utterances produced by the deaf mothers to their hearing children seem to constitute evidence for a third system but this system does not warrant the name signed Dutch in the way this term is usually used.

Initially it appeared that the input to the deaf and hearing children was similar in that SC was prominent for both groups, but now we see that the SC utterances have to be differentiated. The hearing children could receive an input identical to the deaf children and learn SLN in this way, but in fact the deaf and hearing children receive different input. The adaptation of the mothers to the hearing status of the children is reflected amongst other things in the structure of SC. Because the children can see most of their mother's signing the mothers apparently adjust their use of spoken Dutch (for instance by leaving out words) in the SC input. Why is this the case? The deaf mothers are used to communicating with hearing people and having to optimize communication by using as much spoken language as possible. It is probable that this context is so strong for the deaf mothers that they automatically change to this mode with their hearing children. It is also a fact that up to this moment in time many deaf people are still advised by professionals to speak with their hearing children. It is argued that, if they do not, the children's spoken language acquisition might be delayed. These two factors may explain the language choice of the deaf mothers.

In the following discussion of the input and output of the deaf children we will no longer consider the SC input and output as distinct from SLN. In the discussion of the hearing children we will continue to make this distinction. This has some important consequences for the discussion.

10.2 Input and output

10.2.1 Quantitative influences of input on output

In all theories on language acquisition it is accepted that children must come in contact with a language in order to be able to acquire it (Chapter 1). That input must be accessible (uptake) otherwise no processing of the language by the children is possible (intake) (section 1.3.1). The input should also contain the full scale of functions and forms, or the children will not be able to acquire those functions and forms that are part of the language. We also know that in a bilingual situation the amount of language input in each language is necessarily less than in a monolingual situation and that considerable variation occurs in different bilingual situations. It is an important issue to establish the minimum amount of language input required for acquisition to take place.

In our study we found that the deaf mothers offer their deaf and hearing children multilingual input. The amount of all input to the children is comparable to that found for hearing children of hearing parents, but the amounts in different modes differ. (Chapter 5). For the deaf children the input consists of Sign Language of the Netherlands (SLN) with a considerable amount of spoken components and a very little Dutch (NL); for the hearing children this consists of SLN, Dutch and predominantly Simultaneous Communication (SC) (see section 10.1).
The deaf children receive and can access (80%) of the signed input (see Chapter 6) and they also acquire SLN. The amount of signed language offered is clearly enough for acquisition. There was very little Dutch in their input compared to SLN and this is reflected in the output of the deaf children in which they also use very little Dutch. They had increasing visual access to this spoken input over time but Carla still misses around 40%. Less than optimal visual access may be an explanation for this lack of acquisition, at least in part. The mothers' input in Dutch and in the spoken components of SLN was more complex than the children's spoken output, which stayed at the level of single words up to the age of three. This suggests, not surprisingly, that the children's lack of hearing is also an important factor in their lack of acquisition. We cannot therefore conclude that the amount of Dutch offered and visually accessed was too little per se for acquisition to take place - in a hearing child it may be enough. The visual information from spoken words offers at most 30% of the information required to identify and re-produce the sound (Dodd and Campbell 1987) so that intake is problematic for fully learning the spoken language. In the context of deafness in the child we see that acquisition does not take place to a great extent before the age of three, although a small beginning has been made. There is no evidence from this study that increasing the amount offered would be the answer to speeding up the rate of acquisition of the spoken language in the context of deafness.
In conclusion there is evidence to suggest that the little input in Dutch together with the less than optimal visual access may play a part in the lack of acquisition in

Dutch by the deaf children but the fact that visual information alone is not enough to learn spoken language is certainly an important factor.

The hearing children receive mainly SC and some SLN and have good visual access to the signed input (80%). They also produce SLN and SC, sometimes using more SLN utterances than their mothers. The input is clearly enough for acquisition of signing to take place, but the rate of acquisition is on the whole slower than that of the deaf children. This suggests that amount might influence rate of acquisition here. They receive little Dutch from their deaf mothers but use it a great deal. Clearly the other sources of Dutch (other family members, extended family etc.) are enough for acquisition to take place at a similar rate to monolingual Dutch children.

10.2.2 Qualitative influences of input on output

The influence of the quality of the input on the output can be observed in various areas. First of all we saw a change in interaction patterns with the three deaf children and one hearing child, Sander (Chapter 6). A consistent use of attention strategies by the mother seemed to promote the development of attention-giving behavior in the children. We found that the mothers of Laura (D), Mark (D) and Sander (H) gradually shift to predominantly signing and/or speaking when the child is looking at the mother. Carla's mother showed this behavior less consistently. The mothers of Jonas (H) and Alex (H) did not show consistent behavior and used more 'hearing-like' strategies, like beginning to sign/speak while the child is not paying visual attention.

Around the age of 2;6 the children have learned to look up spontaneously at their mother more often to check whether or not linguistic information is being offered. Carla (D) is slower in her development of spontaneous looks than Laura (D), Mark (D), and Sander (H) and this was found to be connected to the less consistent use of attention strategies by her mother. Of the hearing children only Sander showed an increase in visual attention-giving behavior, which can partly be attributed to his mother's use of attentional strategies. Even though his language input was similar to that of the other two hearing children, the development of his attentional behavior is different from Jonas' and Alex'. We will come back to this aspect in section 10.2.3. Jonas and Alex showed inconsistent development in attentional behavior appropriate for sign language interaction; at times their behavior shows evidence that they know they have to look up for signed input, but at other times they do not. It can be the case that their development in appropriate visual attention-giving behavior for signed language is delayed and not only geared to behavior appropriate for spoken language interaction, as it now seems to be. Further research at a later age should shed light on this aspect for Jonas and Alex.

A second area where we can see the input reflected in the output is in sign and word combinations. All children were offered sign combinations increasingly over time, and the children all produce these increasingly (Chapter 7). Sign combinations were offered to the hearing children in SLN (though little) and SC, but they produce them

mainly in SC. The signed input clearly serves as a model for the hearing children to learn sign combinations. The MLU of signed input of the mothers is just ahead of that of the children, and increases over time, as it does in the output of the children, although with Jonas and Alex less than with the other children (Chapter 9). Alex (H) received fewer sign combinations than the other children and also did not produce them until age 3;0.
Word combinations were offered far more to the hearing children than to the deaf children, and to the latter mainly as spoken components of SLN, not as Dutch. The MLU of the spoken input increases with most children, although with the deaf children it remains below 2.0. The deaf children do not combine words (yet) and we see no development up to the age of three years. With the hearing children we see an increasing spoken MLU in the input; the children also show an increase in word combinations and in MLU, although this may well be related to input received from other adults than their mother.

On the whole the children also reflected their mother's level of preference for nouns. The mothers differed from each other in their noun ratios, but their individual preference were mostly reflected in the output of the children. However, we doubt that these individual differences in noun bias will have a long-lasting effect on acquisition. Research on spoken language has shown some evidence for different noun ratios in different languages, depending on the typology of the language (e.g. rich versus poor agreement languages, section 1.3.2). On the basis of typology we would have expected a low noun-ratio in SLN, but the evidence was not convincing since there was so much individual variation. The interaction situation with the children (playing with toys, books) might have induced a higher noun use by the mothers (labeling). We need to look at other interaction situations in order to further compare the input for this aspect to other languages.

On a functional level we found that the mothers offer the children input with declarative, interrogative and imperative functions in proportions similar to the input of Dutch hearing mothers (Chapter 8). The deaf children also produce all of these functions in SLN and the hearing children in all language modes. We saw that the input showed a decrease in the use of labeling utterances over time, which was reflected in the output of the children. With Carla (D) and Alex (H) we found that both they and their mothers showed less of a decrease in labeling utterances than the other mothers and children. This is probably related to the fact that these two children needed more time to develop good visual attention-giving behavior, which induced the mothers to use labeling utterances more with them. This type of interaction in turn influenced the use of labeling utterances by the children themselves.
Interrogatives were offered in the input as mentioned above, slightly more often to the hearing children. The children start to produce interrogative utterances after age 2;0, the deaf children in SLN, the hearing children in all three language modes; the hearing children also produced slightly more than the deaf children. The

interrogatives were not always in a grammatically correct form in the SLN, NL and SC input. Non-manual markers were sometimes omitted in SLN and signed SC input, more so with the hearing children than with the deaf children. In the children *wh-q* signs are first seen between 1;6 and 2;0, but the appropriate non-manual sentence markers for interrogatives are not yet produced. It is not clear whether the lack of correct input here is crucial. In Dutch and spoken SC there were many incorrect interrogatives, more with the deaf children than with the hearing children but with both to a substantial degree (56% versus 30%). Often the verb was not inverted, and no interrogative intonation could be heard. The hearing children did not however seem to be behind in their acquisition of interrogatives compared to monolingual hearing children.
In contrast to *wh-q* and *q*, the negation sentence marker *neg* is offered correctly as sole negator to the deaf children, who also seem to acquire it effortlessly at an early age (after 1;6). The input to the hearing children differed considerably in this respect, where the negation markers were always used together with a negation word. The hearing children reflected this in their output in that they also never used *neg* as sole negator.
A clear difference in functional use was found for affective utterances: these were offered in a signed mode to the deaf children, and in a spoken mode to the hearing children. This difference was reflected in the output of the children, although the actual number of affective utterances was very low in their output.

We looked at the verbal systems in the three language modes and at the (non)realization of arguments. In the input to the deaf children the various inflections of signed verbs appeared often enough for the children to start acquiring them in SLN. The hearing children also were offered inflected forms, primarily in SC. All children start to inflect signed verbs between age 2;0 and 2;6. The deaf children do not produce spoken verbs, although these were present to some extent in their input. The hearing children start to inflect spoken verbs correctly between 1;6 and 2;0, and to use past participles around age 2;6, which is similar to the timing of acquisition of monolingual hearing children, but they have other sources of Dutch input than their mothers.
The deaf children are offered SLN, and in their SLN production they show that are beginning to acquire the grammatical rules of the verbal system in SLN. The hearing children also show the beginning of SLN syntax in their SC production, and also of NL syntax in Dutch and SC. However, the spoken SC in their output showed more characteristics of Dutch syntax than appeared in the input. As described in section 10.1 both the input to and the output of the hearing children sometimes showed a mixture of the verbal systems of SLN and Dutch in the SC contexts.

10.2.3 Output is different from input

There are a few instances where the output does not reflect the mothers' input. The input in Dutch to the deaf children is generally not reflected in their output, but as already discussed, this can be related to the lack of visual information (section 10.2.2). The hearing children also produce more Dutch than their mothers do; for example they have more utterances with a spoken verb than the mothers. As already discussed, the hearing children have access to spoken Dutch from native speakers, for example from the hearing members of their families. These other sources of input are clearly important and result in a development of the spoken language which is similar to monolingual children. The hearing children are not clearly influenced by the Dutch input from their mothers in terms of structure. For example they place verbs more often in final position in their SC utterances (up to 31%) than occurs in the SC input (21%) (section 9.4.2). It must be remembered that this final position is typical in monolingual hearing children of hearing parents at that age. They use this final position to the same extent in their Dutch utterances (28%), which confirms the interpretation that this is a result of their developmental stage in Dutch rather than of the influence of signed verb position from the SC and SLN input.

The signed vocabularies in the input were similar in the input to the deaf and hearing children, but two of the hearing children, Jonas and Alex, show a slower rate of acquisition than the other four children. Sander (H) developed in a way comparable to the deaf children, despite the fact that his signed input was not different from that of the other two hearing children. In our view this is connected to his early awareness that his mother is deaf. The fact that he suppresses his voice from an early age on, and his development of his visual attention-giving behavior support this interpretation. He is oriented towards behavior appropriate for sign language interaction. Even at this early age he has a focus on signed language; a language attitude has been established. It is not clear how this has come about.

10.2.4 Input is one of several factors

In Chapter 1 we discussed the position of language input and interaction in various theories. In most of such theories it is accepted that exposure to a language is a prerequisite for a child to be able to acquire that language (section 1.1). However, exposure to a language, as we have seen here, is not a sufficient condition. With the deaf children accessibility of the language is shown to be important: SLN is very accessible, Dutch is barely accessible (see also section 1.3.1) resulting in a very limited acquisition of Dutch.

With the hearing children a spoken input that is partly different from standard Dutch is shown to have little influence on their acquisition of Dutch. Their acquisition of the spoken language is similar to that of monolingual hearing children. The input that they receive in standard Dutch in their extended families seems to provide the basis for their acquisition, not their mother's input.

The form of the input does appear to be related to what is acquired. What is offered in small amounts or later, also is acquired more slowly or later, for example the non-

manual markers (see also for ASL, Snitzer-Reilly and Bellugi 1996) or verb inflection. From the descriptions we have of SLN to date it does not appear to be the case that these are infrequent aspects in adult-adult language and that therefore slow acquisition can be related to infrequency in the language in general. This study shows that these aspects are particularly infrequent in the adult-child language and so the pacing of acquisition seems really to be directed by the input. It is not clear why such aspects are restricted in the input although there may well be a relationship with the development of attention-giving behavior on the part of the children.
In general input is shown to be important and a necessary factor in explaining acquisition. It cannot continue to be neglected as it has in much of the acquisition literature.

10.3 The influence of hearing status

As already discussed in the previous sections of this chapter, input to and output of the deaf and hearing children is often different. This section will summarize these differences with the focus on the influence of hearing status and look for explanations for these differences.

In the choice of language the input and the output differs between the two groups of children very clearly. Deaf children receive and produce SLN with some use of spoken components but very little Dutch. They focus on SLN. They show evidence that they are aware that they should pay visual attention in order to get the linguistic information. They are beginning to show (Carla less than Laura and Mark) that they are aware that for sign language communication visual access is imperative, and they should thus also take care that their mother in turn can see their output.
The hearing children focus on the spoken language but show a variation in this that is not related to hearing. Jonas uses Dutch, which is a reflection of the fact that he is hearing himself, and he focuses on the spoken mode, but he also uses SC which reflects an adaptation to the fact that his mother is deaf. Alex produces mainly Dutch, which is a reflection of his own hearing status. He receives SC input, although with only few sign combinations, but he is generally slower in his development. He seems to become aware that his mother is deaf somewhat later than the other children. Sander, on the other hand, receives linguistic input similar to that of Jonas' and Alex', but his mother's interactional style is different from that of their mothers, and we saw that his output is different from the language production of Jonas and Alex. He communicates more often in SLN or SC than they do, although he also uses some Dutch. However, the structure of his SC is similar to that of Jonas and Alex as discussed above (10.2.3), he just seems to be more oriented towards signing, so his choice in language is more defined by his mother's hearing status than his own. This is supported by the fact that Sander increasingly

checks whether or not his mother is giving visual attention before signing or speaking. This is not so clear with Jonas and Alex.

A clear difference in the input to the two groups of children is the structure of what was initially called SC as discussed in 10.1. The deaf children receive SLN whereas the hearing children are also offered a mixed form of input. Another difference lies in the frequency of certain forms that are offered to them. We found such differences in several different areas. In SC input we see more signed verbs with the deaf children. The signed input to both groups of children contained a diversity of forms of verb inflection, which all the children began to produce, but the hearing children to a lesser extent than the deaf children (see Table 10.1). This supports again the fact that the hearing children are more focused on the spoken language. More spoken verbs are used with the hearing children; the spoken verbs are more often in finite form with the hearing children and they are also offered more auxiliaries and copulas. In negative signed utterances the non-manual marker *neg* is used only with the deaf children as a sole negator. These differences in the input for frequency of forms is reflected in the output of the deaf and hearing children as discussed in 10.2. In general we see more complexity in the sign language with the deaf children and more in the spoken language with the hearing children.
Another aspect is the correct grammatical realization of the forms described above, both in the input and the output. For interrogatives for instance, we found that the use of incorrect signed forms decreased in the input to the deaf children, but not with the hearing children. The reverse is true for the spoken interrogatives which are more often incorrect with the deaf children.
As already discussed (10.2.4) these quantitative and qualitative differences in the input have an influence on the output of the children. If certain forms are encountered less often, then they will be acquired more slowly. In Table 10.1 an overview is presented of the acquisition of SLN and signed SC for both the deaf children and hearing children on the one hand and of Dutch and the spoken part of SC for the hearing children on the other.
The development of Dutch can only be described for the hearing children. As we see from Table 10.1 representational words first appear around age 1;0, followed by word-combinations at age 1;6 in Jonas and Sander. Alex is a little slower at age 2;0. There are some individual differences, but on the whole the children first produce interrogative utterances around age 2;0, auxiliaries and copulas also appear round this age, as well as finite verbs and morphological markings on nouns and adjectives. At age 2;6 past participles are produced. This is all within normal ranges for monolingual children acquiring Dutch.
From the other column in Table 10.1 it is possible to compare the two groups of children in their SLN and signed SC acquisition in more detail and identify the points of comparison or contrast.

Table 10.1 Overview of acquisition for SLN and signed SC, and NL and spoken SC of the deaf and hearing children.

	SLN and signed SC		Dutch and spoken SC
	Deaf children	Hearing children	Hearing children
1;0	• representational signs *all*	• representational signs *all* • (1 wh-q sign *Alex*)	• representational words *all*
1;6	• sign combinations *Laura, Mark* • questions *Mark* • wh-q sign *Mark* • verbs *all*	• questions *Jonas* • wh-q sign *Jonas* • verbs *Jonas*	• less voice by *Sander* • word combinations *Jonas* • questions *Jonas* • finite verbs *Jonas* • diminutive *Alex*
2;0	• sign combinations *Carla* • questions *Laura* • wh-q sign *Laura* • verb inflected for location and classifier use *Laura*	• visual attention *Sander* • sign combinations *Jonas*, *Sander* • questions *Alex, Sander* • imperatives *Jonas, Sander* • wh-q sign *Sander* • wh-q marker *Jonas* • y/n-q marker *Sander* • verbs *Sander* • verbs inflection for location *Jonas, Sander*	• word combinations *Alex, Sander* • questions *Alex, Sander* • finite verbs *Alex, Sander* • copulas *Alex, Sander* • auxiliaries *Jonas* • plural markers on nouns diminutive markers *Jonas, Sander* • inflected adjectives *Sander*
2;6	• visual attention *Laura, Mark* • questions *Carla* • imperatives *Laura, Carla* • wh-q sign *Carla* • negative verb *Mark*	• imperatives *Alex* • verbs *Alex* • verbs inflected for subject/ object *Jonas*	• imperatives *Jonas, Alex* • auxiliaries *Alex, Sander* • copulas *Jonas* • past participles *Jonas, Sander* • inflected adjectives *Jonas, Alex*
3;0	• visual attention *Carla* • verb inflected for manner/aspect *Carla, Laura* • verb inflected for location, subject/object *Mark* • auxiliary OP *Mark*	• sign combinations *Alex*	

All children produce their first representational signs around their first birthday. Sign combinations are first seen in Laura and Mark (D) at 1;6 and at later ages with the other children. The first signed interrogatives occur at age 1;6 with Mark (D) and Jonas (H) along with *wh-q* signs – the other children follow at later ages, but Alex produces only one (imitation of a) *wh-q* sign at age 1;0. We see no clear difference between the deaf and hearing children here. Interrogative sentence markers are only produced by Jonas and Sander (H) around age 2;0. Mark (D) and Jonas (H) show the quickest rate of development in using interrogatives (still incorrectly formed), Carla (D) and Alex (H) the slowest. After age 2;0 the first verb-

inflections occur with all children except Alex (H), but the deaf children produce more diverse inflections around age 3;0 than Jonas and Sander.
The differences in the language acquisition of the deaf children and the hearing children can partly be attributed to hearing status, most clearly in the fact that the deaf children produce little Dutch. Partly the differences can be explained by the input, for example the hearing children are given an different input with regard to the use of *neg*. Individual variation in language acquisition must also be considered, for example Alex is generally slower than the other children and Sander is more oriented to signing.

10.4 Implications for parents

In Chapter 1 we have discussed the need to establish the quantity and quality of the input and to describe the interaction in which language acquisition takes place. In section 10.2 we have concluded that input can have an influence but that it is not the only factor that decides which language is acquired by a child and how it is acquired. Our study has shown the areas of influence of input and interaction and these have been related to theories of acquisition. However the results also have some implications for parents since they are the primary source of input. The results from the deaf children are relevant for both deaf and hearing parents of deaf children; the results from the hearing children for deaf parents with hearing children.
Deaf parents with deaf children use SLN in bringing up their children. Based on everyday interaction, the children will be able to acquire SLN. By providing signed information within the visual field of the child about the world around him/her, the mothers teach the children appropriate visual attention-giving behavior. The accessibility of the linguistic input is of major importance for the children during the early years of their language acquisition development. This comes naturally to deaf parents of deaf children. What is important is that hearing parents of deaf children are made aware of the absolute necessity to give the child access to the language that is being used. Specific training in how to guide the child to appropriate visual attention-giving behavior should be part of the earliest guidance programs for hearing parents of deaf children. This should be integrated into their sign language lessons. In most family guidance programs in the Netherlands attention training is already integrated from the earliest moment on. Building a vocabulary in signs is important during the early years, along with training the child's visual behavior. Establishing a smooth interaction pattern is one of the prerequisites for the deaf child to be able to learn any language through the visual channel.
Once the child shows appropriate attention-giving behavior, the parents can begin to offer more complex SLN or SC. When the visual attention of the children is appropriate for sign language interaction, deaf parents begin to offer their children sign language which is morpho-syntactically more complex. Deaf parents provide their children with a rich vocabulary from the beginning. They gradually build up

the syntactic structures in the input; the input is relatively simple in the beginning. Hearing parents of deaf children do therefore have some respite in learning the language. Hearing parents of deaf children face the enormous challenge of learning a sign language at the same time as their child is supposed to acquire it. However, we have found that the sign language addressed to the child during the early years of language acquisition does not have to be very complicated or structurally perfect. Since hearing parents of deaf children are usually second language learners in SLN, attention should be paid in their SLN instruction as to how they can make their SLN or SC more complex, that is what forms they should offer to their children. For instance, attention should be paid to non-manual grammatical markers on different levels, the inflectional verb system and the (non-) realization of arguments, as well as the use of classifiers and indexes and the use of space.

By using SLN with mouthed words deaf children become aware that lip-movements can carry symbolic meaning. This forms the basis for acquisition of the spoken (and written) language. On the basis of this form of spoken input, however, we cannot expect that deaf children will have made a real start in acquiring the spoken language by the age of three years. They will need more time than hearing children to acquire the spoken language, and they will need explicit instruction. The most logical way to give form to this instruction is by making use of sign language, their first language.

We have found that the *hearing* children *can* acquire SLN from the SC input they receive. This implies that the languages offered can be SLN, or Simultaneous Communication (see section 10.1). It follows, that if hearing parents, just learning to use SLN, use SLN and SC with their deaf children, these deaf children will also start to acquire SLN. The spoken or mouthed input will make the deaf children aware that lip-movements can carry symbolic meaning in the same way that the deaf children of deaf parents discover this.

Deaf parents with hearing children seem to have no communication problems with their child, whether they use a sign language, spoken language or a mixture of the two. As long as there are other hearing members in their (extended) family, the children acquire the spoken language in the same way as hearing children of hearing parents. We do not know how the acquisition of the spoken language would develop if there was less exposure to the spoken language.

Within deaf mother–hearing child interaction we found that both the mothers and the children adapt to their own hearing status, but also to the hearing status of the partner in conversation. By the time the children are about 2;6 a communication mode has been established that enables both the deaf parent and the hearing child to participate equally in the interaction. For some this means more signing, for others this may mean more spoken language. The hearing children in our study are acquiring SLN, although two of them seem to have a slower development than the deaf children. And they are also acquiring Dutch. The influence of their mothers' different use of Dutch apparently hardly plays a role here, except that the SC production of the children shows characteristics of a third system (see section 10.1).

This third system apparently has little influence on their acquisition of the other languages, and shows that the children are aware that different languages exist. The communication of hearing children with their deaf parent(s) may be determined individually, by the choice of language of the parents, and the communicational needs of the child.
The most important finding of our research is, in our opinion, the fact that the interaction and communication between deaf mothers and their hearing and deaf children appears to pose no problems for the language acquisition development of the children. The deaf children are acquiring SLN, and the hearing children SLN, Dutch and a third system.

10.5 Further research

This thesis was handicapped to some extent by the fact that SLN has not yet been fully described although in-roads have and are being made (see Chapter 2; also Crasborn et al. 1999). Sign language acquisition research depends on a description of the adult form as the target for the acquisition process. Without it the development of the output cannot be fully examined in terms of its differences and similarities in relation to the language that is used by adult native signers. The description of SLN is incomplete in terms of the structure but some areas have hardly been touched at all such as the lexicon and pragmatics. This study limited itself to those areas where some description was available but there is enormous scope for further work.
In this exploratory research we have examined many aspects of the interaction between six deaf mothers and their deaf and hearing children up to age 3;0. We have covered many areas, but still a great deal of the data has not been examined even up to age three years. The phonological development, for example, was not touched on. Our full database also consists of filmed sessions of the mother-child dyads up to the age of 8;0 (see Chapter 4). This study traces the beginnings of acquisition but the same children can be followed into their development of more complex language. We would like to know how the development of spoken language continues for the deaf children for example. The development of their language orientation after age three is also a fascinating aspect. Does Sander continue to have a more SLN orientation than the other two hearing children or do they "catch up"?
Our data are gathered from a restricted sample, that is six mother-child dyads in 10 minutes of interaction at six-monthly intervals. All conclusions therefore have to be interpreted with some care. A study with a much larger group of children in longer interaction samples needs to be done in order to substantiate our findings.
This study provides a guideline to establishing the first suggestions for mile-stones in the acquisition of SLN. What is still needed is a profile for sign language acquisition, comparable to GRAMAT for spoken Dutch (Bol and Kuiken 1988) or the LARSP for English (Crystal, Fletcher and Garman 1976). This kind of profiling

is based on spontaneous language samples but it is also possible to use tests with children older than three years of age. These are currently being developed (Jansma, Knoors and Baker 1997). The larger studies in spontaneous use and the assessment studies together will help us to discover milestones in the language acquisition process of deaf children, both for signed and for spoken language. Such instruments will help parents, teachers and professionals to improve the linguistic opportunities of deaf children. It is imperative that deaf and hearing children, both of deaf and of hearing families, can be objectively assessed for their level of language acquisition (signed and/or spoken) when they start to attend school, so that appropriate decisions can be made for their language education.

This study has produced many pages of results but is just a small beginning. Hopefully it will stimulate further research as suggested above. The results are interesting for the field of acquisition but there is also the practical goal of optimizing the opportunities for deaf children so that they can become a full participant in society with the same chances for success as hearing children of hearing parents.

APPENDIX TO CHAPTER 4

Audiometric information on the deaf children Carla, Laura and Mark

CARLA

Born	May, 1989	
first tests	June, 1990 (1;1)	40dB (125Hz) and 70dB (500Hz) no reaction to sound
further tests	July, 1990 (1;2)	supplied with hearing aids
	June, 1991 (2;1)	no reaction to sound
	March, 1992 (2;10)	some reactions at 40dB (125Hz) and 100 dB (1000Hz)with hearing aids: no reactions
	June, 1992 (3;1)	with hearing aids: some reaction at
	March, 1993 (4;0)	with hearing aids: some reaction at 70Db (250/2000Hz) in best ear
	August, 1994 (5;3)	without hearing aids: no reaction with hearing aids: some reaction at 60dB (125/4000Hz) in right ear. Left: no reaction

Carla was (tentatively) diagnosed as profoundly hearing impaired. As she grew older, her reactions to tests with hearing aids in were improving.

LAURA

Born	April, 1989	
first tests	February, 1990	
further tests	November, 1991 (1;7)	some reaction at 80dB (250/500 Hz) with left ear hearing aid
	February, 1992 (2;10)	some reaction at 70dB (500 Hz) both ears hearing aids Conclusion: some hearing rests
	October, 1992 (3;6)	some reaction at 110dB (250/1000 Hz)
	June, 1993 (4;3)	no reactions
	December, 1993 (4;8)	no reactions
	April, 1994 (4;11)	some reaction at 100dB (125/500 Hz)
	December, 1994 (5;8)	some reaction at 100dB (250/2000 Hz)

MARK

Born	April, 1989	
first test	February, 1990	
further tests	November, 1991 (1;7)	some reaction at 80dB (250/500 Hz)
	February, 1992 (2;10)	some reaction at 70dB (250/1000 Hz)
	October, 1992 (3;6)	some reaction at 80dB (125/4000 Hz)
	June, 1993 (4;3)	idem
	December, 1993 (5;8)	idem

Laura and Mark were diagnosed as profoundly hearing-impaired at the various testing-dates.

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time	
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gloss	
oral	

APPENDIX TO CHAPTER 5

Table A5.1 Chi Square Values for total number of utterances per child over five points in time

	Children:	*df*	Chi Square value p≤ 0.001	sign.
Deaf	Carla	3	χ^2 = 28.8	s
children	Laura	4	χ^2 = 179.93	
	Mark	4	χ^2 = 114.03	
Hearing	Jonas	4	χ^2 = 87.56	s
children	Alex	4	χ^2 = 96.69	s
	Sander	4	χ^2 = 118.75	

s means: significant

Table A5.2 Chi-square values for the total number of utterance of the children per age group

Age	*df*	Chi Square value p≤ 0.001	sign.
1;0	3	χ^2 = 28.8	
1;6	4	χ^2 = 179.93	
2;0	4	χ^2 = 114.03	s
2;6	4	χ^2 = 87.56	s
3;0	4	χ^2 = 96.69	

s means: significant

Table A5.3 Chi-square values for total number of utterances of the mothers and the children, over time

	Mothers:	*df*	Chi Square value p≤ 0.001	sign.
Deaf	MCarla	9	χ^2 = 9.74	
children	MLaura	16	χ^2 = 72.85	s
	MMark	16	χ^2 = 42.85	s
Hearing	MJonas	16	χ^2 = 27.78	
children	MAlex	16	χ^2 = 83.03	s
	MSander	16	χ^2 = 76.86	s

s means: significant

Table A5.4 INPUT: Number and (%) of all linguistic utterances in NL, SLN and SC produced by the deaf mothers

	1;0			1;6			2;0			2;6			3;0		
	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC
MC	-	-	-	4	30	84	2	33	96	1	26	108	0	30	144
				(3)	(25)	(71)	(2)	(25)	(73)	(1)	(19)	(80)		(17)	(83)
ML	1	21	49	2	35	47	3	55	56	0	33	88	0	69	113
	(1)	(30)	(69)	(2)	(42)	(56)	(3)	(48)	(49)		(27)	(73)		(38)	(62)
MM	2	20	22	3	46	53	6	52	98	1	81	58	1*	28*	49*
	(4)	(46)	(50)	(3)	(45)	(52)	(4)	(33)	(63)	(1)	(58)	(41)	(1)	(36)	(63)
MJ	49	0	12	42	15	95	15	13	118	8	18	148	18	21	76
	(80)		(20)	(28)	(10)	(62)	(10)	(9)	(81)	(5)	(10)	(85)	(16)	(18)	(66)
MA	83	2	79	77	15	104	32	13	119	33	15	145	22	5	148
	(51)	(1)	(48)	(39)	(8)	(53)	(20)	(8)	(73)	(17)	(8)	(75)	(12)	(3)	(85)
MS	59	4	48	29	12	111	11	15	116	6	9	135	14	15	102
	(53)	(4)	(43)	(19)	(8)	(73)	(8)	(10)	(82)	(4)	(6)	(90)	(11)	(11)	(78)

**uncorrected for time*

Table A5.5 OUTPUT: Number and (%) of all linguistic utterances in SLN, NL and SC of the deaf and hearing children

		1;6			2;0			2;6			3;0		
		NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC
Deaf children	Carla	2	31	10	5	72	14	4	54	5	3	78	22
		(5)	(72)	(23)	(6)	(79)	(15)	(6)	(86)	(8)	(3)	(75)	(22)
	Laura	1	9	1	1	18	0	0	78	5	0	83	10
		(9)	(82)	(9)	(5)	(95)			(94)	(6)		(89)	(11)
	Mark	1	24	1	4	41	1	0	93	4	0	46	0
		(4)	(92)	(4)	(9)	(89)	(2)		(96)	(4)		(100)	
Hearing children	Jonas	54	17	37	51	14	23	25	26	35	40	4	52
		(50)	(16)	(34)	(58)	(16)	(26)	(29)	(30)	(41)	(42)	(4)	(54)
	Alex	21	5	0	83	0	12	52	4	12	30	17	32
		(81)	(19)		(87)		(13)	(76)	(6)	(18)	(38)	(21)	(41)
	Sander	10	20	11	17	26	52	6	50	66	17	28	48
		(24)	(49)	(27)	(18)	(27)	(55)	(5)	(41)	(54)	(18)	(30)	(52)

APPENDIX TO CHAPTER 6

Table A6.1 INPUT DC+HC: Number and (%) of signs seen by the children. Included are all signs and movs

Seen by	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	135 (75)	179 (77)	204 (68)	305 (77)
	Laura	78 (72)	153 (90)	195 (88)	359 (92)	462 (94)
	Mark	53 (79)	148 (86)	257 (86)	307 (88)	156 (91)
Hearing Children	Jonas	15 (79)	154 (82)	216 (78)	427 (88)	151 (82)
	Alex	85 (72)	115 (67)	157 (71)	260 (87)	218 (68)
	Sander	64 (87)	125 (68)	206 (85)	372 (91)	226 (86)

Table A6.2 INPUT DC+HC: Number and (%) of words in the input seen by the children

Seen by	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	37 (31)	52 (33)	74 (37)	146 (58)
	Laura	18 (26)	54 (65)	66 (63)	151 (73)	199 (83)
	Mark	6 (21)	62 (58)	110 (68)	93 (74)	95 (91)
Hearing Children	Jonas	nr*	3 (75)	33 (85)	12 (71)	27 (60)
	Alex	2 (100)	5 (56)	5 (56)	16 (84)	2 (100)
	Sander	0 (0)	0 (0)	1 (33)	4 (44)	2 (67)

**nr is not relevant (i.e. no words without voice)*
***NB**. For the hearing children only those words uttered without voice are presented, for the deaf children all words and mov's. There are some uncodable words.*

Table A6.3 INPUT HC: Total number of vocalizations and words of the mothers with the hearing children (including minors)

Mothers	1;0	1;6	2;0	2;6	3;0	total
MJonas	132	370	367	551	215	1635
MAlex	296	285	263	343	332	1519
MSander	191	278	287	452	315	1523
total	619	933	917	1346	862	**4677**

Table A6.4 INPUT DC+HC: Number and (%) of non-explicit and explicit attentional strategies by the deaf mothers

	Mothers	1;0		1;6		2;0		2;6		3;0	
		non-expl	expl	non-expl	expl	non-expl	expl	non-expl	expl	non-expl	expl
Deaf children	MCarla	-	-	52 (44)	67 (57)	76 (58)	55 (42)	76 (56)	59 (44)	124 (71)	50 (29)
	MLaura	38 (54)	33 (46)	49 (58)	35 (42)	68 (60)	46 (40)	82 (68)	38 (31)	134 (73)	47 (26)
	MMark	14 (32)	30 (68)	78 (77)	23 (23)	113 (72)	37 (24)	97 (69)	39 (28)	65 (83)	7 (9)
Hearing children	MJonas	69 (92)	5 (7)	95 (63)	56 (37)	92 (63)	51 (35)	149 (86)	25 (14)	83 (72)	30 (26)
	MAlex	119 (72)	27 (16)	154 (78)	35 (18)	120 (73)	33 (20)	173 (90)	17 (9)	103 (59)	72 (41)
	MSander	63 (57)	28 (25)	98 (65)	41 (27)	120 (85)	22 (15)	126 (84)	24 (16)	117 (90)	13 (10)

Not all utterances could be given a code (e.g. first sign in utterance invisible for encoder), which explains why the number do not tally with those in Table 6.1 and why percentages are not always up to 100%.

Table A6.5a INPUT DC: Number and (%) of strategies used by the Mother of Carla

Mother of Carla	1;0	1;6	2;0	2;6	3;0
strategy A	-	19 (16)	22 (17)	31 (23)	74 (43)
strategy B	-	32 (27)	54 (41)	45 (33)	50 (29)
strategy C	-	35 (30)	23 (18)	8 (6)	12 (7)
strategy D	-	32 (27)	32 (24)	51 (38)	38 (22)

NB *If the percentages in Tables A6.5 do not add up to 100% this is caused by some utterances being non codable (X) or being vocatives. Percentages are calculated over all linguistic utterances, including voc's and mov's.*

Table A6.5b INPUT DC: Number and (%) of strategies used by the Mother of Laura

Mother of Laura	1;0	1;6	2;0	2;6	3;0
strategy A	16 (23)	26 (31)	50 (44)	71 (59)	93 (51)
strategy B	22 (31)	23 (27)	18 (16)	11 (9)	41 (23)
strategy C	29 (41)	26 (31)	23 (20)	17 (14)	26 (14)
strategy D	4 (5)	9 (11)	23 (20)	22 (18)	22 (12)

Table A6.5c INPUT DC: Number and (%) of strategies used by the Mother of Mark

Mother of Mark	1;0	1;6	2;0	2;6	3;0'
strategy A	3 (7)	52 (51)	82 (53)	66 (47)	53 (68)
strategy B	11 (25)	26 (26)	31 (20)	31 (22)	12 (15)
strategy C	24 (54)	18 (18)	18 (12)	22 (16)	2 (3)
strategy D	6 (14)	5 (5)	19 (12)	17 (12)	5 (6)

' uncorrected for time

Table A6.5d INPUT HC: Number and (%) of strategies used by the Mother of Jonas

Mother of Jonas	1;0	1;6	2;0	2;6	3;0
strategy A	15 (25)	18 (12)	35 (24)	74 (43)	28 (24)
strategy B	40 (67)	77 (51)	56 (38)	75 (43)	55 (48)
strategy C	3 (5)	54 (36)	41 (28)	16 (9)	27 (24)
strategy D	2 (3)	2 (1)	10 (7)	9 (5)	3 (3)

Table A6.5e INPUT HC: Number and (%) of strategies used by the Mother of Alex

Mother of Alex	1;0	1;6	2;0	2;6	3;0
strategy A	40 (24)	64 (33)	57 (35)	129(67)	18 (10)
strategy B	77 (47)	89 (45)	62 (38)	44 (23)	85 (49)
strategy C	6 (4)	22 (11)	30 (18)	11 (6)	53 (30)
strategy D	21 (13)	13 (7)	3 (2)	6 (3)	19 (11)

Table A6.5f INPUT HC: Number and (%) of strategies used by the Mother of Sander

Mother of Sander	1;0	1;6	2;0	2;6	3;0
strategy A	19 (17)	20 (13)	50 (35)	62 (41)	81 (62)
strategy B	44 (40)	78 (51)	72 (50)	64 (43)	37 (28)
strategy C	13 (12)	29 (19)	18 (13)	13 (9)	5 (4)
strategy D	15 (14)	12 (8)	4 (3)	11 (7)	8 (6)

Table A6.6a INPUT DC+ Raw figures and (%) of attentional strategies used per language by the mother of Carla

Mother of Carla	1;6			2;0			2;6			3;0		
	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC
strategy A	0	4	15	0	4	18	0	5	26	0	12	62
	(0)	(21)	(79)	(0)	(18)	(82)	(0)	(16)	(84)	(0)	(16)	(84)
strategy B	4	6	22	2	14	38	1	13	31	0	11	39
	(13)	(19)	(69)	(4)	(26)	(70)	(2)	(29)	(69)	(0)	(22)	(78)
strategy C	0	16	19	0	12	11	0	1	7	0	2	10
	(0)	(46)	(54)	(0)	(52)	(48)	(0)	(13)	(88)	(0)	(17)	(83)
strategy D	0	4	28	0	3	29	0	7	44	0	5	33
	(0)	(13)	(88)	(0)	(9)	(91)	(0)	(14)	(86)	(0)	(13)	(87)

Table A6.6b INPUT DC: Raw figures and (%) of attentional strategies used per language by the mother of Laura

Mother of Laura	1;0			1;6			2;0			2;6			3;0		
	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC
strat. A	0	3	13	0	9	17	1	22	27	0	19	52	0	31	62
	(0)	(19)	(81)	(0)	(35)	(65)	(2)	(44)	(54)	(0)	(27)	(73)	(0)	(33)	(67)
strat. B	1	7	14	1	10	12	2	13	3	0	2	9	0	15	26
	(5)	(32)	(64)	(4)	(44)	(52)	(11)	(72)	(17)	(0)	(18)	(82)	(0)	(37)	(63)
strat. C	0	11	18	0	15	11	0	12	11	0	8	9	0	19	7
	(0)	(38)	(62)	(0)	(58)	(42)	(0)	(52)	(48)	(0)	(47)	(53)	(0)	(73)	(27)
strat. D	0	0	4	1	1	7	0	7	16	0	4	18	0	4	18
	(0)	(0)	(100	(11)	(11)	(78)	(0)	(30)	(70)	(0)	(18)	(82)	(0)	(19)	(81)

Table A6.6c INPUT DC: Raw figures and (%) of attentional strategies used per language by the mother of Mark

Mother of Mark	1;0			1;6			2;0			2;6			3;0		
	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC	NL	SLN	SC
strat.A	0	0	3	0	23	29	5	25	52	0	39	27	1	15	27
	(0)	(0)	(100	(0)	(44)	(56)	(6)	(30)	(63)	(0)	(59)	(41)	(2)	(28)	(70)
strat. B	2	7	2	3	10	13	1	12	18	0	18	13	0	7	5
	(18)	(64)	(18)	(12)	(39)	(50)	(3)	(39)	(58)	(0)	(58)	(42)	(0)	(58)	(42)
strat. C	0	11	13	0	10	8	0	12	6	0	17	5	0	2	0
	(0)	(46)	(54)	(0)	(56)	(44)	(0)	(67)	(33)	(0)	(77)	(23)	(0)	(100	(0)
strat. D	0	2	4	0	2	3	0	2	17	1	5	11	0	0	5
	(0)	(33)	(67)	(0)	(40)	(60)	(0)	(11)	(89)	(6)	(29)	(65)	(0)	(0)	(100

Table A6.6d INPUT HC: Raw figures and (%) of attentional strategies used per language by the mother of Jonas

Mother of Jonas	1;0 NL	1;0 SLN	1;0 SC	1;6 NL	1;6 SLN	1;6 SC	2;0 NL	2;0 SLN	2;0 SC	2;6 NL	2;6 SLN	2;6 SC	3;0 NL	3;0 SLN	S C
strat. A	13 (87)	0 (0)	2 (13)	1 (6)	4 (22)	13 (72)	1 (3)	3 (9)	31 (89)	2 (3)	11 (15)	61 (82)	0 (0)	8 (29)	20 (71)
strat. B	33 (83)	0 (0)	7 (17)	39 (51)	0 (0)	38 (49)	7 (13)	0 (0)	49 (88)	6 (8)	5 (7)	64 (85)	17 (31)	5 (9)	33 (60)
strat. C	0 (0)	0 (0)	3 (100	0 (0)	11 (20)	43 (80)	0 (0)	10 (24)	31 (76)	0 (0)	2 (13)	14 (88)	0 (0)	7 (26)	20 (74)
strat. D	2 (100	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)	3 (30)	0 (0)	7 (70)	0 (0)	0 (0)	9 (100	0 (0)	0 (0)	3 (100

Table A6.6e INPUT HC: Raw figures and (%) of attentional strategies used per language by the mother of Alex

Mother of Alex	1;0 NL	1;0 SLN	1;0 SC	1;6 NL	1;6 SLN	1;6 SC	2;0 NL	2;0 SLN	2;0 SC	2;6 NL	2;6 SLN	2;6 SC	3;0 NL	3;0 SLN	SC
strat. A	16 (40)	0 (0)	24 (60)	30 (47)	4 (6)	30 (47)	18 (32)	0 (0)	39 (68)	20 (16)	11 (9)	98 (76)	0 (0)	0 (0)	18 (100)
strat.B	45 (58)	2 (3)	30 (39)	38 (43)	6 (7)	45 (51)	10 (16)	8 (13)	44 (71)	11 (25)	3 (7)	30 (68)	21 (25)	1 (1)	63 (74)
strat. C	0 (0)	0 (0)	6 (100)	0 (0)	4 (18)	18 (82)	0 (0)	4 (13)	26 (87)	0 (0)	1 (9)	10 (91)	0 (0)	4 (8)	49 (92)
strat. D	6 (29)	0 (0)	15 (71)	5 (39)	0 (0)	8 (61)	2 (67)	0 (0)	1 (33)	1 (17)	0 (0)	5 (83)	1 (5)	0 (0)	18 (95)

Table A6.6f INPUT HC: Raw figures and (%) of attentional strategies used per language by the mother of Sander

Mother of Sander	1;0 NL	1;0 SLN	1;0 SC	1;6 NL	1;6 SLN	1;6 SC	2;0 NL	2;0 SLN	2;0 SC	2;6 NL	2;6 SLN	2;6 SC	3;0 NL	3;0 SLN	SC
strat. A	6 (32)	0 (0)	13 (68)	4 (20)	0 (0)	16 (80)	4 (8)	7 (14)	39 (78)	3 (5)	7 (11)	52 (84)	7 (9)	8 (10)	66 (81)
strat. B	27 (61)	2 (5)	15 (34)	16 (21)	7 (9)	55 (71)	7 (10)	4 (6)	61 (85)	3 (5)	1 (2)	60 (94)	7 (19)	6 (16)	24 (65)
strat. C	0 (0)	2 (15)	11 (85)	0 (0)	3 (10)	26 (90)	0 (0)	6 (33)	12 (67)	0 (0)	1 (8)	12 (92)	0 (0)	1 (20)	4 (80)
strat. D	6 (40)	0 (0)	9 (60)	2 (17)	1 (8)	9 (75)	0 (0)	0 (0)	4 (100	0 (0)	0 (0)	11 (100)	0 (0)	0 (0)	8 (100)

Table A6.6g INPUT DC+HC: Totals of Strategies for attention with preferred language choice of the mothers (-) means SC is preferred language

	1;0				1;6				2;0				2;6				3;0			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
MCarla					-	-	-	-	-	-	sln	-	-	-	-	-	-	-	-	-
M Laura	-	-	-	-	-	-	sln	-	-	sln	sln	-	-	-	-	-	-	-	sln	-
M Mark	-	sln	-	-	-	-	sln	-	-	-	sln	-	sln	sln	sln	-	-	sln	sln	-
MJonas	nl	nl	-	nl	-	nl	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAlex	-	nl	-	-	-	-	-	-	-	-	-	nl	-	-	-	-	-	-	-	-
MSander	-	nl	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table A6.7 INPUT RESPONSE DC+HC: Raw figures and (%)of positive responses by the children to strategy B

Response to strat. B	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	12 (36)	27 (50)	9 (20)	20 (40)
	Laura	6 (27)	14 (61)	9 (50)	8 (73)	26 (63)
	Mark	2 (18)	13 (50)	15 (48)	23 (74)	6 (50)
Hearing children	Jonas	3 (6)	6 (8)	11 (19)	31 (41)	11 (20)
	Alex	11 (14)	14 (16)	19 (31)	17 (39)	5 (6)
	Sander	3 (7)	14 (18)	22 (31)	27 (42)	8 (21)

Table A6.8 INPUT RESPONSE DC+HC:
Raw figures and (%) of positive responses by the children to strategy D

Response to strat. D	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	14 (44)	16 (50)	25 (49)	21 (55)
	Laura	1 (25)	7 (78)	17 (74)	15 (71)	18 (86)
	Mark	3 (50)	1 (20)	16 (84)	14 (82)	5 (100)
Hearing children	Jonas	1 (50)	1 (50)	7 (70)	8 (89)	1 (33)
	Alex	5 (24)	5 (39)	0 (0)	4 (67)	7 (37)
	Sander	8 (53)	5 (42)	3 (75)	10 (91)	7 (78)

Table A6.9 OUTPUT DC+HC: Number of spontaneous looks of the children at their mother

	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	21	34	29+	73
	Laura	7	28	46	43	36
	Mark	5	52	50	43	51*
Hearing children	Jonas	19	13	12	37	21^
	Alex	24	12	26	49	17´
	Sander	17	20	45	48	37

+ Carla looking at cameraman ** corrected for 10 minutes*
^ Jonas busy with Lego *´ Alex busy with puzzle*

Table A6.10 Number and (%) of Signs and MOV's seen by the deaf mothers

Signs + Mov's seen	by mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	63 (90)	99 (88)	105 (97)	220 (99)
	MLaura	3 (100)	11 (100)	19 (79)	170 (98)	160 (98)
	MMark	3 (100)	27 (96)	61 (97)	175 (96)	102 (98)
Hearing children	MJonas	0:0	57 (95)	44 (100)	89 (96)	89 (95
	MAlex	5 (83)	5 (100)	0 (0)	14 (82)	71 (99)
	MSander	2 (100)	38 (93)	105 (99)	163 (94)	107 (97)

Table A6.11 Number and (%) of Words + vocs seen by the deaf mothers

Words + voc's seen	by mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla		42 (48)	54 (96)	46 (43)	51 (74)
	MLaura	3 (30)	3 (27)	9 (43)	43 (84)	29 (76)
	MMark	0:2 (0)	8 (21)	17 (89)	33 (52)	19 (57)
Hearing children	MJonas	13 (52)	35 (29)	37 (28)	90 (58)	163 (57)
	MAlex	11 (38)	15 (42)	74 (49)	89 (66)	45 (35)
	MSander	10 (42)	4 (19)	69 (68)	101 (75)	117 (77)

Table A6.12a OUTPUT DC: "Attentional Strategies" for voc's and MOV's by Carla

Carla	1;0		1;6		2;0		2;6		3;0	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	-	-	3	5	-	1	-	1	-	1
AB	-	-	2	15	-	3	-	17	-	-
B +	-	-	2	-	-	16	-	15	-	-
B-	-	-	2	22	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-
Total			9	42		20		33		1
Minus %	-	-	67	88	-	95	-	97	-	100

Table A6.12b OUTPUT DC: "Attentional Strategies" for voc's and MOV's by Laura

Laura	1;0		1;6		2;0		2;6		3;0	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	-	3	-	4	-	7	-	2+2	-	1+1
AB	1	5	1	2	-	4	-	1	-	-
B +	1	2	-	-	-	7	-	1	-	1
B -	-	-	-	1	-	-	-	-	-	-
C	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-
Total	2	10	1	7		18		6		3
Minus %	100	70	100	43	-	61	-	33	-	33

Table A6.12c OUTPUT DC: "Attentional Strategies" for voc's and MOV's by Mark

Mark	1;0		1;6		2;0		2;6		3;0*	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	-	-	-	7	-	-	-	1	-	-
AB	-	2	-	4	-	-	-	1	-	-
B +	-	-	-	-	-	-	-	5	-	-
B -	-	-	-	23	-	-	-	-	-	1
C	-	-	-	-	-	-	-	-	-	-
D2.2-	-	-	-	-	-	-	-	-	-	1
Total		2		34				7		2
Minus %	-	100	-	79		-	-	-	71	- 50

* 366 secs.

Table A6.12d OUTPUT HC: "Attentional Strategies" for voc's and MOV's by Jonas

Jonas	1;0		1;6		2;0		2;6		3;0	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	-	1	-	2	-	-	-	-	-	-
AB	-	11	-	-	1	-	-	1	-	-
B +	-	-	-	-	-	-	-	-	-	-
B -	-	8	1	5	-	1	-	5	-	-
C	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-
Total		20	1	7	1	1		6		
Minus %	-	95	100	71	100	100	-	100	-	-

Table A6.12e OUTPUT HC: "Attentional Strategies" for voc's and MOV's by Alex

Alex	1;0		1;6		2;0		2;6		3;0	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	-	1	-	5	-	4	-	9	-	-
AB	-	10	-	1	-	3	-	2	-	-
B +	-	-	-	-	-	5	-	3	-	-
B -	-	14	-	7	-	-	-	-	-	2
C	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-
Total		25		13		12		14		2
Minus %	-	96	-	62	-	67	-	36	-	100

Table A6.12f OUTPUT HC: "Attentional Strategies" for voc's and MOV's by Sander

Sander	1;0		1;6		2;0		2;6		3;0	
	mov	voc	mov	voc	mov	voc	mov	voc	mov	voc
A and A'	1	3	2	-	-	-	-	-	-	-
AB	-	3	2	-	-	1	-	-	-	2
B +	-	10	2	-	-	2	-	-	-	-
B -	-	-	1	-	-	-	-	-	-	3
C	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	-	-	-	-	-	-
Total	1	16	7			3				5
Minus %	0	81	71	-	-	100	-	-	-	100

Table A6.13a OUTPUT DC: Number and (%) of check per AS for all linguistic utterances by Carla

Carla	1;0	1;6	2;0	2;6	3;0
A /A' 0	-	6 (14)	21 (23)	17 (27)	32 (31)
AB -	-	15 (35)	28 (31)	29 (46)	36 (35)
B -	-	12 (28)	32 (35)	13 (21)	27 (26)
C -	-	10 (23)	10 (11)	2 (3)	8 (8)
D +	-	0	0	2 (3)	0
Tot.utt.	-	43	91	63	103
Minus	-	33 (77%)	70 (77)	44 (70)	71 (70)

Table A6.13b OUTPUT DC: Number and (%) of check per AS for all linguistic utterances by Laura

Laura	1;0	1;6	2;0	2;6	3;0
A + A' 0	1 (100)	6 (55)	5 (26)	45 (54)	40 (43)
AB -	0	1 (9)	4 (21)	13 (16)	20 (22)
B -	0	4 (36)	8 (42)	20 (24)	22 (24)
C -	0	0	0	5 (6)	9 (10)
D +	0	0	2 (1)	0	(1=rest)
Total utt.	1	11	19	83	93
Minus	-	5(46)	12 (63)	38 (46)	51 (55)

Table A6.13c OUTPUT DC: Number and (%) of check per AS for all linguistic utterances by Mark

Mark	1;0	1;6	2;0	2;6	3;0*
A + A' 0	0	9 (35)	9 (20)	51 (52)	30 (65)
AB -	2 (67)	9 (35)	24 (52)	24 (25)	7 (15)
B -	1 (33)	6 (23)	11 (24)	19 (20)	6 (13)
C -	0	2 (7)	0	3 (3)	1 (2)
D +	0	0	2 (4)	0	2 (4)
Total utt.	3	26	46	97	46
minus	-	17 (65)	35 (76)	46 (47)	14 (30)

*not corrected for time

Table A6.13d OUTPUT HC: Number and (%) of check per AS for all linguistic utterances by Jonas

Jonas	1;0	1;6	2;0	2;6	3;0
A + A' 0	1 (20)	16 (15)	14 (16)	41 (48)	15 (16)
AB -	3 (60)	22 (20)	32 (36)	18 (21)	22 (23)
B -	1 (20)	63 (58)	40 (46)	26 (30)	56 (58)
C -	0	7 (7)	2 (2)	1 (1)	0
D +	0	0	0	0	3 (3)
Total utt.	5	108	88	86	96
minus	-	92 (85)	74 (84)	45 (52)	78 (81)

Table A6.13e OUTPUT HC: Number and (%) of check per AS for all linguistic utterances by Alex

Alex	1;0	1;6	2;0	2;6	3;0
A + A' 0	1 (11)	12 (46)	16 (17)	34 (50)	16 (20)
AB -	2 (22)	3 (12)	32 (34)	7 (10)	27 (34)
B -	4 (44)	11 (42)	44 (46)	26 (38)	34 (43)
C -	0	0	1 (1)	0	2 (3)
D +	0	0	0	0	0
rest	2 (22)	0	2 (2)	1 (2)	0
Total utt.	9	26	95	68	79
minus	-	14 (54)	77 (81)	33 (49)	63 (80)

Table A6.13f OUTPUT HC: Number and (%) of check per AS for all linguistic utterances by Sander

Sander		1;0	1;6	2;0	2;6	3;0
A + A'	0	2 (25)	4 (10)	38 (40)	62 (51)	56 (60)
AB	-	2 (25)	8 (20)	22 (23)	24 (20)	24 (26)
B	-	4 (50)	19 (46)	21 (22)	25 (20)	12 (13)
C	-	0	10 (24)	10 (11)	5 (4)	1 (1)
D	+	0	0	4 (4)	6 (5)	0
Total utt.		8	41	95	122	93
minus		-	37 (90)	55 (58)	54 (44)	37 (40)

Table A6.14 OUTPUT DC+HC: Percentages of all linguistic utterances of the children coded 'plus check'

Minus check	Children	1;6	2;0	2;6	3;0
Deaf	Carla	33	33	30	30
children	Laura	54	37	54	45
	Mark	35	24	53	70
Hearing	Jonas	15	16	48	19
children	Alex	46	19	51	20
	Sander	10	42	56	60

Tables A6.15a-f show all analyzable SC utterances of the mothers, excluding minors, divided into the categories for propositional content. (Differences with figures in other table stem from the fact that for this analysis minors and unintelligible/ incomprehensible utterances are excluded).

Key:
ff - fully signed and fully spoken *fc - fully signed, complementary spoken*
ss - supplementary signed and spoken *cf - fully spoken, complementary signed*

Table A6.15a INPUT DC: Mother of Carla

MCarla	1;0	1;6	2;0	2;6	3;0
ff	-	31 (39)	34 (36)	28 (27)	40 (28)
ss	-	8 (10)	8 (8)	21 (20)	20 (14)
fc	-	36 (45)	43 (45)	51 (49)	78 (55)
cf	-	5 (6)	10 (11)	4 (4)	3 (2)
total SC	-	80	95	104	141

Table A6.15b INPUT DC: Mother of Laura

MLaura	1;0	1;6	2;0	2;6	3;0
ff	20 (47)	14 (31)	12 (21)	15 (17)	32 (29)
ss	7 (16)	4 (9)	11 (20)	3 (3)	5 (4)
fc	14 (32)	26 (58)	29 (52)	69 (78)	72 (65)
cf	2 (5)	1 (2)	4 (7)	1 (1)	2 (2)
total SC	43	45	56	88	111

Table A6.15c INPUT DC: Mother of Mark

MMark	1;0	1;6	2;0	2;6	3;0
ff	10 (48)	18 (36)	35 (37)	15 (26)	12 (25)
ss	0 (0)	5 (10)	9 (9)	5 (9)	7 (15)
fc	10 (48)	21 (42)	48 (51)	38 (65)	26 (54)
cf	1 (4)	6 (12)	3 (3)	0 (0)	3 (6)
total SC	21	50	95	58	48'

' uncorrected for time

Table A6.15d INPUT HC: Mother of Jonas

MJonas	1;0	1;6	2;0	2;6	3;0
ff	6 (50)	38 (42)	38 (33)	28 (20)	16 (22)
ss	0 (0)	11 (13)	34 (29)	53 (38)	19 (26)
fc	1 (8)	8 (9)	18 (15)	27 (19)	18 (25)
cf	5 (42)	32 (36)	25 (22)	32 (23)	19 (26)
total SC	12	89	114	142	72

Table A6.15e INPUT HC: Mother of Alex

MAlex	1;0	1;6	2;0	2;6	3;0
ff	37 (48)	48 (54)	38 (35)	46 (34)	44 (34)
ss	12 (15)	10 (11)	25 (23)	46 (34)	39 (30)
fc	6 (8)	14 (16)	27 (25)	17 (12)	26 (20)
cf	23 (29)	17 (19)	19 (17)	28 (20)	22 (16)
total SC	78	89	109	137	131

Table A6.15f INPUT HC: Mother of Sander

MSander	1;0	1;6	2;0	2;6	3;0
ff	12 (26)	40 (39)	37 (33)	46 (35)	16 (17)
ss	14 (30)	21 (20)	33 (29)	48 (36)	39 (42)
fc	3 (7)	9 (9)	21 (18)	13 (10)	6 (6)
cf	18 (37)	33 (32)	22 (20)	24 (18)	33 (35)
total SC	47	103	113	131	94

Table A6.16a OUTPUT DC: Propositional content in SC utterances of Carla

Carla	1;6	2;0	2;6	3;0
ff	3 (30)	6 (46)	4 (75)	3 (14)
ss	3 (30)	2 (15)	1 (25)	4 (19)
fc	4 (40)	5 (39)	0	14 (67)
cf	0	0	0	0
total SC	10	13	5	21

Table A6.16b OUTPUT DC: Propositional content SC utterances of Laura

Laura	1;6	2;0	2;6	3;0
ff	0		1	0
ss	1		1	1
fc	0		2	5
cf	0		0	0
total SC	1	0	4	6

Table A6.16c OUTPUT DC: Propositional content SC utterances of Mark

Mark	1;6	2;0	2;6	3;0
ff		1		
ss				
fc			3	
cf				
total SC	0	1	3	0

Table A6.16d OUTPUT HC: Propositional content SC utterances of Jonas

Jonas	1;6	2;0	2;6	3;0
ff	24 (86)	7 (32)	6 (19)	1 (2)
ss	2 (7)	9 (41)	15 (47)	15 (35)
fc	1 (3)	1 (5)	4 (12)	2 (5)
cf	1 (3)	5 (22)	7 (22)	25 (58)
total SC	28	22	32	43

Table A6.16e OUTPUT HC: Propositional content SC utterances of Alex

Alex	1;6	2;0	2;6	3;0
ff		8 (73)	1 (11)	4 (15)
ss		3 (27)	1 (11)	17 (63)
fc		0	0	0
cf		0	6 (67)	6 (22)
total SC	0	11	9	27

Table A6.16f OUTPUT HC: Propositional content SC utterances of Sander

π	1;6	2;0	2;6	3;0
ff	5 (83)	23 (47)	19 (34)	12 (28)
ss	1 (17)	10 (20)	26 (46)	12 (28)
fc	0	11 (22)	5 (9)	2 (5)
cf	0	5 (10)	6 (11)	16 (38)
total SC	6	49	56	42

APPENDIX TO CHAPTER 7

Table A7.1 INPUT DC+HC: Total number of analyzable utterances plus Points alone of the mothers

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	107	117	120	163
	MLaura	61	78	100	112	166
	MMark	39	86	136	126	63/ 103*
Hearing children	MJonas	38	129	135	159	96
	MAlex	132	151	134	160	147
	MSander	70	124	131	137	115

**corrected for 10 minutes*

Table A7.2 INPUT DC+HC: Number and (%) of utterances of the deaf mothers, consisting of a Point only and of a Point with one representational symbol (DS, DS/R)

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	54 (50) (-1Dw)	39 (33)	25 (21)	43 (26)
	MLaura	13 (21)	34 (44)	40 (40)	42 (38)	37 (22)
	MMark	19 (50)	22 (26)	46 (34)	37 (29)	14'(22)
Hearing children	MJonas	0 (0) 2 Dw(5)	22 (17) (-2Dw)	26 (19)	23 (15) (1+Dw)	17 (18) (-5Dw)
	MAlex	14 (11)	23 (15) (-2Dw)	37 (28)	36 (23) (-3Dw)	42 (29) (-3Dw)
	MSander	20 (29) (-1Dw)	38 (31) (-1Dw)	23 (18)	13 (9)	9 (8)

' uncorrected for time

Table A7.3 INPUT DC+HC: Number and (%) of utterances of the deaf mothers, consisting of one representational symbol (R)

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	37 (35)	41 (35)	28 (23)	30 (18)
	MLaura	27 (44)	18 (23)	27 (27)	14 (13)	27 (16)
	MMark	8 (21)	35 (41)	40 (29)	37 (29)	23'(37)
Hearing children	MJonas	8 (21)	24 (19)	19 (14)	17 (11)	15 (16)
	MAlex	35 (27)	80 (53)	39 (29)	50 (31)	34 (23)
	MSander	11 (16)	18 (15)	28 (21)	18 (13)	20 (17)

' uncorrected for time

Table A7.4 INPUT DC+HC: R+R combinations in analyzable utterances of the mothers, plus Points alone

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla: total		107	117	120	163
	RS+RS		4 (4)[a]	9 (8)	27 (23)	30 (18)
	RW+RW	-	7 (7)	11 (9)	8 (7)	12 (7)
	RS+RS+RW+RW		5 (5)	17 (15)	32 (27)	48 (29)
						(-2s≠w)
	MLaura: total	61	78	100	112	166
	RS+RS	9 (15)	9 (12)	11 (11)	23 (21)	42 (25)
	RW+RW	4 (7)	6 (8)	11 (11)	0 (0)	9 (5)
	RS+RS+RW+RW	8 (13)	11 (14)	11 (11)	33 (30)	51 (31)
	MMark: total	39	86	136	126	63'
	RS+RS	8 (21)	9 (11)	19 (14)	34 (27)	4 (6)
	RW+RW	1 (3)	11 (13)	11 (8)	2 (2)	4 (6)
	RS+RS+RW+RW	3 (8)	9 (11)	20 (15)	16 (13)	18 (29)
Hearing children	MJonas: total	38	129	135	159	96
	RS+RS	1 (3)	5 (4)	5 (4)	9 (6)	11 (12)
	RW+RW	23 (61)	58 (45)	44 (33)	24 (15)	33 (34)
	RS+RS+RW+RW	4 (11)	19 (15)	41 (30)	86 (54)	20 (21)
	MAlex: total	132	151	134	160	147
	RS+RS	1 (0)	5 (3)	4 (3)	4 (3)	3 (2)
	RW+RW	69 (52)	33 (22)	30 (22)	47 (29)	36 (25)
	RS+RS+RW+RW	13 (10)	10 (7)	24 (18)	23 (14)	31 (21)
				(-4 s≠w)		(-2r≠w)
	MSander: total	70	124	131	137	115
	RS+RS	0 (0)	2 (2)	7 (5)	1 (0)	1 (1)
	RW+RW	33 (47)	41 (33)	36 (28)	33 (24)	40 (35)
	RS+RS+RW+RW	6 (9)	24 (19)	37 (28)	72 (53)	45 (39)
				(-4s≠w)	(-3s≠w)	(-4s≠w)

' uncorrected for time *r≠w = a sign and word combination*

[a] *Percentages are from total of analyzable utterances with different semantic content*

Table A7.5 INPUT DC+HC: Chi-square values for proportional use of DS and DS+R combinations by the deaf mothers

Age	Df	Chi-square value	significance
1;0	1	$\chi^2 = 19.01$	s
1;6	1	$\chi^2 = 19.84$	s
2'0	1	$\chi^2 = 17.52$	s
2;6	1	$\chi^2 = 12.66$	s
3;0	1	$\chi^2 = 7.21$	

p≤ 0.001

Table A7.6 OUTPUT DC+HC: Total number of analyzable utterances plus Points alone of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	38	80	58	89
	Laura	1	7	12	66	66
	Mark	0	21	29	66	41' 67*
Hearing children	Jonas	5	74	73	60	65
	Alex	7	19	63	50	51
	Sander	8	29	80	80	66

' uncorrected for time ** corrected for time*

Table A7.7 OUTPUT DC+HC: Number and (%) of category DS of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	22 (58)	22 (27)	9 (15)	13 (15)
children	Laura	0	3 (43)	6 (50)	14 (21)	13 (20)
	Mark	0	8 (38)	7 (24)	13 (20)	7' (17)
Hearing	Jonas	0	2	2	6	1
children			+dw: 6	+dw: 6	+dw: 1	+dw: 1
			tot:8 (11)	tot:8 (11)	tot:7 (11)	tot: 2 (3)
	Alex	0	2	0	2	3
			+dw: 6	+dw: 1	+dw: 4	+dw:1
			tot:8 (42)	tot:1 (2)	tot:6 (12)	tot:4 (8)
	Sander	1	16 (55)	10 (12)	8 (10)	3 (4)
		+dw: 1				
		tot:2 (25)				

Table A7.8 OUTPUT DC+HC: Number and (percentages) of category DS+R of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	8 (21)	22 (27)	18 (31)	46 (52)
children	Laura	0	0 (0)	1 (8)	19 (29)	22 (33)
	Mark	0	1 (5)	4 (14)	21 (32)	15' (37)
Hearing	Jonas	0	7 (9)	12 (16)	7 (12)	3 (5)
children	Alex	0	2 (11)	5 (8)	13 (26)	10 (20)
	Sander	0	5 (17)	20 (25)	9 (11)	7 (11)

'uncorrected for time

Table A7.9 OUTPUT DC+HC: Number and (percentages) of category DS and DS/R of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	30 (79)	45 (56)	27 (46)	60 (67)
children	Laura	0	3 (43)	7 (58)	33 (50)	35 (53)
	Mark	0	9 (43)	11 (38)	34 (52)	22' (54)
Hearing	Jonas	0	15*(20)	20*(27)	14*(23)	5* (8)
children	Alex	0	10*(53)	6*(10)	19*(38)	14*(28)
	Sander	2*(25)	21 (72)	30 (37)	17 (21)	10 (15)

'uncorrected for time
** including deictic words (alone or in combination with a word)*

Table A7.10 OUTPUT DC+HC: Number and (percentages) of category R of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	8 (21)	34 (43)	23 (40)	12 (14)
children	Laura	1 (100)	3 (43)	4 (33)	19 (29)	17 (26)
	Mark	0	11 (52)	12 (41)	10 (15)	7 (17)
Hearing	Jonas	5 (100)	56 (76)	29 (40)	13 (22)	10 (15)
children	Alex	7 (100)	9 (47)	46 (73)	10 (20)	16 (31)
	Sander	6 (75)	8 (28)	38 (48)	28 (35)	23 (35)

Tabel A7.11 OUTPUT DC+DC: Utterances of children, consisting of ≥2 RSRS

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	0	1 (1)	8 (14)	17 (19)
children	Laura	0	1 (14)	1 (8)	14 (21)	14 (21)
	Mark	0	1 (5)	6 (21)	22 (33)	12' (29)
Hearing	Jonas	0	0	4 (7)	3 (5)	8 (12)
children	Alex	0	0	0	0	1 (2)
	Sander	0	0	3 (4)	8 (10)	5 (8)

'uncorrected for time

Tabel A7.12 OUTPUT DC+HC: Utterances of children, consisting of ≥2 RW+RW

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	0	0	0	0
children	Laura	0	0	0	0	0
	Mark	0	0	0	0	0
Hearing	Jonas	0	3 (4)	20 (27)	30 (50)	42 (65)
children	Alex	0	0	11 (17)	21 (42)	20 (39)
	Sander	0	0	9 (11)	27 (34)	19 multi:9 tot: 28 (42)

Table A7.13 INPUT DC+HC: Noun ratio (Nouns / (Nouns +Verbs)) in SLN, NL and SC input of the deaf mothers to the deaf and hearing children at age 2;0.

INPUT	Mothers	SLN	NL	signed SC	spoken SC
Deaf	Mother of Carla	0/(0+4)	0/0	45/(45+12)	45/(45+15)
Children	Mother of Laura	1/(1+20)	0/(0+3)	19/(19+26)	14/(14+23)
	Mother of Mark	1/(1+11)	-	22/(22+42)	22/(22+35)
Hearing	Mother of Jonas	1/(1+0)	6/(6+4)	62/(62+59)	83/(83+73)
Children	Mother of Alex	2/(2+1)	4/(4+11)	48/(48+34)	54/(54+46)
	Mother of Sander	1/(1+2)	2/(2+2)	60/(60+14)	78/(78+49)

(-) means no utterances produced in this language mode

Table A7.14 OUTPUT DC+HC: Noun ratio – Nouns / (Nouns +Verbs) - in SLN, NL and SC output of the deaf and hearing children at age 2;0.

INPUT	Children	SLN	NL	signed SC	spoken SC
Deaf	Carla	24/(24+3)	4/(4+0)	9/(9+0)	11/(11+0)
Children	Laura	2/(2+4)	-	-	-
	Mark	0/(0+3)	-	-	-
Hearing	Jonas	2/(2+3)	21/(21+14)	2/(2+5)	17/(17+8)
Children	Alex	-	35/(35+8)	4/(4+0)	5/(5+2)
	Sander	9/(9+2)	7/(7+1)	31/(31+4)	36/(35+10)

(-) means no utterances produced in this language mode

Table A7.15 INPUT DC+HC: Total number ofsign tokens and types of the deaf mothers

INPUT	Mothers	1;0		1;6		2;0		2;6		3;0	
		tokens	types	tokens	types	tokens	types	tokens	types	tokens	types
Deaf	MCarla	-	-	110	40	175	51	237	86	309	102
Children	MLaura	92	25	113	46	148	47	287	90	376	118
	Mmark	58	22	143	45	226	48	271	93	238	110*
Hearing	MJonas	17	6	126	43	187	65	366	113	142	57
children	MAlex	93	34	134	61	164	52	217	76	217	76
	MSander	41	19	111	40	171	73	312	117	201	81

** corrected for time*

Table A7.16 INPUT DC+HC: TTR for signs

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla	-	36	29	36	33
Children	MLaura	(27)*	41	32	31	31
	MMark	(38)	31	21	34	46
Hearing	MJonas	(35)	35	35	31	40
children	MAlex	(37)	46	32	35	35
	MSander	(46)	36	43	38	40

** The number of sign types between brackets indicate that actually fewer than 100 tokens were produced*

Table A7.17 INPUT DC+HC: Chi square values of prorated sign types per deaf mothers across time

INPUT	Mothers	Df	Chi-square	signi.
Deaf	MCarla	3	$\chi^2 = 0.99$	ns
children	MLaura	4	$\chi^2 = 3.3$	ns
	MMark	4	$\chi^2 = 9.94$	ns
Hearing	MJonas	4	$\chi^2 = 1.16$	ns
children	MAlex	4	$\chi^2 = 3.09$	ns
	MSander	4	$\chi^2 = 1.55$	ns

p≤ 0.001 ns: not significant

Table A7.18 INPUT DC+HC: Chi-square values of prorated number of sign types of the deaf mothers per age of the children

Age	Df	Chi-square	sign.
1;0	4	$\chi^2 = 5.04$	ns
1;6	5	$\chi^2 = 3.68$	ns
2;0	5	$\chi^2 = 8.12$	ns
2;6	5	$\chi^2 = 1.13$	ns
3;0	5	$\chi^2 = 3.58$	ns

p≤ 0.001 ns: not significant

Table A7.19 INPUT DC+HC: New and repeated (rep.) sign types of the mothers

INPUT	Mothers		1;0	1;6	2;0	2;6	3;0	total of rep. types	total no. of types
Deaf	MCarla	new	-	40	38	61	67	48	254
children		rep.		-	13	25	35	(19%)	
	MLaura	new	25	36	28	67	83	51	290
		rep.	-	10	19	23	35	(18%)	
	MMark	new	22	36	29	65	49*	54	255
		rep.	-	9	18	28	61*	(21%)	
Hearing	MJonas	new	6	40	49	81	34	51	261
children		rep.	-	3	16	32	23	(20%)	
	MAlex	new	34	48	28	45	41	58	254
		rep.	-	13	24	31	35	(23%)	
	MSander	new	19	33	45	84	40	69	290
		rep.	-	7	28	33	41	(24%)	

** corrected for 10 min.*

Table A7.20 INPUT DC+HC: Word tokens and word types of the deaf mothers

INPUT	Mothers	1;0		1;6		2;0		2;6		3;0	
		tokens	types	tokens	types	tokens	types	tokens	types	tokens	types
Deaf	MCarla	-	-	113	47	158	57	194	84	246	95
children	MLaura	66	26	82	48	96	43	195	69	224	89
	MMark	33	20	94	39	149	41	108	51	159	98*
Hearing	MJonas	110	27	354	86	362	96	545	141	199	90
children	MAlex	280	64	241	89	239	89	305	109	315	104
	MSander	179	51	267	83	280	103	447	155	309	126

** corrected for time*

Table A7.21 INPUT DC+HC: TTR for words of the mothers

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla	-	42	36	43	39
children	MLaura	(39)*	(59)	(45)	35	40
	MMark	(61)	(42)	28	47	62
Hearing	MJonas	25	24	27	26	45
children	MAlex	23	37	37	36	33
	MSander	29	31	37	35	41

**The number of word types between brackets indicate that actually fewer than 100 tokens were produced.*

Table A7.22 INPUT DC+HC: Chi-square values of prorated word types of the deaf mothers across time

INPUT	Mothers	Df	Chi-square	sign.
Deaf	MCarla	3	$\chi^2 = 1.02$	ns
children	MLaura	4	$\chi^2 = 7.98$	ns
	MMark	4	$\chi^2 = 16.14$	s*
Hearing	MJonas	4	$\chi^2 = 10.52$	ns
children	MAlex	4	$\chi^2 = 4.23$	ns
	MSander	4	$\chi^2 = 2.62$	ns

*p≤ 0.001 *p ≤ 0.005 s: significant ns: not significant*

Table A7.23 INPUT DC+HC: Chi-square values of prorated number of word types of the deaf mothers per age of the children

Age	Df	Chi-square	sign.
1;0	4	$\chi^2 = 27.43$	s
1;6	5	$\chi^2 = 18.14$	s*
2;0	5	$\chi^2 = 6.31$	ns
2;6	5	$\chi^2 = 7.19$	ns
3;0	5	$\chi^2 = 11.4$	ns

*p≤ 0.001 *p≤ 0.005 s: significant ns: not significant*

Table A7.24 INPUT DC+HC: New and repeated (rep.) word types of the mothers

INPUT	Mothers		1;0	1;6	2;0	2;6	3;0	total of rep. types	total no. of types
Deaf children	MCarla	new	-	47	42	57	58	58	263
		rep.		-	16	27	37	(22%)	
	MLaura	new	26	38	28	52	60	49	253
		rep.	-	10	15	17	29	(19%)	
	MMark	new	20	33	25	35	54*	63	230
		rep.	-	6	16	16	44	(27%)	
Hearing children	MJonas	new	27	67	49	89	44	91	367
		rep.	-	19	47	52	44	(25%)	
	MAlex	new	64	59	43	42	51	102	361
		rep.	-	30	46	67	53	(28%)	
	MSander	new	51	57	52	102	57	129	448
		rep.	-	26	51	53	69	(29%)	

** corrected for time*

Table A7.25 OUTPUT DC+HC: Total number of SIGN tokens and types of the deaf and hearing children in the linguistic utterances.

OUTPUT	Children	1;0		1;6		2;0		2;6		3;0	
		tokens	types	tokens	types	tokens	types	tokens	types	tokens	types
Deaf children	Carla	-	-	17	10	66	23	65	29	106	61
	Laura	1	1	7	4	15	11	124	49	117	41
	Mark	3	1	19	12	49	14	131	46	118*	49*
Hearing children	Jonas	0	0	45	15	26	9	63	25	68	29
	Alex	5	3	3	3	6	4	5	3	28	5
	Sander	0	0	6	3	67	40	122	40	91	43

** corrected for time*

Table A7.26 OUTPUT DC+HC: Chi Square values for sign types pro-rated to a 100 tokens, per child over time

OUTPUT	Children	Df	Chi-square	sign.
Deaf children	Carla	3	$\chi^2 = 7.97$	ns
	Laura	4	$\chi^2 = 45.86$	s
	Mark	4	$\chi^2 = 20$	s
Hearing children	Jonas	3	$\chi^2 = 1.69$	ns
	Alex	4	$\chi^2 = 57.27$	s
	Sander	3	$\chi^2 = 20.85$	s

p≤0.001 s: significant ns: non-significant

Table A7.27 OUTPUT DC+HC: Chi-square values for sign types prorated to a 100 tokens of the children per age group

Age	Df	Chi-square	sign.
1;0	4	$\chi^2 = 187.54$	s
1;6	5	$\chi^2 = 40.53$	s
2;0	5	$\chi^2 = 36.96$	s
2;6	5	$\chi^2 = 11.16$	ns
3;0	5	$\chi^2 = 22.06$	s

p≤0.001

Table A7.28 OUTPUT DC+HC: New and repeated sign types

OUTPUT	Children		1;0	1;6	2;0	2;6	3;0	total rep. types	total no. of sign types
Deaf	Carla	new	-	10	21	23	43	22 (19)	119
children		rep.		-	2	6	18		
	Laura	new	1	4	9	46	34	7 (7)	101
		rep.	-	0	2	3	7		
	Mark	new	1	11	9	39	28*	22 (20)	110
		rep.	-	1	5	7	21*		
Hearing	Jonas	new	0	15	6	20	22	9 (13)	72
children		rep.	0	0	3	5	7		
	Alex	new	3	3	4	3	3	2 (11)	18
		rep.	0	0	0	0	2		
	Sander	new	0	3	38	33	30	16 (13)	120
		rep.	0	0	0	7	13		

**corrected for 10 min.*

Table A7.29 OUTPUT DC+HC: Total number of word tokens and types of the deaf and hearing children in linguistic utterances.

OUTPUT	Children	1;0		1;6		2;0		2;6		3;0	
		tokens	types	tokens	types	tokens	types	tokens	types	tokens	types
Deaf	Carla	-	-	6	3	33	7	14	5	27	20
children	Laura	0	0	1	1	0	0	6	6	16	10
	Mark	0	0	2	2	1	1	4	3	0	0
Hearing	Jonas	5	3	103	22	123	48	139	62	259	88
children	Alex	5	3	22	9	127	43	103	31	123	47
	Sand	7	4	15	9	82	54	123	66	135	70

Table A7.30 Chi-square values for word types prorated for a 100 tokens per child over time

OUTPUT	Children	Df	Chi-square	sign.
Deaf	Carla	3	$\chi^2 = 33.66$	ns
children	Laura	4	$\chi^2 = 191.06$	s
	Mark	4	$\chi^2 = 190.91$	s
Hearing	Jonas	4	$\chi^2 = 20.68$	s
children	Alex	4	$\chi^2 = 13.11$	ns
	Sander	4	$\chi^2 = 2.08$	ns

$p \leq 0.001$ s: significant ns: non-significant

Table A7.31 OUTPUT DC+HC: Chi-square values for prorated word types per age group of the children

Age	Df	Chi-square	sign.
1;0	4	$\chi^2 = 118.16$	s
1;6	5	$\chi^2 = 83.18$	s
2;0	5	$\chi^2 = 143.03$	s
2;6	5	$\chi^2 = 60.29$	s
3;0	5	$\chi^2 = 77.54$	s

$p \leq 0.001$ s: significant

Table A7.32 OUTPUT DC+HC: Chi-square values for prorated word types for deaf children versus hearing children

Age	Df	Chi-square	sign.
1;0	1	χ^2 =177	s
1;6	1	χ^2 = 44.04	s
2;0	1	χ^2 = 2.49	ns
2;6	1	χ^2 = 19.78	s
3;0	1	χ^2 = .54	ns

p≤0.001 s: significant ns: non-significant

Table A7.33 OUTPUT DC+HC: New and repeated word types

OUTPUT	Children		1;0	1;6	2;0	2;6	3;0	total rep. types	total no. of word types
Deaf children	Carla	new	-	3	6	4	17	3 (9)	33
		rep.		0	1	1	3		
	Laura	new	0	1	0	6	7	3 (18)	17
		rep.		0	0	0	3		
	Mark	new	0	2	1	3	0	0 (0)	6
		rep.		0	0	0	0		
Hearing children	Jonas	new	3	20	37	48	53	48 (23)	209
		rep.		2	11	14	35		
	Alex	new	3	7	39	20	26	32 (25)	127
		rep.		2	4	11	21		
	Sander	new	4	9	47	55	46	42 (21)	203
		rep.		0	7	11	24		

Table A7.34 OUTPUT DC+HC: Cumulative sign vocabulary of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	10	31	54	97
	Laura	1	5	14	60	94
	Mark	1	12	21	60	88
Hearing children	Jonas	0	15	21	41	63
	Alex	3	6	10	13	16
	Sander	0	3	41	74	104

Table A7.35 OUTPUT DC+HC: Cumulative word vocabulary of the children

OUTPUT	Children	1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	-	3	9	13	30
	Laura	0	1	1	7	14
	Mark	0	2	3	6	6
Hearing children	Jonas	3	23	60	108	161
	Alex	3	10	49	69	95
	Sander	4	13	47	115	161

Key to Tables A7.38 - A7.47

S = sign occurring alone
W = word occurring alone
S/W = sign and word co-occurring
S+W = category 1
S+S/W = category 2
W+S/W = category 3
S+W+S/W = rest
() in row "total types" is the percentage without lexical equivalence

Table A7.36 INPUT DC: Lexical Equivalence of Mother of Carla

	1;0	1;6	2;0	2;6	3;0
S+W	-	0	0	0	0
S+S/W	-	1	5	7	16
W+S/W	-	0	2	9	1
S+W+S/W	-	1	2	4	5
total types	-	86 (98)	108 (92)	170 (88)	196 (89)

Table A7.37 INPUT DC: Lexical Equivalence of Mother of Laura

	1;0	1;6	2;0	2;6	3;0
S+W	0	1	0	0	2
S+S/W	4	9	10	13	22
W+S/W	0	1	0	5	0
S+W+S/W	0	0	2	0	2
total types	51 (92)	94 (88)	89 (87)	159 (89)	207 (87)

Table A7.38 INPUT DC: Lexical Equivalence of Mother of Mark

	1;0	1;6	2;0	2;6	3;0*
S+W	0	0	1	1	3
S+S/W	5	8	9	14	13
W+S/W	0	1	0	1	2
S+W+S/W	0	3	1	0	0
total types	42 (88)	83 (86)	86 (87)	143 (89)	208 (91)

**corrected for time*

Table A7.39 INPUT HC: Lexical Equivalence of Mother of Jonas

	1;0	1;6	2;0	2;6	3;0
S+W	1	0	0	1	1
S+S/W	0	2	2	14	5
W+S/W	4	10	24	17	12
S+W+S/W	0	2	1	6	5
total types	33 (85)	129 (89)	161 (83)	253 (85)	146 (84)

Table A7.40 INPUT HC: Lexical Equivalence of Mother of Alex

	1;0	1;6	2;0	2;6	3;0
S+W	0	2	2	0	0
S+S/W	0	5	4	9	4
W+S/W	13	17	7	18	15
S+W+S/W	2	2	4	5	4
total types	98 (85)	149 (83)	141 (88)	183 (83)	180 (87)

Table A7.41 INPUT HC: Lexical Equivalence of Mother of Sander

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	1	0	4
S+S/W	1	1	0	3	6
W+S/W	5	15	14	18	12
S+W+S/W	1	2	4	2	6
total types	47 (85)	123 (85)	175 (89)	273 (92)	206 (86)

Table A7.42 OUTPUT DC: Lexical Equivalence in output of Carla

	1;0	1;6	2;0	2;6	3;0
S+W	-	0	3	0	1
S+S/W	-	1	1	1	3
W+S/W	-	0	1	0	1
S+W+S/W	-	0	0	0	0
total types	-	13 (92)	30 (83)	34 (97)	80 (95)

Table A7.43 OUTPUT DC: Lexical Equivalence in output of Laura

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	0	0	0
S+S/W	0	0	0	3	5
W+S/W	0	0	0	0	0
S+W+S/W	0	0	0	0	0
total types	1 (100)	5 (100)	11 (100)	55 (95)	51 (90)

Table 7.44 OUTPUT DC: Lexical Equivalence in output of Mark

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	0	0	0
S+S/W	0	1	0	2	0
W+S/W	0	0	0	0	0
S+W+S/W	0	0	0	0	0
total types	1 (100)	14 (93)	15 (100)	49 (100)	49* (100)

** corrected for time*

Table A7.45 OUTPUT HC: Lexical Equivalence in output of Jonas

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	2	2	0
S+S/W	0	0	1	1	0
W+S/W	0	3	2	3	7
S+W+S/W	0	3	1	3	3
total types	3 (100)	37 (84)	57 (89)	87 (90)	117 (92)

Table A7.46 OUTPUT HC: Lexical Equivalence in output of Alex

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	1	0	0
S+S/W	0	0	0	1	0
W+S/W	0	0	0	1	1
S+W+S/W	1	0	0	0	2
total types	6 (83)	12 (100)	38 (97)	34 (94)	52 (94)

Table A7.47 OUTPUT HC: Lexical Equivalence in output of Sander

	1;0	1;6	2;0	2;6	3;0
S+W	0	0	0	4	5
S+S/W	0	0	3	4	3
W+S/W	0	1	2	3	4
S+W+S/W	0	0	1	3	1
total types	4 (100)	12 (92)	94 (94)	106 (87)	113 (89)

APPENDIX TO CHAPTER 8

Table A8.1 INPUT DC+HC: Number and % of declaratives, interrogatives and imperatives in SLN, NL and SC input to the deaf and hearing children pooled over time

	Mothers	SLN			NL			SC		
		D	Q	I	D	Q	I	D	Q	I
Deaf	MCarla	33	14	14	2	0	0	371	32	17
		(54)	(23)	(23)	(100)			(88)	(8)	(4)
children	MLaura	96	25	18	1	0	0	254	65	26
		(69)	(18)	(13)	(100)			(74)	(19)	(7)
	MMark	112	33	25	0	0	0	184	48	38
		(66)	(19)	(15)				(68)	(18)	(14)
Hearing	MJonas	22	7	0	48	11	17	341	99	18
		(76)	(24)		(63)	(15)	(22)	(75)	(22)	(4)
children	MAlex	21	1	0	59	20	65	374	71	96
		(95)	(5)		(41)	(14)	(45)	(69)	(13)	(18)
	MSander	5	5	1	32	11	17	325	94	29
		(45)	(45)	(10)	(53)	(18)	(28)	(72)	(21)	(6)

Table A8.2 INPUT DC + HC: Number and (%) of labeling utterances from deaf mothers; % are of total of analyzable utterances in SLN, NL and SC (-) = no input in that language mode

SLN Input	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla		2 (15)	0	0	0
Children	MLaura	2 (14)	5 (21)	0	1 (6)	1 (2)
	MMark	0	2 (6)	0	5 (8)	0
Hearing	MJonas	-	0	2 (40)	0	0
Children	MAlex	1 (100)	1 (14)	1 (25)	1 (13)	1 (50)
	MSander	-	0	1 (25)	0	0
NL Input	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla		0	1 (100)	-	-
Children	MLaura	-	0	0	-	-
	MMark	-	-	-	-	-
Hearing	MJonas	6 (23)	8 (30)	1 (13)	0	0
Children	MAlex	3 (6)	12 (24)	0	0	1 (8)
	MSander	6 (29)	9 (60)	2 (29)	0	1 (7)
SC Input	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	MCarla		60 (75)	41 (44)	25 (24)	29 (27)
Children	MLaura	4 (9)	13 (29)	3 (6)	14 (16)	3 (3)
	MMark	9 (43)	11 (22)	5 (5)	14 (24)	2 (4)
Hearing	MJonas	2 (17)	32 (36)	21 (18)	2 (1)	2 (3)
Children	MAlex	17 (22)	16 (18)	15 (14)	11 (8)	18 (14)
	MSander	4 (9)	34 (33)	38 (34)	12 (9)	2 (2)

Table A8.3 OUTPUT DC+HC: Number and % of declaratives, interrogatives and imperatives in SLN, NL and SC output of the deaf and hearing children pooled over time

	Children	SLN			NL			SC		
		D	Q	I	D	Q	I	D	Q	I
Deaf	Carla	139	5	2	2	0	0	9	0	0
		(95)	(3)	(1)	(100)			(100)		
children	Laura	107	2	1	1	0	0	13	0	0
		(97)	(2)	(1)	(100)			(100)		
	Mark	112	12	1	1	0	0	3	0	0
		(90)	(10)	(-)	(100)			(100)		
Hearing	Jonas	22	0	1	108	8	5	119	4	2
		(96)		(4)	(89)	(7)	(4)	(95)	(3)	(2)
children	Alex	7	1	1	101	13	1	44	2	3
		(78)	(11)	(11)	(88)	(11)	(-)	(90)	(4)	(6)
	Sander	31	2	0	40	1	0	147	5	1
		(94)	(6)		(98)	(2)		(96)	(3)	(-)

Table A8.4 INPUT DC + HC: Number and (%) of labeling utterances of the deaf and hearing children; % are of total of analyzable utterances in SLN, NL and SC (-) = no output in that language mode

SLN output	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla		6 (75)	23 (56)	9 (21)	20 (36)
Children	Laura	-	1 (33)	0	7 (14)	9 (19)
	Mark	-	2 (17)	0	7 (13)	4 (10)
Hearing	Jonas	-	8 (73)	2 (40)	0	0
Children	Alex	1 (20)	3 (100)	-	0	-
	Sander	-	-	8 (61)	1 (10)	1 (10)
NL output	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla		1 (100)	4 (100)	2 (100)	0
Children	Laura	-	-	-	-	-
	Mark	-	1 (100)	-	-	-
Hearing	Jonas	3 (60)	15 (44)	15 (34)	0	1 (5)
Children	Alex	0	1 (7)	15 (29)	4 (10)	7 (78)
	Sander	5 (71)	6 (63)	6 (60)	2 (40)	0
SC output	Children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla		7 (70)	11 (85)	0	8 (38)
Children	Laura	-	0	-	0	0
	Mark	-	-	0	1 (33)	-
Hearing	Jonas	-	13 (46)	9 (41)	0	0
	Alex	0	-	6 (55)	0	7 (26)
	Sander	-	5 (83)	30 (61)	11 (20)	0

APPENDIX TO CHAPTER 9

Procedures to calculate Mean Length of Utterance and MLUL10 (see section 9.1)

The Mean Length of Utterances in signs of the SLN input and output (**SLN-MLU**) was calculated as follows:

- Only analyzable SLN utterances (see section 5.1) *and* utterances coded as 'Point alone' were included in the analysis (so excluding vocatives, minors and unintelligible utterances).
- All deictic and representational signs count as signs (this means that MOV's (and incomprehensible signs) are excluded from the analysis)
- Utterances consisting of a Point and one representational sign *referring to the same referent* form a distinct class. As the pointing gesture actually selects and thus defines the object, person, location or action that the representational sign refers to, the two signs are considered to form one sign. In example (1) we indicate how we counted the number of signs:

  (1) POINTpicture of church in book CHURCH (that is a church)
  0 1

- In other cases, where the Point and the sign refer to the same referent but the representational sign is used attributively or predicatively while the Point refers to the referent itself, the Point and the sign count as two signs:

  (2) POINTcar DRIVE (that car is driving)
  1 1

- If a sign is repeated immediately after its first occurrence it is ignored for the MLU. If, however, there is a representational or a deictic sign between the two occurrences of a particular sign they are both counted.
- In enumerations only the first two items are counted as in example (3):

  (3) [ML 2;6]
  PAPA MAMA JONAS LAURA MARK ALLEMAAL ZWEMMEN
  DAD MOM JONAS LAURA MARK ALL SWIM
  1 1 0 0 0 1 1

  (Daddy and mummy, Jonas, Laura and Mark, we all went swimming)

  The utterance in example (3) consists of 4 signs.
- Special cases:

NEG - a headshake counts as one sign, except when uttered simultaneously with the signs *NOT, NEVER, NONE* etc., in which cases it is disregarded. When produced simultaneously with the sign *KAN-NIET* 'CAN-NOT' it is counted separately.
NOD - a head nod counts always as one sign
PU - (palm(s)-up) counts as one sign
OH - (expression of surprise, hand before mouth, widened eyes) counts as one sign

The mean length of utterances in words of the NL input and output (**NL-MLU**) was established as follows:

- Only analyzable NL utterances are included in the analysis
- Vocalizations in analyzable utterances are ignored
- Proper names consisting of two terms (e.g. *Zwarte Piet*, *tante Gerda*) are considered one word.
- If a word is repeated immediately after it first occurrence it is ignored.
- In enumarations only the first two items are counted, the following items are ignored.
- Special cases:
  dm - Discourse markers like *oh, eh, nou* 'now' etc., are counted as one word. We decided to include these because we expect them to be used with and by the hearing children, but not with or by the deaf children.
  brr - words like *brr* (sound of car) *boem* (when an object falls) or *pom* (sound of drum) are considered to be words in early mother-child interaction.

To establish the MLU in signs and words of SC utterances that are considered to form one unit (**SC-MLU**) the following rules were followed:

- A solitary sign (i.e. without a simultaneously uttered word) within a SC utterance is counted as one sign, a solitary word (without a simultaneously uttered sign) also
- If a sign in a SC utterance is produced simultaneously with a word *with the same semantic content*, then the sign+word is counted as one sign/word.
  The utterance in example (4) has two signs/words:

(4) *PAKKEN BOEK* (take the book)
pak
TAKE BOOK
take
1 1

- If a sign is produced simultaneously with a word *with different semantic content* then the sign+word are counted as two signs/words:

(5) *POINTbuiten FIETS* (outside is a red bicycle)
rood

POINToutside BICYCLE
red
1 1+1

The utterance in example (5) has three signs/words.
We will give another example in (6)

(6) *POINTboek BOEK LEZEN KLAAR HUIS BOUWEN*
als boek lezen klaar dan gaan wij huis bouwen
POINTbook BOOK READ FINISH HOUSE BUILD
when book read finish then go we house build
1+1 1 1 1 1 1 1 1 1
(When we have finished reading the book, then we will build a house)

The signed part in example (6) contains 6 signs, 5 with a simultaneously spoken word with same semantic content, and 1 Point produced simultaneously with a word with different semantic content. The spoken part contains 9 words, 5 with a simultaneously uttered sign with same semantic content, 1 with a sign with different semantic content and 3 without a sign. This comes to a total of 10 signs/words in this SC utterance.

- For Deictic Signs (Points) combined with one representational sign and/or word the following rules apply:
  a) Point and word have the same referent; they count as one l sign/word:

(7) POINTpicture of train (that is a train)
train
1

(8) POINTto train (that one)
that
1

b) Point is combined with a sign and a word which have the same semantic content; they count as one sign/word:

(9) POINTpicture-of- train TRAIN (that is a train)
train
0 1

c) Point is combined with an attributive or predicative sign/word (two signs/words):

(10) POINTcar (that one is driving)
drive
1+1

(11) POINTbicycle (that one is red)
red
1+1

d) When the Point and the representational sign and word have different semantic content, they are all counted as separate signs/words:

(12) POINTmother SEARCH (I am searching for the ball)
ball
1 1+1

In this case the SC utterance has three signs/words.

- Special cases:
brr - When words like *brr* or *boem* occur simultaneously with a signed verb of motion like 'DRIVE' or 'FALL' they are considered to be part of SLN and are not considered words in SC utterances (but note the definitions for NL-MLU).
NEG -when a headshake is produced simultaneously with a spoken or mouthed negation (e.g. *niet* 'not', *geen* 'no', *nooit* 'never' etc.) the headshake is ignored as a sign.
NOD - a head nod produced simultaneously with words of emphasis or affirmation like *wel* 'díd', *al* 'already' or *ook* 'also' is ignored as a sign.

Table A9.1 INPUT DC+HC: MLUL10 for SLN utterances of the deaf mothers

SLN INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla		1.3	1.6	1.5	2.5
	MLaura	1.4	2.4	2.9	2.9	3.6
	MMark	1.7	1.8	2.6	4.2	1.6
Hearing children	MJonas	-	1.0	1.3	-	1.5
	MAlex	-	1.1	1.0	-	-
	MSander	-	-	1.0	-	-

- fewer than 10 utterances

Table A9.2 INPUT DC: NL-MLU of the deaf mothers with the deaf children

NL INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	(1.0)*	(1.1)	0	0
	MLaura	0	(2.0)	(2.5)	0	0
	MMark	0	0	0	0	0

Table A9.3 INPUT DC+HC: MLUL10 for NL utterances of the mothers

NL INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla		-	-	0	0
	MLaura	0	-	-	0	0
	MMark	0	0	0	0	0
Hearing children	MJonas	2.1	3.1	-	-	2.4
	MAlex	2.2	2.6	2.4	1.9	1.3
	MSander	2.8	1.9	-	-	1.9

- = fewer than 10 utterances

Table 9.4 INPUT DC+HC: MLU for SC utterances of the mothers

SC INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	1.6	1.9	2.6	2.5
	MLaura	1.9	2.4	2.6	3.4	2.5
	MMark	1.8	2.2	2.3	3.1	3.0
Hearing children	MJonas	3.2	3.3	3.4	4.3	3.0
	MAlex	2.2	1.9	2.2	2.6	2.7
	MSander	2.7	2.5	2.7	3.8	3.7

Table A9.5 INPUT DC+HC: MLUL10 for SC utterances of the mothers

SC INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	MCarla	-	3.3	3.8	5.8	2.5
	MLaura	3.2	4.3	4.7	7.5	5.6
	MMark	2.6	2.7	4.3	6.5	5.6
Hearing children	MJonas	3.5	6.3	8.3	10.6	5.8
	MAlex	4.0	3.9	4.5	6.1	6.4
	MSander	4.3	4.7	5.6	9.0	6.9

- no information available

*Table A9.6 INPUT DC+HC: **MLU-s** for the signed part and **MLU-w** for the spoken part in SC utterances of the deaf mothers*

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf children	**MLU-s**					
	MCarla	-	1.4	1.6	2.3	2.2
	MLaura	1.7	2.1	2.3	3.3	2.9
	MMark	1.6	1.8	2.1	3.0	2.6
Hearing children	MJonas	1.5	1.8	2.1	3.1	2.1
	MAlex	1.4	1.5	1.6	1.9	2.0
	MSander	1.5	1.6	1.9	2.8	2.4

INPUT	Mothers	1;0	1;6	2;0	2;6	3;0
Deaf	**MLU-w**					
children	MCarla	-	1.3	1.5	1.7	1.7
	MLaura	1.4	1.5	1.6	1.8	1.9
	MMark	1.4	1.6	1.5	1.6	1.9
Hearing	MJonas	3.1	3.1	2.8	3.6	2.3
children	MAlex	2.0	1.6	1.7	2.0	2.0
	MSander	2.3	1.9	2.2	3.2	2.8

Table A9.7 OUTPUT DC+HC: MLU L10 of SLN utterances of the children

OUTPUT	children	1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	1.5	1.7	3.1	3.4
children	Laura	0	0	1.5	3.5	3.7
	Mark	0	1.1	2.4	3.9	3.7
Hearing	Jonas	0	1.0	0	0	0
children	Alex	0	0	0	0	0
	Sander	0	1.0	1.2	1.5	1.5

Table A9.8 MLU L10 of NL utterances of the children

		1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	0	0	0	0
children	Laura	0	0	0	0	0
	Mark	0	0	0	0	0
Hearing	Jonas	0	1.4	2.9	3.1	2.6
children	Alex	0	1.2	2.9	2.2	2.2
	Sander	0	0	1.2	0	1.8

Table A9.9 MLU of SC utterances of the children

		1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	1.4	1.2	(1.4)	2.0
children	Laura	0	(2.0)	0	(2.5)	(2.7)
	Mark	0	0	(1.0)	(2.7)	0
Hearing	Jonas	0	1.2	2.1	3.4	4.2
children	Alex	(1.0)	0	1.5	(3.1)	3.0
	Sander	0	(1.3)	1.6	2.7	2.7

** Use of brackets indicates that fewer than 10 utterances were produced*

Table A9.10 MLUL10 of SC utterances of the children

		1;0	1;6	2;0	2;6	3;0
Deaf	Carla	-	1.4	1.2	0	2.8
children	Laura	0	0	0	0	0
	Mark	0	0	0	0	0
Hearing	Jonas	0	1.5	3.0	5.4	7.5
children	Alex	0	0	1.9	0	4.5
	Sander	0	0	3.1	4.8	4.5

Table 9.11 ***MLU-s*** *for the signed part and* ***MLU-w*** *for the spoken part in SC utterances of the children*

			1;0	1;6	2;0	2;6	3;0
Deaf children	Carla	MLU-s	-	(1.1)	1.0	(1.2)	1.8
		MLU-w	-	(1.0)	1.0	(1.0)	1.1
	Laura	MLU-s	0	(1.0)	0	(2.3)	(2.5)
		MLU-w	0	(1.1)	0	(1.1)	(1.5)
	Mark	MLU-s	0	0	(1.0)	(2.7)	0
		MLU-w	0	0	(1.0)	(1.0)	0
Hearing children	Jonas	MLU-s	0	1.0	1.1	1.8	1.8
		MLU-w	0	1.1	1.8	2.7	3.9
	Alex	MLU-s	(1.0)	0	1.0	(1.0)	1.3
		MLU-w	(1.0)	0	1.2	(2.7)	2.2
	Sander	MLU-s	0	(1.2)	1.2	1.6	1.6
		MLU-w	0	(1.0)	1.3	2.0	2.3

** Use of brackets indicates that fewer than 10 utterances were produced*

Table A9.12 INPUT DC: Number and (%)s of SLN and NL utterances with a verb of Mother of Carla

INPUT	1;0	1;6	2;0	2;6	3;0
SLN					
tot. utterances	-	12	17	13	18
Utt + verb	-	1 (8)	4 (24)[a]	2 (15)	7 (39)
NL	-				
tot. utterances		1	1	0	0
utt + verb	-	0	0	0	0

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.13 INPUT DC: Number and (%) of SLN and NL utterances with a verb of Mother of Laura

INPUT	1;0	1;6	2;0	2;6	3;0
SLN					
tot. utterances	14	24	35	19	49
Utt + verb	1 (7)	7 (24)	18 (51)	2 (11)	23 (47)
NL					
tot. utterances	0	2	2	0	0
utt + verb	0	1 (50)	2 (100)	0	0

Table A9.14 INPUT DC: Number and (%) of SLN and NL utterances with a verb of Mother of Mark

INPUT	1;0	1;6	2;0	2;6	3;0*
SLN					
tot. utterances	17	32	40	63	15
Utt + verb	3 (18)	17 (53)	13 (33)	20 (32)	4 (27)
NL					
tot. utterances	0	0	0	0	0
utt + verb					

** uncorrected for time*

Table A9.15 INPUT HC: Number and (%) of SLN and NL utterances with a verb of Mother of Jonas

INPUT	1;0	1;6	2;0	2;6	3;0
SLN					
tot. utterances	0	5	5	9	10
Utt + verb	0	2 (40)	1 (20)	7 (78)	7 (70)
NL					
tot. utterances	26	27	8	5	11
utt + verb	14 (54)	10 (37)	4 (50)	1 (20)	4 (36)

Table A9.16 INPUT HC: Number and (%) of SLN and NL utterances with a verb of Mother of Alex

INPUT	1;0	1;6	2;0	2;6	3;0
SLN					
tot. utterances	1	7	4	8	2
Utt + verb	0	5 (83)	1 (25)	3 (38)	0
NL					
tot. utterances	53	51	15	13	12
utt + verb	40 (75)	16 (31)	10 (67)	5 (38)	3 (25)

Table A9.17 INPUT DC: Number and (%)(of SLN and NL utterances with a verb of Mother of Sander

INPUT	1;0	1;6	2;0	2;6	3;0
SLN					
tot. utterances	0	1	4	1	5
Utt + verb	0	0	2 (50)	0	1 (20)
NL					
tot. utterances	21	15	7	3	14
utt + verb	11 (52)	6 (40)	2 (29)	2 (67)	9 (64)

Table A9.18 INPUT DC: SC utterances with and without verbs of Mother of Carla

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	-	74 (93)	80 (84)	75 (72)	92 (65)
+Vsln -Vnl	-	0	1 (1)	5 (5)	10 (7)
-Vsln +Vnl	-	2 (2)	4 (4)	4 (4)	10 (7)
+Vsln +Vnl	-	4 (5)	10 (11)	20 (19)	29 (21)
subtotal	-	*6 (7)*	*15 (16)*	*29 (28)*	*49 (35)*
tot.SC utt.	-	80	95	104	141

Table A9.19 INPUT DC: SC utterances with and without verbs of Mother of Laura

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	20 (47)	27 (60)	29 (52)	64 (73)	41 (37)
+Vsln -Vnl	3 (7)	3 (7)	4 (7)	9 (10)	23 (21)
-Vsln +Vnl	1 (2)	3 (7)	1 (2)	1 (1)	2 (2)
+Vsln +Vnl	19 (44)	12 (27)	22 (39)	14 (16)	45 (41)
subtotal	*23 (53)*	*18 (40)*	*27 (48)*	*24 (27)*	*70 (63)*
tot.SC utt.	43	45	56	88	111

Table A9.20 INPUT DC: SC utterances with and without verbs of Mother of Mark

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	11 (52)	31 (62)	58 (61)	39 (67)	24 (50)
+Vsln -Vnl	3 (14)	4 (8)	8 (8)	7 (12)	9 (19)
-Vsln +Vnl	0	6 (12)	0	0	2 (4)
+Vsln +Vnl	7 (33)	9 (18)	29 (31)	12 (21)	13 (27)
subtotal	*10 (48)*	*19 (38)*	*37 (39)*	*19 (33)*	*24 (50)*
tot.SC utt.	21	50	95	58	48

Table A9.21 INPUT HC: SC utterances with and without verbs of Mother of Jonas

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	5 (42)	39 (44)	52 (46)	42 (30)	31 (43)
+Vsln -Vnl	0	1 (1)	3 (3)	5 (4)	5 (7)
-Vsln +Vnl	7 (58)	27 (30)	15 (13)	23 (16)	10 (14)
+Vsln +Vnl	0	22 (25)	44 (39)	72 (51)	26 (36)
subtotal	*7 (58)*	*50 (56)*	*62 (54)*	*100 (70)*	*41 (56)*
tot.SC utt.	12	89	114	142	72

Table A9.22 INPUT HC: SC utterances with and without verbs of Mother of Alex

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	40 (51)	57 (64)	69 (63)	86 (63)	91 (70)
+Vsln -Vnl	0	4 (4)	1 (1)	8 (6)	7 (5)
-Vsln +Vnl	20 (26)	4 (4)	8 (7)	5 (4)	5 (4)
+Vsln +Vnl	18 (23)	24 (27)	31 (28)	38 (28)	28 (21)
subtotal	*38 (49)*	*32 (36)*	*41 (37)*	*51 (37)*	*40 (30)*
tot.SC utt.	78	89	109	137	131

Table A9.23 INPUT HC: SC utterances with and without verbs of Mother of Sander

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	22 (47)	59 (58)	71 (63)	48 (37)	43 (46)
+Vsln -Vnl	2 (4)	2 (2)	1 (-)	3 (2)	3 (3)
-Vsln +Vnl	13 (28)	37 (36)	27 (24)	32 (24)	13 (14)
+Vsln +Vnl	10 (21)	5 (5)	14 (13)	48 (37)	35 (37)
subtotal	*25 (53)*	*44 (42)*	*42 (37)*	*93 (63)*	*51 (54)*
tot.SC utt.	47	103	113	131	94

Table A9.24 INPUT DC: Number and (%) of SC utterances without a verb: Mother of Carla

SC utt: -verb	1;0	1;6	2;0	2;6	3;0
Total –verb	-	74	80	75	92
*nl	-	3 (4)	7 (9)	14 (19)	15 (16)
*sln	-	0	3 (4)	2 (3)	0
nl=1 const.	-	71 (96)	73 (91)	61 (81)	77 (84)
sln=1 const.	-	39 (53)	37 (46)	44 (59)	47 (51)

**nl means : ungrammatical Dutch, categories 2, 3 and 4:*
2= copula is omitted
3= auxiliary is omitted
4= other verb omitted
**sln means ungrammatical SLN, categories 3 and 4*

Table A9.25 INPUT DC: Number and (5) of SC utterances without a verb: Mother of Laura

SC utt: -verb	1;0	1;6	2;0	2;6	3;0
Total –verb	20	27	29	64	41
*nl	0	2 (7)	3 (10)	16 (25)	6 (15)
*sln	0	1 (4)	1 (3)	0	0
nl=1 const.	20	25 (93)	26 (90)	48 (75)	35 (85)
sln=1 const.	17 (85)	7 (26)	12 (41)	16 (15)	16 (39)

Table A9.26 INPUT DC: Number and (%) of SC utterances without a verb: Mother of Mark

SC utt: -verb	1;0	1;6	2;0	2;6	3;0'
Total –verb	11	31	58	39	23
*nl	1 (9)	2 (6)	5 (9)	2 (5)	4 (17)
*sln	0	1 (3)	2 (3)	0	0
nl=1 const.	10 (91)	29 (94)	53 (91)	37 (95)	19 (83)
sln=1 const.	5 (56)	16 (52)	27 (47)	19 (49)	12 (52)

' uncorrected for time

Table A9.27 INPUT HC: Number and (%) of SC utterances without a verb: Mother of Jonas

SC utt: -verb	1;0	1;6	2;0	2;6	3;0
Total –verb	5	39	52	42	31
*nl	1 (40)	7 (18)	8 (15)	10 (24)	4 (13)
*sln	0	0	0	1 (2)	2 (7)
nl=1 const.	4 (80)	32 (82)	44 (85)	32 (76)	27 (87)
sln=1 const.	4 (80)	29 (74)	31 (60)	24 (57)	22 (71)

Table A9.28 INPUT HC: Number and (%) of SC utterances without a verb: Mother of Alex

SC utt: -verb	1;0	1;6	2;0	2;6	3;0
Total –verb	40	60	69	86	91
*nl	5 (13)	6 (10)	15 (22)	29 (34)	12 (13)
*sln	0	0	1 (10)	1 (1)	0
nl=1 const.	35 (88)	54 (90)	54 (78)	57 (66)	79 (87)
sln=1 const.	34 (85)	51 (85)	49 (71)	56 (65)	59 (65)

Table A9.29 INPUT HC: Number and (%) of SC utterances without a verb: Mother of Sander

SC utt: -verb	1;0	1;6	2;0	2;6	3;0
Total –verb	22	60	71	48	43
*nl	8 (36)	9 (15)	7 (10)	10 (21)	5 (12)
*sln	0	0	0	1 (2)	1 (2)
nl=1 const.	14 (64)	51 (85)	64 (90)	37 (77)	38 (88)
sln=1 const.	18 (82)	50 (83)	49 (69)	36 (75)	32 (74)

Table A9.30 OUTPUT DC: Number and percentages of SLN and NL utterances with a verb of Carla

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	-	8	41	42	55
utt. + verb	-	0	2 (5)[a]	3 (7)	12 (22)
NL					
tot.utterances	-	1	4	2	1
utt. + verb	-	0	0	0	0

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.31 OUTPUT DC: Number and percentages of SLN and NL utterances with a verb of Laura

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	0	3	8	51	48
utt. + verb		2 (66)	4 (50)	10 (20)	25 (52)
NL					
tot.utterances	0	0	0	0	0
utt. + verb					

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.32 OUTPUT DC: Number and percentages of SLN and NL utterances with a verb of Mark

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	0	12	21	53	39
utt. + verb		2 (17)	3 (14)	14 (26)	13 (33)
NL					
tot.utterances	0	1	0	0	0
utt. + verb					

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.33 OUTPUT HC: Number and percentages of SLN and NL utterances with a verb of Jonas

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	0	11	5	6	1
utt. + verb		2 (18)	3 (60)	6 (100)	0
NL					
tot.utterances	5	34	44	18	21
utt. + verb	0	0	12 (27)	14 (78)	9 (43)

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.34 OUTPUT HC: Number and percentages of SLN and NL utterances with a verb of Alex

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	5	3	0	1	0
utt. + verb	0	0		1 (100)	
NL					
tot.utterances	0*	14	52	39	23
utt. + verb		2 (14)	9 (17)	10 (26)	10 (44)

[a] *percentages from total of analyzable utterances in that language mode*
** One verb of Alex at age 1;0 was coded as a 'minor form', like stroking a cat and saying aai 'stroke' as accompaniment of the action. It is disregarded in the analysis.*

Table A9.35 OUTPUT HC: Number and percentages of SLN and NL utterances with a verb of Sander

	1;0	1;6	2;0	2;6	3;0
SLN					
tot.utterances	0	0	13	10	10
utt. + verb			2 (15)	5 (50)	3 (30)
NL					
tot.utterances	7	8	10	5	11
utt. + verb	0	0	1 (10)	1 (20)	3 (27)

[a] *percentages from total of analyzable utterances in that language mode*

Table A9.36 OUTUT DC: SC utterances with and without a verb: Carla

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	-	10	13	4 (80)	20 (95)
+Vsln -Vnl	-	0	0	1	1
-Vsln +Vnl	-	0	0	0	0
+Vsln +Vnl	-	0	0	0	0
subtotal		*0*	*0*	*1 (20)*	*1 (5)*
tot.SC utt.	-	10	13	5	21

Table A9.37 OUTPUT DC: SC utterances with and without a verb: Laura

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	0	1	1 (100)	2 (50)	3 (50)
+Vsln -Vnl	0	0	0	1	2
-Vsln +Vnl	0	0	0	1	0
+Vsln +Vnl	0	0	0	0	1
subtotal	*0*	*0*	*0*	*2 (50)*	*3 (50)*
tot.SC utt.	0	1	1	4	6

Table A9.38 OUTPUT DC: SC utterances with and without a verb: Mark

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	0	0	1 (100)	3 (100)	0
+Vsln -Vnl	0	0	0	0	0
-Vsln +Vnl	0	0	0	0	0
+Vsln +Vnl	0	0	0	0	0
subtotal	*0*	*0*	*0*	*0*	*0*
tot.SC utt.	0	0	1	3	0

Table A9.39 OUTPUT HC: SC utterances with and without a verb: Jonas

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	0	25 (89)	13 (59)	10 (31)	15 (35)
+Vsln -Vnl	0	0	1	1	0
-Vsln +Vnl	0	0	4	8	18
+Vsln +Vnl	0	3	4	14	10
subtotal	*0*	*3 (11)*	*9 (41)*	*23(72)*	*28 (65)*
tot.SC utt.	0	28	22	32	43

Table A9.40 OUTPUT HC: SC utterances with and without a verb: Alex

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	0	0	9 (82)	3 (33)	14 (52)
+Vsln -Vnl	0	0	0	0	0
-Vsln +Vnl	0	0	2	6	12
+Vsln +Vnl	0	0	0	0	1
subtotal	*0*	*0*	*2 (18)*	*6 (66)*	*13 (48)*
tot.SC utt.	0	0	11	9	27

Table A9.41 OUTPUT HC: SC utterances with and without a verb: Sander

	1;0	1;6	2;0	2;6	3;0
-Vsln -Vnl	0	0	39 (80)	41 (73)	20 (48)
+Vsln -Vnl	0	0	0	0	4
-Vsln +Vnl	0	0	6	9	7
+Vsln +Vnl	0	0	4	6	11
subtotal	*0*	*0*	*10 (20)*	*15 (27)*	*22 (52)*
tot.SC utt.	0	0	49	56	42

Table A9.42 OUTPUT DC: Number and (%) of SC utterances without a verb: Carla

	2;6	3;0
Total - Verb	4	20
*nl	0	0
*sln	0	0
nl - 1 const.	4 (100)	17 (85)
sln - 1 const.	4 (100)	4 (20)

**nl means : ungrammatical Dutch, categories 2, 3 and 4:*
2= copula is omitted
3= auxiliary is omitted
4= other verb omitted
**sln means ungrammatical SLN, categories 3 and 4*

Table A9.43 OUTPUT DC: Number and (%) of SC utterances without a verb: Laura

	2;0	2;6	3;0
Total - Verb	1	2	3
*nl	0	0	0
*sln	0	0	0
nl - 1 const.	1	2	1
sln - 1 const.	1	1	1

Table A9.44 OUTPUT DC: Number and (%) of SC utterances without a verb: Mark

	2;0	2;6	3;0
Total -Verb	1	3	0
*nl	0	0	
*sln	0	0	
nl=1const.	1	3	
sln=1const	1	0	

Table A9.45 OUTPUT HC: Number and (%) of SC utterances without a verb: Jonas

	1;6	2;0	2;6	3;0
Total -Verb	25	13	10	15
*nl	0	2 (15)	1 (10)	7 (47)
*sln	0	1 (8)	0	4 (27)
nl=1 const.	25	11 (85)	9 (90)	8 (53)
sln=1 const.	24	12 (92)	9 (90)	8 (53)

Table A9.46 OUTPUT HC: Number and (%) of SC utterances without a verb: Alex

	1;6	2;0	2;6	3;0
Total -Verb	0	9	3	14
*nl		0	2	0
*sln		0	0	0
nl=1 const.		9	1	14
sln=1 const.		9	3	14

Table A9.47 OUTPUT HC: Number and (%) of SC utterances without a verb: Sander

	1;6	2;0	2;6	3;0
Total -Verb	0	39	41	20
*nl		4 (10)	9 (22)	4 (20)
*sln		0	0	0
nl=1 const.		35 (90)	30 (73)	16 (80)
sln=1 const.		27 (69)	34 (83)	18 (80)

SIGNED VERBS IN THE INPUT

TRANSITIVE VERBS, English equivalent, used by mother:

AAIEN (to caress) MJ, MA, MS
ACHTERVOLGEN (to pursue) ML
AFDRUK-MAKEN (to make a print) MC
AFDROGEN (to dry dishes) ML
AFSCHEUREN (to tear) MA
AFWASSEN (to do the dishes) ML
BAKKEN (to bake) MS
BEWEGEN (to move) ML
BLAZEN (to blow) MA
BOTSEN (to collide) MJ,
BOUWEN (to build) MC, ML, MJ
BIJTEN (to bite) ML,MA
BRENGEN (to bring) MJ
DENKEN (to think) MJ, MA, MS
DICHTDOENdeur (to close door) ML
DOEN (to do) MM,MJ, MA,MS
DRAAIEN (to turn) ML,MM, MJ,MA, MS
DRAGEN (to carry) ML,MA, MS
DREIGEN (to threaten) ML
DRINKEN (to drink) MC
DUWEN (to push) MA,MS
ETEN (to eat) MC,ML, MJ,MA, MS
FILMEN (to film) ML
GAAN (to go) ML,MM, MJ, MA, MS
GEBAREN (to sign) MC,MA
GEVEN (to give) ML,MA, MS
GOOIEN (to throw) MJ, MA, MS
HALEN (to fetch) MC, MM,MJ, MA, MS
HELPEN (to help) MC,ML, MM,MS
HOREN (to hear) MA
JAGEN (to hunt) ML
JONGLEREN (to juggle) MM
KAN-NIET (cannot) ML,MM, MJ,MS
KNIPPEN (to punch [ticket]) MS
KIJKEN (to look at) MC, ML, MM, MA, MS
KOKEN (to cook) MS
KOMEN (to come) MM, MJ, MA
KOPEN (to buy) MS
KNUFFELEN (to hug) MS
KRIJGEN (to get) MA, MS
KUNNEN (to be able to) MC, ML, MM, MJ, MS
KUSSEN (to kiss) MM
LATEN (no Engl. equivalent) MC, ML, MJ, MS
LEZEN(to read) MM, MJ, MA,
MAAIEN (to mow) MC
MAKEN (to make) MC, ML, MM, MJ, MA, MS
MEENEMEN (to take) MJ, MS
MORSEN (to spill) MJ
NEMEN (to take) MS
OMHAKKEN (to chop down) MS
OMKEREN (to upturn) MM, MS
OPENEN (to open) ML, MM
OPRUIMEN (to clean up) ML, MM, MJ, MS
OPSTAAN (to rise) MS
PAINT (to paint) MC
PAKKEN (to fetch) MC, ML, MM, MJ, MA, MS
PASSEN (to fit in) MA
PIKKEN (to peck) MA
PLAKKEN (to glue) MJ
PLATSTRIJKEN (to flatten) MM
PLUKKEN (to pick flowers) MJ
POETSEN (to clean) MA, MS
PRIKKEN (to sting) ML
ROKEN (to smoke) MS
ROLLEN (to roll) MA
ROND-GAAN (to go round) MC
RUILEN (to exchange) ML
RIJDEN (to drive) ML, MM, MJ, MA
RIJGEN (to string [beads]) ML
RUIKEN (to smell) MA
SCHOPPEN (to kick) MA
SCHMINKEN (to make-up) ML
SCHREEUWEN (to shout) MA
SCHRIJVEN (to write) MC, MM
SCHROEVEN (to screw) MM
SLAAN (to strike) MJ, MA
SPAREN (to save money) MS
STRIJKEN (to iron) MC
STAPELEN (to stack) ML
STOTEN (to push) MM
STUREN (to steer) MC, MS
TEKENEN (to draw) MC, MM, MJ
TELEFONEREN (to telephone) MA
TREKKEN (to pull) ML, MM, MA
TILLEN (to lift) ML, MS
TIMMEREN (to hammer) MA
TOVEREN (to conjure) MS
UITDOEN (to take off) ML
UITSTAPPEN (to descend) MJ
VANGEN (to catch) MJ

VASTHOUDEN (to hold) MJ
VERGETEN (to forget) MC,ML
VERANDEREN (to change) MA
VERSCHUIVEN (to move over) ML
VERTELLEN (to tell) ML, MS
VINDEN (to find) ML,MM, MA
VISSEN (to fish) MM
WASSEN (to wash) ML
WETEN (to know) MC
WILLEN (to want) MC,MS
ZAGEN (to saw) MJ, MS
ZEGGEN (to say) MC, MJ
ZETTEN (to put [on, in, etc) MC,ML MM,MJ, MA,MS
ZIEN (to see) ML,MM, MS
ZINGEN (to sing) MC
ZOEKEN (to search) MC,ML, MM,MJ, MA

INPUT: INTRANSITIVE VERBS, English equivalent used by mother:

BLIJVEN (to stay) MC,MM, MJ,MA,, MS
DANSEN (to dance) MS
FIETSEN (to bicycle)ML,MM
GEBEUREN (to happen) MJ
GILLEN (to shout/scream) MJ
GLIMMEN (to glitter) ML
HOEFT-NIET (no need) ML
HUILEN(to cry) MC,ML, MM,MJ, MA
KLIMMEN(to climb) ML
KNAGEN (to gnaw) MJ
KRUIPEN (to crawl) ML
LACHEN (to laugh) MA
LIGGEN (to lie [down]) MM,MJ, MA
LOPEN (to walk) MC,ML, MJ, MA, MS
MOETEN (must) MC,ML, MA,MS
NAAST-ZIJN (to be next to someone) MC
PRATEN (to talk) MC,ML, MJ, MS
PROBEREN (to try) MM, MA, MS
RENNEN (to run) ML
ROEREN (to stir) MC
SCHOMMELEN (to swing) MC
SCHRIKKEN (to be frightened) MJ
SLAPEN (to sleep) ML, MM, MJ, MA, MS
SPELEN (to play) MC, ML, MM, MJ, MA, MS
SPRINGEN (to jump) MJ
SPUGEN (to spit) MA
STAAN (to stand) ML, MM, MJ, MA
STAPPEN-OVER (to step over) ML
STINKEN (to stink) MA
STRUIKELEN (to stumble) ML
TERUGGAAN (to return) ML, MM
VALLEN (to fall) MC, ML, MM, MJ, MA, MS
VERDWIJNEN (to disappear) ML
VLIEGEN-Yc (to fly (plane) MC
WAAIENvangras (to wave [grass]) ML
WADEN (to wade through) ML
WACHTEN (to wait) MC, ML, MM, MJ, MA
WANDELEN (to walk) MJ
WERKEN (to work) MJ, MS
WONEN (to live) MJ
ZITTEN (to sit) MC, ML, MM, MJ, MA
ZWAAIEN (to wave) MM
ZWEMMEN (to swim) ML, MM, MJ, MA, MS

SPOKEN VERBS IN THE INPUT

AUXILIARY VERBS, English equivalent, used by mother:

hebben (aux) (to have) MC, ML, MJ, MA, MS
kunnen (aux) (can) ML, MJ, MA, MS
mogen (aux) (to be allowed to) MC, MJ, MA
willen (aux) (to want) MC, MJ
worden (to become) MJ
zijn (to be) MC, ML, MJ, MA, MS
zullen (aux) (shall/will) MJ, MS

INPUT: TRANSITIVE VERBS + obligatory objects, English equivalent, used by mother:

bakken (to bake) MS
brengen (to bring) MJ
halen (to get) MJ, MA
hebben (to have, own) MC,ML, MJ,MA, MS
geven (to give) ML, MJ, MA,MS
gooien(to throw) MJ, MA, MS
jagen (to hunt) ML
kopen (to buy) MS
krijgen (to get) MA,MS

losmaken (to loosen) MM
maken (to make) MC,MM, MJ, MA, MS
meenemen (to bring) MM,MJ, MS
neerleggen (to put down) MA
opleggen (to put onto) MA
optillen (to lift) MS
pakken (to fetch) MC,ML, MM,MJ, .MS
poetsen (to clean) MA,MS
proberen (to try) MM,MA, MS
sparen (to save) MS
vasthouden (to hold) MJ
vastmaken (to fasten) ML
vergeten (to forget) MC,ML
vieren (to celebrate) MC
vinden (to find) MC,MM, MA,MS
weggooien (to throw away) MJ
weten (to know) MC, MJ, MS
zeggen (to say) MC, MJ
zetten (to put) MJ

INPUT: TRANSITIVE VERB + optional object, English equivalent, used by mother:

aaien (to caress) MJ, MA, MS
afdrogen (to dry dishes) ML
afscheuren (to tear) MA
afwassen (to do the dishes) ML
bouwen (to build) MC, MJ
bijten (to bite) MA
denken (to think) MJ, MS
doen (to do) ML, MJ, MA,MS
draaien (to turn) ML,MM, MJ,MA, MS
dragen (to carry) MS
drinken (to drink) MC, MM
eten (to eat) MJ, MS
filmen (to film) ML
gebaren (to sign) MA
helpen (to help) MM, MS
hoeven (to need) ML, MS
houden (to keep) MS
knippen (to punch) MS
koken (to cook) MS
laten (no equiv.) MJ, MS
lezen (to read) MM, MJ, MA
morsen (to spill) MJ
opruimen (to clear away) ML, MM, MJ
passen (to fit) MA
plukken (to pick flowers) MJ
prikken (to sting) ML
ruiken (to smell) MA
rijden (to drive) MM, MJ, MA
schrijven(to write) MM, MA
schuiven (to shift) MA
slaan (to strike) MJ, MA
spelen (to play) MC, ML, MM, MJ, MA, MS
spugen (to spit) MA
strijken (to iron) MC
sturen (to steer) MS
tekenen (to draw) MC, MJ
tellen (to count) MS
toveren (to conjure) MS
trekken (to pull) MA
vertellen (to tell) MS
volgen (to follow) ML
zagen (to saw) MJ
zien (to see) MC, ML, MM, MJ, MA, MS
zingen (to sing) MC
zoeken (to search) MC, ML, MM, MJ, MA, MS

INPUT: INTRANSITIVE VERBS, English equivalent, used by mother:

blazen (to blow) MA
blijven (to stay) MC, MM, MJ, MA, MS
dansen (to dance) MS
gaan (to go) MM, MJ, MA, MS
gebeuren (to happen) MJ
gillen (to scream) MJ
glimmen (to glitter) ML
hollen (to run) ML
huilen (to cry) MC, ML, MM, MJ, MA
komen (to come) ML, MM, MJ, MA, MS
kruipen (to crawl) ML
kijken (to watch) MC,ML, MJ, MA, MS
lachen (to laugh) MA
liggen (to lie) MM,MJ, MA
lopen (to walk) ML, MJ, MA, MS
moeten (must) MC,ML, MJ, MA, MS
ophouden (to stop) MC
opletten (to pay attention) MJ, MA
opstaan (to rise) MS
praten (to talk) MA,MS
schreeuwen (to shout) MA
schrikken (to be frightened) ML, MJ
slapen (to sleep) ML,MM, MJ, MA, MS
springen (to jump) MJ
staan (to stand) MM,MJ, MA,MS
struikelen (to stumble) ML
telefoneren (to telephone) MA

uitkijken (to watch out) MA
uitstappen (to descend) MJ
vallen (to fall) MC,ML, MM,MJ, MA,MS
varen (to sail) MA
wachten (to wait) MC.MM, MJ, MA, MS
wandelen (to walk) MJ
werken (to work) MJ, MS
wonen (to live) MJ
zitten (to sit) MC,ML, MM,MJ, MA,MS
zwemmen (to swim) MJ, MA, MS

SIGNED VERBS IN THE OUTPUT

TRANSITIVE VERBS, followed by English equivalent, used by child:

AFDRUKKEN (to print) C
BAKKEN (to fry) S
BRENGEN (to bring) J
BIJTEN (to bite) L
DRAGEN (to carry) S
DUWEN (to push) J
ETEN (to eat) C, M, J, S
FIETSEN (to cycle) C
FILMEN (to film) C
GOOIEN (to throw) J, S
HALEN (to get) S
HEBBEN (to have) J, S
KAN-NIET (cannot) M
KNIPPEN (to punch) S
KOKEN (to cook) S
KOPEN (to buy) S
KUNNEN (can) J
LEGGEN (to put ...)M
LEUNEN (to lean) M
LEZEN (to read) S
MORSEN (to spill) J
NAAIEN (to sew) L
OMDRAAIEN (to turn over) M
OMSLAANblz. (to turn a page) C
OPENENdeur (to open/close a door) L
PAKKEN (to fetch) C, M, J, A, S
PLUKKEN (to pick flowers) J
PRIKKEN (to sting) L
ROEREN (to stir) C
RIJDEN (to ride/drive) L, S
SCHIETEN (to shoot) J
SCHROEVEN (to screw) M
SCHUDDEN (to shake) J
STUREN (to steer) S
TEKENEN (to draw) M
TOVEREN (to conjure) S
VERGETEN (to forget) C
VISSEN (to fish) M
ZAGEN (to saw) J
ZETTEN (to put down) J
ZOEKEN (to search) L, M

OUTPUT: INTRANSITIVE VERBS, English equivalent, used by child:

BLIJVEN (to stay) M, J
BONZEN (to pound) L
DANSEN (to dance) S
DENKEN (to think) J, S
DOEN (to do) S
GAAN (to go) L, S
HUILEN (to cry) C, L, M, J
KOMEN (to come) A
KIJKEN (to watch) C, L, M, S
LATEN (no equiv.) J
LOPEN (to walk) C, J
PISSEN (to piss) C
PRATEN (to talk) L
SCHRIKKEN (to be frightened) L
SLAPEN (to sleep) M, J, S
SPELEN (to play) L, S
SPRINGEN (to jump) J
STAAN (to stand) J
TROMMELEN (to drum) S
VALLEN (to fall) C
VLIEGEN (to fly) S
WACHTEN (to wait) L
WERKEN (to work) M, S
WETEN (to think) S
ZITTEN (to sit) C, L
ZON-SCHIJNEN (to shine [sun]) C
ZWAAIEN (to wave) M
ZWEMMEN (to swim) L, S

SPOKEN VERBS IN THE OUTPUT:

AUXILIARY VERBS, English, used by hearing child:

kunnen (can) J, A, S
mogen (to be allowed to) J, S
willen (to want) J
zullen (shall/will) A
zijn (to be) J, A, S

OUTPUT: TRANSITIVE VERBS + obligatory object, English equivalent, used by hearing child:

bakken (to fry) S
brengen (to bring) J
doodmaken (to kill) J
gooien (to throw) J, S
halen (to fetch) A
hebben (to have) J, S
kopen (to buy) S
maken (to make) J
meenemen (to take along) A
pakken (to fetch) J, A, S
vasthouden (to hold) J
vastplakken (to glue) J
weten (to know) A
zeggen (to say) J
zetten (to put down) J

OUTPUT: TRANSITIVE VERB + optional object, English equivalent, used by hearing child:

bijten (to bite) A
bouwen (to build) J
denken (to think) J, S
doen (to do) S
duwen (to push) J
eten (to eat) J
hoeven (need) J
knippen (to punch) S
koken (to cook) S
laten (no equiv.) J
lezen (to read) J, S
morsen (to spill) J
plukken (to pick flowers) J
rijden (to ride/drive) J
tellen (to count) S
vertellen (to tell) A
vliegen (to fly) S
vragen (to ask) J
zagen (to saw) J
zien (to see) J
zoeken (to search) A, S

OUTPUT: INTRANSITIVE VERBS, English equivalent, used by child:

blijven (to stay) J
dansen (to dance) S
gaan (to go) J, A, S
huilen(to cry) J
komen (to come) S
kijken (to watch) A, S
liggen (to lie) J, A
lopen (to walk) J
moeten (must) J, A, S
praten (to talk) A
slapen (to sleep) S
springen (to jump) J
staan (to stand) J
wonen (to live) J
zitten (to sit) J, A
zwemmen (to swim) S

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NEDERLANDSE SAMENVATTING

TAALAANBOD EN INTERACTIE IN DOVE FAMILIES
(Input and interaction in deaf families)
Beppie van den Bogaerde

Dit proefschrift beschrijft het taalaanbod en de interactie van vier dove moeders met drie dove en drie horende kinderen, alsook de taalverwerving van deze kinderen van één tot drie jaar.
Tot nu toe was weinig tot niets bekend over het taalaanbod van dove moeders aan zowel dove als horende kinderen in Nederland: welke taal of talen worden gebruikt, de Nederlandse Gebarentaal en/of het Nederlands? hoe worden deze talen gebruikt in de interactie? en wat is de structuur van deze talen? Ook het taalverwervingsproces van dove en horende kinderen uit dove families was tot op heden nog niet beschreven.

Hoofdstuk 1 gaat in op de rol die wordt toegekend aan taalaanbod en interactie in verschillende taalverwervingstheorieën. Een eerste belangrijke bevinding is, dat het taalaanbod (input) toegankelijk moet zijn voor het kind: slechts de gesproken taal die gehoord wordt, en de gebarentaal die gezien wordt is functioneel (uptake). Het gemiste taalaanbod kan niet als model voor verwerving dienen (intake). Verder wordt geconcludeerd, dat het nodig is om de rol van het taalaanbod in de taalverwerving van het kind duidelijk te maken. Zowel kwantitatieve als kwalitatieve aspecten van het taalaanbod moeten worden beschreven. Vervolgens kan aan de hand van de kwantitatieve en kwalitatieve aspecten in de taalproductie van het kind bekeken worden, of er inderdaad een relatie vastgesteld kan worden tussen taalaanbod van de moeder en taalproductie van het kind. In onderzoek naar tweetalige situaties is deze relatie des te meer belangrijk. Immers, als een kind twee talen (of meer) aangeboden krijgt, is de kwantiteit van de twee talen logischerwijs lager dan als er één taal wordt gebruikt. Kan het kind op basis van de lagere frequentie dan toch deze taal verwerven? En hoe is de kwaliteit van zijn of haar taalproductie?
De drie hoofdaspecten die in dit proefschrift worden bekeken zijn de ontwikkeling van (meertalig) taalaanbod en (meertalige) productie van de kinderen, de invloed van het taalaanbod op de verwerving van de kinderen en de invloed van een gehoorstoornis bij één of beide gesprekspartners.

In Hoofdstuk 2 wordt de taalsituatie van dove families in Nederland beschreven. De internationale literatuur over taalaanbod, zowel gesproken als gebaard, en over taalverwerving van dove en horende kinderen wordt besproken.

In dove families wordt zowel gebarentaal als gesproken taal gebruikt met de kinderen, alsook een soort gemengde taal waarvoor vaak de termen Sign Supported Speech of Contact Signing (Lucas and Valli 1992) worden gebruikt. In de gemengde vorm worden simultaan gebaren en woorden (met of zonder stem) geproduceerd. Het is nog niet duidelijk wat de structuur van deze taalmodus is.
Uit de literatuur blijkt dat dove ouders die gebarentaal gebruiken met hun kinderen er zorg voor dragen dat hun taalaanbod (input) toegankelijk is voor hun kind (uptake). Het verschil in gehoorstatus van dove en horende kinderen doet ons verwachten dat het taalaanbod zal verschillen, alsook de interactie.
Kinderen die een gebarentaal aangeboden krijgen, verwerven deze op dezelfde manier en net zo snel als kinderen die een gesproken taalaanbod krijgen. Van dove kinderen is bekend dat de gesproken taal pas laat, en vaak niet volledig verworven wordt. Horende kinderen van dove ouders blijken de gesproken taal goed te kunnen verwerven, maar er is weinig bekend over hun gebarentaalverwerving. Tevens is weinig tot niets bekend over het effect van het gebruik van de derde gemengde taalvorm op de taalontwikkeling van horende kinderen van dove ouders, of van dove kinderen van dove of horende ouders.

Hoofdstuk 3 bevat de onderzoeksvragen. Deze betreffen globaal vijf gebieden: de resultaten worden in aparte hoofdstukken besproken.
1 de kwantiteit van het taalaanbod in totaal, en welke talen worden gebruikt (hoofdstuk 5)
2 de toegankelijkheid van de taal voor de gesprekspartner (hoofdstuk 6)
3 het vocabulaire en de scheiding van de talen (hoofdstuk 7)
4 de taalfuncties die gebruikt worden (hoofdstuk 8)
5 de taalstructuren die voorkomen (hoofdstuk 9)

In hoofdstuk 4 wordt de onderzoeksopzet en de dataverzameling gepresenteerd.
Vier dove moeders en hun zes kinderen zijn vanaf 1988 tot 1997 met verschillende tijdsintervallen gefilmd. De dove kinderen zijn: Carla, Laura en Mark. Laura en Mark zijn een tweeling. De horende kinderen zijn: Jonas, Alex en Sander. Jonas is de oudere broer van Laura en Mark.
In dit proefschrift worden de opnamen beschreven waarin de kinderen 1;0[1], 1;6, 2;0, 2;6 en 3;0 zijn. Elk moeder-kind paar is afzonderlijk gefilmd in een spontane speelsituatie met zelfgekozen speelgoed of boeken. Per sessie is 10 minuten getranscribeerd en geanalyseerd. Alle taaluitingen van de moeder en het kind zijn gecodeerd en geanalyseerd voor de verschillende onderzoeksvragen.

Hoofdstuk 5 bespreekt hoeveel taal de kinderen in totaal aangeboden krijgen, en in welke taal. Over het algemeen krijgen de dove en horende kinderen net zoveel taal aangeboden als horende kinderen van horende ouders of dove kinderen van dove ouders, bijvoorbeeld in het Engels, of BSL (British Sign Language, de Britse

[1] 1;0 betekent 1 jaar en 0 maanden

gebarentaal). Naarmate de kinderen ouder worden vermeerdert het taalaanbod, en ook de kinderen produceren steeds meer taal. Op driejarige leeftijd dragen zij ongeveer 40% bij aan de conversatie, vergelijkbaar met andere horende kinderen.
Als werkdefinitie wordt iedere uiting waarbij gelijkertijd gebaard en gesproken wordt als simultane uiting beschouwd en voorlopig gecategoriseerd als een gemengde taalvorm (simultane communicatie of SC).
Zowel de dove als de horende kinderen krijgen voornamelijk deze gemengde taalvorm aangeboden (respectievelijk 65% en 70%). De dove kinderen krijgen daarbij ook NGT (Nederlandse Gebarentaal) en slechts heel weinig Nederlands (gemiddeld 2%). De horende kinderen daarentegen wordt naast SC weinig NGT aangeboden (gemiddeld 8%), maar meer Nederlands (gemiddeld 22%). De dove kinderen produceren eigenlijk alleen NGT, en de horende kinderen gebruiken zowel NGT en Nederlands als de gemengde vorm.

In hoofdstuk 6 wordt de toegankelijkheid van het taalaanbod van de moeders en de taalproductie van de kinderen bekeken.
De kinderen kunnen van het gebarentaalaanbod ongeveer 80% waarnemen op alle leeftijden. Er is geen verandering in de toegankelijkheid van het gebaarde taalaanbod over tijd. De gesproken taal is toegankelijk voor de horende kinderen, omdat de moeders hun stem gebruiken, zodat zij het gesproken taalaanbod kunnen horen. De dove kinderen, echter, missen aanvankelijk veel van het gesproken taalaanbod, maar naarmate zij ouder worden zien vooral Laura en Mark steeds meer, hoewel Carla een aanzienlijk deel van het gesproken taalaanbod blijft missen.
De moeders zien bijna alle gebaarde taalproductie van de kinderen, voornamelijk omdat zij de kinderen voortdurend gadeslaan (monitoring). Van het gesproken gedeelte van de taalproductie van de horende kinderen missen de moeders van Jonas en Alex vrij veel, van Sander minder.
De moeders kijken bijna voortdurend naar hun kind, waardoor zij weinig van hun taalproductie missen. Met de dove kinderen en met Sander beginnen de moeders zelf meestal pas te gebaren nadat ze naar haar opkijken, wat alle kinderen in toenemende mate doen. De moeders van Jonas en Alex beginnen vaker te gebaren en/of spreken terwijl hun kind *niet* naar ze kijkt.
De kinderen zelf houden er nog maar weinig rekening mee dat hun taalproductie visueel toegankelijk moet zijn voor hun dove moeder, hoewel er aanwijzingen zijn dat de dove kinderen en Sander vlugger leren hun taal toegankelijk te maken dan Jonas en Alex.
Voor de SC uitingen is het geven van aandacht complex, omdat de dove kinderen en de moeders zowel het gesproken als het gebaarde gedeelte moeten zien, maar de horende kinderen hoeven slechts het gebaarde gedeelte waar te nemen. Daarbij speelt ook een rol, dat simultane uitingen in de twee verschillende modaliteiten òf elementen kunnen bevatten met dezelfde betekenis (complementair) òf elementen met verschillende betekenis die samen een propositie vormen (supplementair). Bij de supplementaire proposities moeten zowel de gebaren als de woorden gezien of gehoord worden om de hele propositie te kunnen verwerken. Supplementaire proposities blijken veel meer voor te komen bij de horende kinderen (29%) dan bij de dove kinderen (10%). Gemengde SC uitingen van dit type zouden wel eens tot

een 'derde systeem' gerekend kunnen worden, dat door Romaine (1995) beschreven is. In situaties van intens taalcontact is het mogelijk dat een derde taalsysteem ontstaat dat eigenschappen vertoont die niet in de input talen voorkomen. Door een vermenging van de twee systemen kan zo een nieuw systeem ontstaan (Romaine 1995:4). In hoofdstuk 9 wordt dieper ingegaan op dit aspect van de structuur van het taalaanbod.

In Hoofdstuk 7 wordt gekeken naar het lexicon van de moeders en de kinderen. Ten eerste naar het gebruik van combinaties van deictische (wijs-) gebaren en referentiële gebaren en/of woorden. Naarmate de kinderen ouder worden combineren de moeders steeds vaker referentiële elementen, en de kinderen ook.
Omdat uit de literatuur blijkt dat kinderen in hun vroege lexicon vaak meer zelfstandige naamwoorden dan werkwoorden hebben, is gekeken naar de verhouding tussen nomina en verba in het taalaanbod, en in de taalproductie van de kinderen. We vonden enig bewijs voor een directe invloed van het taalaanbod van de moeders op de taalproductie van de kinderen voor dit aspect, op individuele basis, hoewel er tussen de diverse moeder-kind paren duidelijke verschillen zijn.
Het vocabulaire van moeders en kinderen is ook bekeken voor wat betreft de rijkdom (TTR) en de variatie. Er zijn veel individuele verschillen tussen de moeders en de kinderen over tijd, maar de variatie in het aangeboden gebaren lexicon is min of meer gelijk voor de dove en horende kinderen. Het gesproken lexicon in het taalaanbod is net zo gevarieerd bij de dove als bij de horende kinderen, maar bij de dove kinderen veel kleiner. Over het algemeen zijn geen verschillen gevonden met de variatie die bekend is voor horende kinderen van horende ouders, ook niet in de taalproductie van de kinderen, behalve bij de dove kinderen die nog nauwelijks gesproken woorden produceren.
Tevens is gekeken naar het voorkomen van lexicale equivalenten in de verschillende talen. Als in een taal een bepaald concept lexicaal wordt uitgedrukt (bijvoorbeeld *boom*) en dit concept komt in een andere uiting voor in een andere taal (bijvoorbeeld *BOOM*[2]) dan zijn het woord *boom* en het gebaar *BOOM* lexicale equivalenten van elkaar. Lexicale equivalenten vormen bewijs voor het separaat bestaan van twee talen. Zowel in het taalaanbod van de moeders als in de taalproductie van de kinderen vinden wij heel weinig lexicale equivalenten, omdat het merendeel van de woorden en gebaren meestal gecombineerd voorkomt, of alleen in één taal.

Hoofdstuk 8 bevat een functionele analyse van taalaanbod en taalproductie. De moeders produceren voornamelijk mededelende zinnen, en slechts weinig vraagzinnen. De moeders vereenvoudigen vaak de vraagzinnen die zij produceren in NGT en in het Nederlands gebruiken ze vaak afwijkende vormen, vooral met de horende kinderen. Dit kan natuurlijk zijn invloed hebben op de verwerving van vraagzinnen door de kinderen. De horende kinderen produceren echter gesproken vraagzinnen met dezelfde structuur als die geproduceerd worden door monolinguale horende kinderen van dezelfde leeftijd.

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[2] Gebaren uit de NGT worden zoals gebruikelijk in hoofdletters (glossen) weergegeven.

In dit hoofdstuk wordt een duidelijke relatie gevonden tussen de taalkeuze voor affectieve uitingen: met de dove kinderen uitten de moeders deze in de NGT, en met de horende kinderen voornamelijk in gesproken taal, en de kinderen hebben dezelfde voorkeuren als hun moeders.

Hoofdstuk 9 behandelt verschillende structurele aspecten van de NGT, het Nederlands en SC in het taalaanbod en in de taalproductie van de kinderen. De Gemiddelde Zinslengte (GZL) van zowel input als output wordt besproken, alsook het voorkomen van werkwoorden, de (non-)realisatie van argumenten en de plaats van de werkwoorden in de zin. In het algemeen blijkt dat de dove moeders NGT regels volgen met de dove kinderen, wat soms tot ongrammaticaal gesproken taalaanbod leidt in de SC uitingen. Bij de horende kinderen is het NGT aanbod vergelijkbaar met dat aan de dove kinderen, maar het Nederlandse en SC aanbod is minder vaak ongrammaticaal. De dove en horende kinderen volgen meestal NGT regels in hun NGT en gebaarde SC productie, en de horende kinderen volgen Nederlandse regels in hun Nederlands en gesproken deel van de SC productie en zijn vergelijkbaar met horende leeftijdsgenootjes.
Ook wordt in dit hoofdstuk gekeken naar werkwoordsvervoegingen van gebaarde en gesproken werkwoorden, waarbij we zien dat gebaarde werkwoorden vaak in de citeervorm[3] aangeboden worden. Als ze vervoegd worden, gebeurt dat op dezelfde manier bij de dove kinderen als bij de horende kinderen. Vanaf twee jaar beginnen de dove en horende kinderen ook zelf gebaarde werkwoorden te vervoegen, waarbij de dove kinderen wat sneller lijken te gaan in hun ontwikkeling.
De dove kinderen wordt vaak afwijkende gesproken werkwoordsvormen aangeboden of niet-vervoegde vormen, terwijl de horende kinderen veel meer vervoegde vormen horen. De dove kinderen produceren nog geen gesproken werkwoorden, en de horende kinderen laten een ontwikkeling in hun werkwoordgebruik zien die vergelijkbaar is met die van horende kinderen van horende ouders.
Vanaf 2;0 krijgen Laura en Mark grammaticale zinsmarkeerders voor vraagzinnen en ontkenningen aangeboden, bij de ander kinderen is er grote variatie en zijn de markeerders vaak afwezig. De kinderen produceren zelf nog nauwelijks vraag-markeringen, maar de dove kinderen geven wel blijk de ontkennings-markeerder in NGT vroeg en vlot te verwerven, in tegenstelling tot de horende kinderen.
Het gebruik van verbuigingen bij zelfstandige en bijvoeglijke naamwoorden is sterk gereduceerd in het gesproken taalaanbod aan de kinderen, en de dove kinderen verbuigen zelf ook nog helemaal niet. De horende kinderen beginnen wel meervoudsvormen en andere verbuigingen en verkleinwoorden te gebruiken vanaf ongeveer twee jaar. Tenslotte worden andere gebaren- en woordsoorten besproken, waarbij het opvalt dat de dove kinderen geen functiewoorden gebruiken, en meer wijsgebaren als persoonlijke voornaamwoorden gebruiken dan de horende kinderen.

In Hoofdstuk 10 wordt vooraf als hoofdconclusie gesteld dat het SC taalaanbod aan de dove kinderen eigenlijk NGT is en dat bij de horende kinderen een derde systeem

[3] De citeervorm van een gebaar is vergelijkbaar met de infinitief-vorm van gesproken werkwoorden.

voorkomt naast de NGT en het Nederlands, zowel in het aanbod als in hun eigen productie.
De dove kinderen wordt dus voornamelijk NGT aangeboden, en slechts heel weinig Nederlands. Ze produceren ook geen Nederlands, niet alleen omdat het zo weinig in het aanbod voorkomt en omdat ze veel missen van het gesproken taalaanbod, maar ook omdat de gesproken taal slechts visueel toegankelijk voor ze is. De horende kinderen krijgen voornamelijk SC aangeboden en verder nog NGT en Nederlands. Het taalaanbod aan de horende kinderen is duidelijk voldoende om de drie taalvormen te verwerven, hoewel hun ontwikkeling in NGT iets trager verloopt dan bij de dove kinderen. De hoeveelheid aangeboden NGT speelt hierbij wellicht een rol. Hoewel ze weinig Nederlands in het taalaanbod aantreffen, gebruiken ze het zelf veel, waarschijnlijk ook omdat binnen hun gezin andere horende personen aanwezig zijn.
Wij constateren een duidelijke invloed van het taalaanbod op de taalverwerving van de kinderen in de volgende gebieden: het voorkomen van gebaar combinaties, nomen-verbum ratio per taal, functies van uitingen (vooral benoemingen) en de ontkenningsmarkeerder bij de dove kinderen. Op andere gebieden kan de invloed niet echt aangetoond worden of spelen nog andere factoren een rol (bijvoorbeeld individuele variatie of omgevingsfactoren).
De invloed van een gehoorstoornis valt duidelijk te zien bij de dove kinderen die zich concentreren op gebarentaal, en een ontwikkeling laten zien in het geven van visuele aandacht. Sander (horend) toont zich gevoelig voor de gehoorstatus van zijn moeder, en oriënteert zich meer op gebaren dan de andere twee horende kinderen. Kwantitatieve en kwalitatieve verschillen in het taalaanbod, die gekoppeld kunnen worden aan de gehoorstatus van de kinderen laten zien, dat het minder of vaker voorkomen van bepaalde structuren in het aanbod de verwerving van deze structuren door de kinderen beïnvloedt.

De belangrijkste bevinding van het onderzoek is ons inziens het feit, dat de interactie en communicatie tussen dove moeders en hun dove en horende kinderen geen problemen blijkt te geven in het taalontwikkelingsproces van de kinderen. De dove kinderen verwerven NGT en de horende kinderen verwerven NGT, Nederlands en een derde systeem.

CURRICULUM VITAE

Beppie van den Bogaerde was born in Amsterdam on February 19, 1953. In 1973 she finished her studies of Translator/Interpreter in English, after which she got her Gymnasium alpha diploma in 1976. In 1984 she achieved her teacher's degree (MO A) in English. She entered the University of Amsterdam in 1985 to study English, and started her studies in General Linguistics in 1986, with the focus on language acquisition and bilingualism. In 1989 she obtained her MA degree with a thesis on 'Bilingual aspects in the input of three deaf mothers and their hearing children' (written together with Claudia Blankenstijn). In 1990 she started a doctorate research on interaction in deaf families, which resulted in this thesis.
Currently she is working at the Seminarium voor Orthopedagogiek, Hogeschool van Utrecht for the newly founded Department for Teachers and Interpreters of Sign Language of the Netherlands. Here she is responsible for the development of the curriculum.