Methods and procedures for research into Sign Language Acquisition

Baker, A.E.; van den Bogaerde, B.; Coerts, J.A.; Woll, B.

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METHODS AND PROCEDURES IN SIGN LANGUAGE ACQUISITION STUDIES

Anne Baker [2], Beppie van den Bogaerde [3], Jane Coerts [1], Bencie Woll [4]

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1. DESIGN AND SUBJECTS

Only after formulating the research questions can the research design be completed. Fundamental aspects of design which affect all developmental studies have to be established first, for example, whether the children are to be followed for an extended period of time or studied at one point in time only. Then the subjects who will

participate in the study have to be selected and the manner of data collection established. In the following sections we will discuss these aspects

1.1 Design

1.1.1 Case or group studies

In order to be able to generalise research results, groups of children are usually chosen for study, rather than an individual child. Generalisability will increase with the number of children studied. There are no hard and fast rules determining the number; statistical procedures used for establishing significant differences in behaviour will have to take group size into account.

Before embarking on a group study it can often be useful to run a preliminary study on one child in order to test out aspects of method or analysis. In that case, the individual study is clearly a pilot. However, there are circumstances under which it is desirable that a research project as a whole consists of a case study. If for example the study will be done in depth and in great detail it may not be feasible to attempt to examine the language of more than one child, in the literature on spoken language acquisition there are many classic examples of such case studies.

Often, children with atypical language development are the subject of a case study. Genie, for example, was exceptional in having little language input until the age of nine; once she was exposed to English her language development was closely studied in order to assess the influence of a critical period (Curtiss, 1977). In other cases, features of the individuals cognitive profile are unique and therefore must be dealt with as case studies, for example, Woll, Grove and Kenchington's study of a pair of hearing identical twins with Down Syndrome who have Deaf parents.

Some deaf children are exceptional cases too because they have had no or inaccessible language input or because they produce no or little language (see for example Emmorey, Grant & Ewan, 1994; Morford, 1995). These children often have not only delayed linguistic development, but also delayed cognitive, emotional, social and cultural development. It is very difficult to assess these different aspects in their own right, separate from the other domains. If children such as these are being studied, special attention should be paid to all the intimation available on their background (see 1.2). Preferably these children should be followed over a longer period of time.

1.1.2 Cross-sectional or longitudinal research

A study in language acquisition can be related to a particular point in time, usually the chronological age of the child (see 1.2.5). In this case the research focuses on a particular state rather than on development and change. These studies are less common, but they can be relevant in educational settings, for example when the variability in language level, in a particular age group is to be established.

Most studies, however, concentrate on development. This can be done in two ways. In a longitudinal study the same subjects are followed over a period of time so that data collected at different points in time can be compared in order to chart development. Such a study has the advantage that the subjects are the same, so that many variables are kept constant. The pro-drop study by Coerts and Mills (1994) is an example of a longitudinal study. Two children were followed during the period between l;4, when the first utterances consisting of lexical combinations occurred, and 2;6, when the majority of the children's utterances consisted of combinations (see also 1.2.5).

However, in a longitudinal study the collection of the data normally requires a longer time-span which involves a number of risks. For instance, during a longitudinal study lasting several years there are often problems such as losing subjects because of illness or moving house, or a change in mode of communication, etc. Additionally, the project can be a burden on child and parent which may negatively influence the family's willingness to participate or lead to a greater drop-out.

An alternative to longitudinal studies are cross-sectional studies, in which groups of children of different ages are compared with one another, for example the comparison of a group of three-year-old children with a group of five-year-olds. Development is described on the basis of the group comparison. It will be clear that such a design assumes that the group are representative and differ only in chronological age. For a group to be representative it needs to be of a reasonable size.

Cross-sectional studies have the advantage that they take less time to complete than longitudinal studies. If developmental aspects are studied in a cross-sectional design careful consideration should be given to a strict matching of the subjects (see 1.2) so that any changes in the features under study are attributable to the factor of age only.

1.1.3 Control groups

Generally speaking, studying control-groups is not common in language acquisition research, since they are normally used to determine the influence of a particular factor such as an intervention programme. There are cases in which it is essential to have data from a control group: for example, investigation of the influence of a cochlear implant on spoken and sign language development. This is the only way in which development attributable to the implant can be distinguished from development that would have taken place anyway. However, studies to date in this area have made little use of such control groups (see discussion in Coerts & Mills, 1996). The control group needs to be matched on a number of variables (see I.2) so that it differs only in respect of the experimental condition, in this case the cochlear implant.

1.2 Selection of subjects

The nature of the research questions will determine the need for a more homogeneous or heterogeneous sample of deaf children. The population of children acquiring a sign language is often small and usually heterogeneous. A higher level of homogeneity can be reached by choosing variables that are constant across the children and by allowing as little variation as possible within the variables themselves. A detailed description of all subjects participating in the study is always required. Factors that account for relevant variation in the group of deaf children include:

- age at onset of deafness
- degree of hearing loss
- medical history
- linguistic background
- age

Depending on the research questions, factors like gender, IQ and socio-economic status of the parents may also play a role in the selection of subjects. In the following sections we will discuss all these variables in more detail.

1.2.1 Age at onset of deafness

The point of onset of deafness is an important variable in a group of deaf children, because it has far-reaching consequences for the general development of the child and his or her language development in particular, as we will describe below.
If deafness occurs before birth it is referred to as prenatal or congenital deafness. It can be genetically inherited or acquired, for instance if the mother was infected with

rubella during pregnancy. Nowadays it is possible to identify a hearing impairment at a very early age. Whether or not such tests are carried out as routine procedures depends on the organisation of the Health Services in a given country.

When a child becomes deaf after birth, for instance as a result of illness or an accident, he or she may become deaf before spoken language is acquired (prelingually deaf) or after spoken language is acquired (postlingually deal). This distinction is made between 3 and 5 years of age, at the point it is assumed that most of the formal aspects of spoken language: phonology, morphology and syntax, are acquired. There is agreement on age 5,0 as the limit, although it is clear that some aspects of acquisition such as vocabulary continue to develop in the postlingual years.

The distinction between prelingual and postlingual deafness is clearly relevant for the acquisition of spoken language. Postlingually deaf children develop spoken language differently from prelingually deaf children, because they have had acoustic experience to the extent that they were able to acquire most aspects of the spoken language in a natural way. They will have had a normal (start to) spoken first language development, in contrast to prelingually deaf children. They are believed to have a better chance of learning to speech-read, because they are better able to link the visual information accompanying speech to the intended language form, and usually they are more successful in learning the written form of the spoken language than prelingually deaf children.

The age of onset of deafness also has important consequences for the acquisition of sign language. However it is not clear that the prelingual-postlingual distinction is important in this respect. This is because in the case of sign language acquisition, the amount of sign language input is a crucial factor. A postlingually deaf child of deaf parents may acquire sign language without problems, while a prelingually deaf child of hearing parents may not, in general one can say that children who learn a sign language in the postlingual period do not filly master certain aspects of the sign language such as verb agreement and other morphological structures (Newport, 1984; Galena, 1989); they behave much more like second language learners.

For some aspects of sign language acquisition the distinction between congenital and non-congenital may be more relevant. In a study of attentional strategies used by deaf mothers with their children all the deaf children studied were congenitally deaf.

These children were compared with hearing children of deaf parents. Whether children have had any exposure to language interaction using hearing would be an important variable if this study were repeated with different populations. To initiate communication, hearing mothers will usually approach their hearing child making use of sound, e.g. mother begins to speak - child turns head towards her. With deaf children such an approach is not possible and visual strategies will have to be employed. A child who became deaf after birth will have experienced spoken language in interaction before the onset of deafness; and his/her awareness of, for example, turn-taking or joint attention (Tomasello & Farrar, 1986), will play a role in the further development of appropriate visual attentional behaviour and the use of attentional strategies by their conversational partner(s). A child deaf from birth will have quite different experiences in turn-taking and joint attention, since he or she has had to develop visual attentional behaviour from birth. It is obvious that a child who becomes deaf at age 10 will have bad different experiences in this area from a child who becomes deaf at 2;6, although both children would be called prelingually deaf. For this research question a small fluctuation in the variable of age at onset of deafness might have a substantial influence on the strategies used by the deaf mothers and thus on the outcome of the study. The deaf children participating in such a study would have to be strictly matched with regard to this variable to form a homogeneous group as far as possible.

The distinction between prelingually deaf and postlingually deaf can be relevant according to the theoretical framework adopted since the prior development of spoken language can mean that the sign language will be acquired as a second language in a theoretical framework assuming an innate language component, second language learning is often assumed to take place in the same way as first language acquisition; it is not relevant whether a first language has been acquired. The interference theory on the other hand, postulates that one's first language interferes with acquisition of the second language (Appel & Muysken, 1987:82 ff.); if a sign language is acquired after postlingual deafness it is automatically a second language and therefore subject to interference. A study on the production of utterances with null subjects by children acquiring SLN might choose to ignore age at onset of deafness if carried out within the first framework, whereas the interference theory would require that a distinction be made.

1.2.2 Degree of hearing loss

Researchers have used different criteria to determine the hearing status of subjects. The most commonly used terms to indicate hearing loss are:

- moderately hearing impaired 20-60 decibel (dB)

- severely hearing impaired/ hard of hearing 60-90dB

- profoundly hearing impaired I deaf $\geq$ 90dB

Some researchers use the term 'deaf' only for those people with a hearing loss of $\geq$ l00 dB, others include all people with a hearing loss of $\geq$ 60dB. Thus it is clear that audiological definitions are not uniformly used.

We would like to emphasise that there is a distinction between audiological deafness, functional deafness and cultural deafness. Not all people who have an audiological hearing loss of, for instance, 90 dB are the same with respect to what they hear. Residual hearing and use of hearing aids may make a the functional hearing loss comparable with an audiological loss of less than 90 dB. On the other hand, someone with an audiological hearing loss of 70dB may refuse to wear a hearing aid and functionally be profoundly deaf.

The cultural definition of deafness is based on membership of the deaf cultural community. Padden and Humphries(1988), following Woodward (1972), use the terms 'deaf' when referring to hearing status and 'Deaf' when referring to membership of the Deaf community. They ascribe a socio-cultural value to the degree of identification of an individual with the Deaf community, usually measured by the degree to which a person uses and is fluent in a sign language. Hearing children of Deaf parents (sometimes called Children Of Deaf Adults: CODAS) can be described as being Deaf, if they acquired a sign language as their first language and if they consider themselves to be part of the Deaf community. However, this distinction is not applicable as a variable in studies of language acquisition of young children, since neither their linguistic nor their social and cultural development is completed. The cultural distinction can be used for deaf parents or teachers involved in sign language acquisition studies since it is an indication of their signing skills and of their commitment to use sign language with children. However, it should always be complemented with a description of audiological and/or functional hearing loss since the degree of hearing loss will also have an influence on their spoken language skills, and this may in turn influence the language input offered to the child.

The criteria for the selection of subjects with respect to degree of hearing loss depends partly on the line of approach and partly on the research questions to be asked. For example, in a study of attentional strategies used by deaf mothers, the four deaf mothers comprising the sample were comparable in terms of audiological deafness, all having a hearing loss of> 90 dB. However, mother A usually wore an hearing aid, which enabled her to perceive loud sounds; mother B always wore her hearing aid, but she said she heard nothing with it, while the other two mothers (C and D) wore no hearing aids. So functionally there was a difference between the mothers' degree of hearing loss. As well as this difference, mother A and mother C considered themselves active members of the Deaf community, while mothers B and D felt this to a much lesser extent. This variation has to be considered when interpreting the results, it probably can explain the varying proportion in use of SLN and Dutch in the input to their children (van den Bogaerde, forthcoming) and also their choice of (or skills in) attentional strategies.

For the subjects in the SLN pro-drop study, degree of hearing loss would not be an important variable, since the acquisition of SLN is expected to be similar for all children regardless of hearing loss, assuming of course that the input consists of SLN.

The degree of deafness can be reduced by the use of technology, for instance by powerful hearing aids or a device such as a Cochlear implant (CI). In a longitudinal study there is a chance that some children's hearing will improve for the reasons just mentioned; the hearing of other children may deteriorate as the result of an illness or syndrome, such as Usher's syndrome. For some studies a change in degree of hearing loss will not be important, but for others, such as a study of attentional strategies, it will be important.

1.2.3 Medical history

in order to keep the subjects comparable it is relevant to have some information on the medical history of the children. This information is usually available through family support programmes or audiological services. For example, different causes of deafness in children may have different implications: a child with Usher's syndrome will have a visual impairment as well as a hearing impairment, which will progressively limit the child's access to both spoken and sign language input. This could strongly influence, for instance, the attentional strategies that can be used with

the child over time. Medical information not related to deafness may also be relevant. For instance, a motor impairment may restrict a child's sign and spoken language acquisition so that language production is severely impaired (see Freeman, Carbin & Boese, 1981).

1.2.4 Linguistic background

It is evident that in relation to the child's acquisition of language that the input to the child needs to be described. Whether or not the child's parents are native signers will affect the quality and form of input. Native signers are usually themselves deaf; but it is estimated that less than 10% of deaf children have deaf parents (Quigley & Paul, 1984; Schemer, l990). These parents know what it is to be deaf and usually find their child's deafness easier to accept than hearing parents. They are attuned to a visual mode of communication and in general are able to provide their child with a deaf role model on a cognitive, social, emotional and linguistic level.

The majority of deaf children have hearing parents, most of whom know little about deafness and the effect this will have on their child's development at the point of diagnosis. The process of accepting the child's deafness is often difficult and prolonged (Calderon & Greenberg, 1993; de Kierk, 1996). The degree to which (hearing) parents eventually accept their child's deafness often has a great impact on their choice of language with the child. Hearing parents may choose to use only a spoken language with their deaf child, for instance Dutch, or to use sign supported speech or simultaneous communication, or to lean a sign language like SLN. If it is their choice to use a sign language, they will have to learn this language. While they are learning it, they will also use it in communication with their child. The child will simultaneously be acquiring this language from the input the parents provide. Like all second language learners, patents vary in how long it takes them to learn the language and in the level of their ultimate skill. It is therefore of paramount importance that information is obtained on the nature of the language input offered to a child, and on how long the child has been exposed to this input. These factors may have a great influence on the process of language acquisition (v.d. Bogaerde, 2000). Sometimes signing deaf parents are also late learners of a sign language, for instance if they did not learn to sign until they were in their teens. This may be reflected in their sign language skills (see Mayberry & Fischer, 1989; Mayberry, 1993), which may in turn have an effect on their children's language production (see

Singleton, 1989). Oral deaf parents who do not use a sign language in their home, will use spoken language, gesture and home--signs, end may not differ from hearing parents who use a spoken language, although deaf adults may have limited syntax, and deviant articulation, voice amid stress patterns" (Schiff-Myer, 1988; 47)

In studies on spoken language acquisition by hearing children, the linguistic input is usually easy to describe as monolingual, bilingual or multilingual. This is not the case when considering the input to deaf children. In the context of bilingual input involving spoken languages, the languages offered to the child can be clearly identified: for example, either English or Spanish. However, from the literature on code-switching (Romaine, 1989) and on pidgins and creoles (Bickerton, 1981) we know that influence of the one language on the other can be present in the input. The effects of such mixtures in the input have not yet been fully investigated (for an overview see Gallaway & Richards, 1994).

The input to deaf children usually shows more variation than the input to hearing children. When the input is indisputably a sign language (e.g. ASL) or a spoken language (e.g. English) there is seemingly no problem in describing the input, apart from accounting for individual variation However, it is often not so easy to establish the exact nature of the input to deaf children. If deaf parents are native signers, they will use sign language at home in interaction with their children (deaf or hearing); their deaf children will be in a signing environment from birth and are in a position to acquire that sign language as a first language. It has been shown, however, that signing deaf parents not only provide their children with sign language, but also with spoken language and simultaneous communication (SC) Mills & Coerts, 1990; Mallory, Zingle & Schein, 1993). Although it is not clear yet exactly how spoken and sign languages are combined by deaf parents in interaction with their children (but see v.d. Bogaerde, 1995), we do know from our own research that in the early years the percentage of simultaneous utterances averages around 60% (v.d.Bogaerde & Baker, forthcoming).

The extent to which mouthing of words and other influences from spoken language should be considered part of sign language will be discussed later

1.2.5 Age of subjects

In group studies children are usually matched for chronological age This variable is used to compare the path and rate of language development, for instance the development of Mean Length of Utterance (MLU) at the ages of 2;0, 2;0, 3;0 and 3;6. Children can also be matched on the basis of their mental or linguistic development. For children with a learning disability mental age is calculated from intelligence test scores. Linguistic age can be calculated on the basis of linguistic variables; children with a language impairment are often matched on the basis of MLU. Matching on linguistic age may be important when exposure to a sign language has been extremely variable within a group.

Selection of the age groups to be studied is necessarily related to those aspects of linguistic interest. For example, pro-drop cannot be studied if the child is still in the one word/sign stage; on the other hand, the earliest combinations are extremely important in such a study. The age range to be studied should also be large enough to reflect development. If the age range is very large, then a cross-sectional design (see 1.12) may be necessary.

1.2.6 Other variables

In some studies groups of children are matched for variables such as gender, intelligence or socio-economic status of parents. This is done where it is believed that such variables are important in accounting for language acquisition. For example, there is some evidence that girls are more precocious in language development than boys. Whether or not this is partly due to differences in input ha, not yet been established. Although there is no conclusive evidence about differences in language development between girls and boys (but see Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991; Sheldon, 1993), many studies select an equal number of boys and girls The variable of intelligence does not in itself play a crucial rule in the process of language acquisition. Children with a low IQ do not necessarily have limited language, for example children with William Syndrome. Children suffering from Down syndrome, however, are known to have delayed and somewhat deviant language (see Rondal, 1988; Woll & Grove, 1996), related to some extent to their mental age (1.2.5). Children with an IQ lower than 90 are usually excluded from studies of normal language acquisition to avoid any confounding factors.

There is a substantial literature on the possible influence of socio-economic status of parents on children's language acquisition. The results are contradictory, although

Hoff-Ginsberg, in a large scale study, has shown that the socio-economic status of parents can have an effect on the development of the lexicon.

1.3 Data Collection

The research questions should determine in which way the data are to be collected. The following aspects should be considered

Style	spontaneous or structured
Setting	at home in a laboratory or in an institute/school
Video-recording angle:	front or face to face
number of cameras:	one or more
one individual or interaction:	teacher + pupil(s) mother + child, child + child and group-interaction
durational aspects	one-session data, cross-sectional, longitudinal, or in combination, video-recording time per session
presence	other persons present or not (e.g. camera-person or researcher)

These aspects ,will be discussed in the following sections. It should be born in mind that if data are to be used which have beet, collected in an earlier study, certain of these aspects may be problematic for the current research questions. The data should be screened from this point of view.

1.3.1 Privacy of the individual

For all use of collected data permission must be obtained from the subjects themselves, or in the case of minors, from their legal guardians. It is good practice to explain to subjects, before asking permission, what will be done with the results of the study; how long the video tapes are to be kept; to what extent it is intended to show the recorded data to the public, scientific or otherwise; and whether or not the recordings may be made available for subsequent studies, perhaps by a third party. In order to protect the privacy of the subjects, they should only be referred to by number or pseudonym. These codes should be used at all times in the description of the subjects and study, and also in the indexing of the tapes and other files.

1.3.2 Spontaneous of structured data

The choice of spontaneous or structured language data depends on the aspects of language under study. Spontaneous language gives a broad picture of the child's ability in production; comprehension on the other hand cannot be systematically studied in this way.

The researcher gathering spontaneous language data needs to be sure in advance that the structure or behaviour under study will occur frequently enough for analysis. Diaries kept by the parents can be used to collect data on spontaneous language. The majority of such studies have been carried out by researchers themselves (e.g. Stem & Stem, 1907; Leopold, 1939-1948). Since observations are by nature selective, very clear instructions have to be given on how to keep a diary. The risk of bias is quite considerable. Another way of gathering spontaneous language data is the video-recording office-play interaction between adult and children) or between children. This provides a less biased record of the language of the child. However, the researcher should be aware that, even though only limited instructions are necessary or desirable before collecting spontaneous language, the choice of toys or topics of interaction are of considerable influence. For instance, the exploratory study on the use of attentional strategies by deaf mothers mentioned previously demonstrated that when a mother and a child were discussing pictures in a book, the attentional strategies used differed slightly from those used in a conversation about an event that bad taken place earlier that morning in school. Likewise, the use of indicative gestures is different in a picture-book-reading situation (here-and-now) than in a past-event situation (e.g. an event in school that morning) (Rooijmans, 1995). The situation can be given more structure by restricting the activity, for example to the telling of stories, or by selecting a specific type of group interaction such as classroom interaction.

As is clear from the above the drawback of spontaneous data is that its very nature makes it difficult to control the aspects under study; sometimes the required structures or interactional aspects may not occur during the specific recording. Therefore it s always advisable, although not always possible, to complement spontaneous language data with elicited data or with diary notes made by the parents.

Structured or elicited data allow the researcher to control the language behaviour. The most structured situation is a language test. Language comprehension data can best be collected in this way. Structured situations have frequently been used to study subsets of grammatical features in the sign language of adults. For example, negative or interrogative sentences have been elicited using picture material (Coerts, 1992); sentences involving verb-agreement have been elicited using short written

stories in the spoken language as stimuli (Bos, forthcoming) There is little experience with structured material or tests for use with children learning a sign language and there are specific complications compared to elicitation procedures used with children learning a spoken language. The use of picture material can result in too much deictic pointing, the use or written language obviously requires a considerable competence in that language on the part of the child. Currently many elicitation tasks are being developed, so it is relevant to consider the experience of other researchers in choosing a particular method.

1.3.3 Home or institutional setting

The choice of a home or institutional setting is usually driven by the choice between informal and formal, or spontaneous and structured language data. The institutional setting is intrinsically more formal than the home setting. From spoken language research it is known that adults are influenced by the formality of the situation; they are aware of different sociolinguistic registers and choose the register that matches the situation. Children begin to develop this awareness at an early age. In Deaf communities, formality of a situation is often accompanied by increasing influence of the spoken language (Deuchar, 1984). In countries where sign languages do not have official status as a minority language or official language of the Deaf community this influence may be even stronger. An institutional setting may therefore not give a representative picture of the child's sign language or of the input. The lack of familiarity in an institutional setting is usually greater than in the home; if the child is affected by unfamiliar people and settings this can have a negative effect on the child's willingness to communicate.

Informality is usually a characteristic of spontaneous language data Spontaneous language data need to be collected in all informal setting, most commonly the home. For example, the research on the use of attentional strategies by deaf mothers demanded a home setting; the most informal interaction between mother and child was required. It is possible to obtain informal language data in an institutional setting, however. For instance, if children are filmed in interaction with a teacher in their own school, the familiarity of the school environment can help to ensure that representational informal data are collected. An advantage of the formality of an institutional setting is that it can increase the child's concentration so that test performance is improved. An institutional setting such as a school can have the

practical advantage that the children are easily accessible. These positive aspects must be weighed up against the negative aspects set out above.

1.3.4 Technical aspects of recording

Pilot

Before collecting data for a main study, it is advisable to plan a pilot video-recording session which will not be used for analysis. This pilot enables the researcher(s) to check whether the video-recording conditions produce the desired results. In home-situations recording is often complicated by insufficient light, cramped space, noise, interruptions by the telephone or other children, and other inconveniences. A pilot session gives the researcher the opportunity to optimise video-recording conditions. In the case of a longitudinal study, a pilot also has the advantage that the subjects become familiar with the procedure, lithe subjects will be recording themselves (see 1.36) the pilot sessions can be used to assist the subjects to lean, how to use the camera, and to become aware of requirements for sufficient light, focusing, etc.

Background

The background affects the visibility of the signing produced by the subject(s). In a studio a simple unpatterned background should be chosen. Schermer (1996) reports that in video-data evaluated for visibility of signs by deaf and hearing informants, a mid-blue background was preferred by most viewers. When transferring video-data to CD-ROM it is also advisable to have the background as simple and unpatterned as possible to aid comprehension. In home video-recording settings it is usually not possible to find the perfect background, but every effort should be made to keep it as simple as possible.

Camera position

The aspect(s) of language behaviour under study often determine the number of cameras and their position Th general, both adult and child need to be recorded so that the signing of both can be unambiguously transcribed. With a single camera, the mother and child should sit alongside one another so that both can be adequately recorded. The camera can best be placed approximately 2,5 to 3 meters from the subjects, with the lens of the camera at the same height as, or a little below, the mother's face.

This set-up for the studies described above on the attentional strategies used by the deaf mothers and the development of visual attention of the children in relation to

spoken and sign language production. It was imperative, therefore, that both mother and child were visible at the same time, that eye-gaze direction could be observed and that both spoken and signed language could be recorded by the camera. As they moved about slightly, they were in practice either filmed facing the camera (front-position) or in profile (see also Schermer, 1996). A microphone on the camera recorded all spoken language, so there was no need to use an extra microphone. Some studies require highly detailed information, for example studies of phonological or morphological aspects of sign language. In these cases the size of the image has to be increased which makes it impossible to capture both mother and child using one camera. The recording has to be done with two cameras and this requires synchronisation of the data, for which a split-screen technique is advised. The same technique is necessary if research is being done on non-manual features, since a close-up of the face has to be related to the movements of the hands (see Coerts, 1992:91, partially adapted from Liddell, 1986:253).

In this set-up, the signer (S) and the addressee (A) are sitting opposite each other. S is recorded with two cameras (C1 and C2), while telling a story to A. In the split-screen technique the signers upper body is visible on one half while the other half shows a close-up of the signet's face.

Note-taking

It is advisable to make a sketch of the camera position and the position of the subjects during video-recording. This forms part of the contextual information alongside the notes made before and during video-recording, (e.g. child is teething, mother is not feeling well, which toys are involved in a play situation etc.) This contextual information may be helpful during the transcription phase

Cataloguing of recordings

Before actual video-recording starts it is advisable to record on tape all relevant information. All tape, should be marked with the pseudonyms of the subject(s) involved, the date arid successive number of the session, the age of the subject(s) and the name of the camera-person/researcher. The name or number of the research project should be added as necessary. If notes have been taken during the video-recording sessions, these should be categorised in the same manner as the data and be filed as such. Confidential files should be clearly marked confidential (for instance the files containing personal data).

Cataloguing is partly dependent on the research questions. If, for instance, children have been followed over a certain period of time, the tapes can be catalogued by child (child A session 1, session 2 etc.) or by point in time (at 1;0: child A child B etc.).

1.3.5 Duration of sessions

The researcher has to decide on the duration of each video-recording session. This decision depends on the research questions. Sufficient data of the relevant type must be collected. The amount will depend on the linguistic phenomena, the age of the child and the type of data. Some linguistic constructions do not occur frequently in a spontaneous setting, for example negative utterances; recordings need to be longer in order to contain enough data. Very young children have a shorter concentration span than older children or adults. The recordings therefore need to be shorter; tins can be compensated by recording more frequently. If in collecting spontaneous data it is necessary to obtain a minimum number of utterances or turns, the duration will depend on how communicative the child is. This is again also related to age. The time necessary for collecting 100 utterances can vary from 10 minutes to almost an hour. The alternative to collecting a number of utterances or turns is to record a fixed number of minutes of interaction. This might be desirable in a situation where the research question involves interaction rather than structural language properties. Whilst video-recording, it is important to recognise whether material is going to be unsuitable for analysis, for example if the child disappears out of the camera-view or if interruptions occur during the interaction. The video-recording session should then be prolonged to compensate.

All video-recording sessions should include five minutes warm-up', so that adult and child can relax and get accustomed to the situation. The carriers should be naming but these initial minutes are not be included in transcription and analysis.

1.3.6 Presence of others

Recording the language behaviour of children or adults can have an effect on their spontaneity. In different social situations, there are variations in style within the language of individuals. These stylistic variations are not random. All users of a language are likely to alter their communication to fit the casualness or formality of the occasion, though they are often unaware of doing so. Variations occur not only in

pronunciation, but also in syntax and vocabulary (Aitchison, 1981 :51). It is therefore difficult to obtain informal casual speech or sign samples. As Labov notes:

> We must somehow become witnesses to the everyday speech which the informant will use as soon as the door is closed behind us: the style in which he argues with his wife, scolds his children, or passes the time of day with his friends. The difficulty of the problem is considerable. (Labov, 1972:70)

Informants tend to adapt their speaking or signing style to the formality of the situation, or to the interaction style or speaking/signing of the researcher, or even to the more presence of a researcher. Schaerlaekens (1989), for instance, found that the presence of a researcher resulted in children producing longer utterances.

The 'observer's paradox', frequently discussed in sociolinguistic studies, also applies to sign language data collection. Because of the long history of suppression of sign language, many deaf people are still reluctant to sign in the presence of hearing persons. Airy hearing person present changes the (in)formality of the situation, and thus usually the language production of the subjects. It has been pointed out by many researchers (e.g. Deuchar, 1984) that when collecting sign language data from deaf subjects, time person(s) present, as conversation partner, camera-person, etc. should be deaf wherever possible so as to exclude any influence from a hearing person. However, an unfamiliar person, even a deaf one, may also have an inhibiting effect. If it is not possible to find a deaf person who knows the subjects there are several possibilities. A hearing person who can sign and who knows the subjects well can make the recordings, although some sign researchers reject this approach on principle. Alternatively the subjects can record themselves, for instance one parent can record the other in spontaneous interaction with the child. In an institutional setting, it may be possible to record using a one-way minor.

In some research designs the signer is asked to sign directly to the camera without a conversation partner. Although this is a way to avoid the observer's paradox, it has the disadvantage that the situation is highly unnatural. This will influence the language production of the subject

In structured data gathering sessions the situation is usually more formal and in test-situations the researcher is unavoidably present. This person should be Deaf if possible.

2. TRANSCRIPTION

2.1 Choice of data to transcribe

Before the transcription process begins, it is necessary to decide which data you need for your analysis. Clearly these data have to be included in the transcript. Beyond that you may decide to include additional information which may be relevant for later analysis. No guidelines can be given on this. There is always a chance that the data you want at a later stage will not have been transcribed. A number of issues relating to choice of data to transcribe will be addressed in the following sections.

2.1.1 Sign Language and Simultaneous Communication

Sign languages are almost always languages in contact with spoken languages. This sociolinguistic fact together with the status of sign languages as minority languages leads to a considerable influence from the spoken language community on the community of sign language users. This influence can be observed in the lexicon in the use of mouthings or word-pictures (Vogt-Svendsen, 1983; Schermer, 1990). It is not always clear when a mouthing is a compulsory element in a sign, that is, a loan element, and therefore belongs to the particular sign language. A mouthing can be the result of code-mixing, in which case it is not part of the sign language. Another complicating factor is the bilingual experience of most Deaf signers. It is important to realise that most of the children who acquire a sign language also are exposed to a spoken language. In Deaf families it is common for Deaf parents not only to provide their children with a sign language input but also with a spoken language input, often combined simultaneously with signs. In the first year of life the proportion of the spoken language offered to children forms a substantial part of the total language input (Kyle et al., 1987; Mills & Coerts 1990, Bogaerde 1997). The sign language acquisition of deaf children is therefore often part of a bilingual language acquisition process.

Deaf children in such a bilingual situation often produce utterances in which both the manual and vocal channel are used Within the Amsterdam acquisition project such utterances are defined as simultaneous communication (SC utterances). Such a classification does nor distinguish between loan mouthings and code-mixing.

Since it is not yet possible to identify those mouthings which are obligatorily part of Sign Language of the Netherlands, the category SC-utterances contains both types. In this project a distinction is made between SLN-utterances. Dutch utterances and

SC-utterances. It is possible to extract the sign part from a SC-utterance for analysis, but the researcher has to be careful not to treat these utterances as comparable to the 'sign-only' utterances. The linguistic proposition can be divided between the sign part and spoken part of an SC-utterance. There are various ways to code this relationship (see i.e. Goldin-Meadow & Morford (1990), Helm & Mills (1994) and van den Bogaerde & Mills (1995). To consider only the sign past would be to miss part of the proposition as is shown below..

sign level	YELLOW CAR
spoken level	broken
translation	The yellow car is broken

Secondly, the context of producing signs accompanied by spoken language may have an effect on the structural organisation of the sign part. For example, the position of a sign verb may be influenced by the word-order pattern of the spoken part of the utterance.

For these reasons, we consider it necessary to transcribe all SC-utterances and to keep them separate from 'sign-only' utterances in the analysis.

2.1.2 Non-linguistic and linguistic elements in sign language

Sign linguists, whether describing adult or children's language, have to decide which manual or non-manual signals are considered linguistic and which non-linguistic in the sign language they are studying. Not all movements of the hands or facial expressions are part of the a sign language. For example, the 7-hand which is part of the phonological system of BSL is not part of the phonological system of SLN (Brien & Brennan, 1992). Before beginning transcription of child language, the researcher must have knowledge of the linguistic elements of the adult language. If the adult language has not yet been adequately described, a decision has to be taken as to which criteria will be used to determine the linguistic status of the signal (see Deuchar, 1984 and Coerts, 1992). In early language acquisition a different problem arises. It is important to know when a form produced by the child has true linguistic status, with the form having symbolic meaning over several contexts arid referring to more than one object. These properties are used in spoken language to distinguish between vocalisations and words. For example, if a child articulates 'ba' in the context of playing with a ball on several different occasions and with different balls, then the form can be given the status of word. In sign language acquisition the

distinction between linguistic forms and pre-linguistic forms has been a subject of much debate. One problem is that that deaf and hearing children use similar gestures in the first year (Bates et at 1975). These gestures are often identified as signs when produced by deaf children, while the ascription of linguistic status to the gestures produced by hearing children is not even considered. Volterra and Caselli (1983) contest reports from some studies that the first signs of children acquiring a sign language emerge significantly earlier than the first words of hearing children (Bonvillian et al., 1983; Schlesinger, 1978). Most hearing children do not produce their first spoken word until about one year of age, whereas it is claimed that children acquiring a sign language as a first language produce their first recognisable sign by 9 months of age (Bonvillian et al. 1983).

Volterra and Caselli argue that the gestures that other researchers have identified as signs are not yet symbolic and that clear definitions are necessary in sign language acquisition research. To this end, Volterra & Iverson (1995) propose a set of criteria to determine the symbolic or linguistic status of both spoken and gestural elements, following Goodwin & Accredolo (1993). A symbolic element:

1. must be used to refer to an object or event not present in the immediate environment.

2. must be used with a variety of communicative intentions to refer to the same referent in different contexts;

3. must refer to a class of related referents and not be restricted to particular exemplars of the class.

They reserve the term 'linguistic' for symbolic elements when they are used in combination within the same modality, that is when syntax begins to emerge. Criterion us not commonly used in spoken language acquisition and it may be that this criterion is too strict since the communication topics in the early stages of language acquisition are usually restricted to the here and now. In relation to the remaining two criteria, it is often difficult to obtain evidence of varied use at a single point in time.

These criteria can be useful when considering deictic gestures (pointing) (Pizzuto, 1990). when the deaf child is in the one-sign stage, the linguistic status of pointing is unclear. If a point occurs independently and is analysed as a linguistic element then the language abilities of the child may be overestimated. When a point is produced in combination with a lexical sign, it is more plausible to assume its linguistic status (Volterra, 1990). The use of a point to refer to an object or event outside the

immediate environment (criterion 1) implies grammatical use of syntactic signing space. This does not emerge until the child is about three years old. It would therefore seem too restrictive to exclude points before that age.

Another aspect to consider is the status of headnods and headshakes. These non-manual signals are used in most sign languages to express affirmation and negation respectively. These gestures are also used by hearing children from an early age. Only criterion 2 is clearly applicable for deciding their symbolic status since their reference is necessarily abstract. They can best be considered linguistic when produced in combination with a manual sign. From the above discussion it is clear that there is no one correct solution to the problem of determining the linguistic status of early gestures. Before beginning a project, the researcher should determine his or her own criteria and be consistent in applying them.

2.1.3 Transcription level

The detail with which language data is transcribed depends on the research questions and/or hypothesis. Independent of the research question, it is necessary to include information on the contest of utterances and paraphrases of the transcribed utterances. The amount of information included about context will however depend on your research question. In interaction research this aspect is moat important.

The detail with which the language (sign and/or speech) is transcribed has to be determined. The more specific the research question, the more detailed the transcription of that particular aspect will be. Other aspects con be ignored, although if or transcribed in less detail the transcript can form the basis for subsequent research.

If studying the acquisition of sign phonology, the sub-lexical units have to be transcribed. According to the research question a choice can be made to transcribe only the manual elements of handshape, place, movement, palm orientation and finger orientation, These can be related to either the right or the left hand or indicate that both hands perform the articulation. The researcher has to decide whether to note the exact form of realisation (phonetic level) or whether to remain at the level of the phoneme. A study directed at all aspects of phonology would have to include the transcription of non-manual information since non-manual phonemes form part of the phonological system of sign languages (Coerts 1992, Schermer 1991). This means including at least eye-gaze, facial expression, mouth movements and orientation of

the head and body (sec 2.3.2 and 2.4.1) If you are only interested in the child's signing, the utterances of the conversational partner need not be transcribed. However it may be relevant to exclude direct imitations by the child of adult utterances. For this purpose a rough transcription of the adult's signing is needed.

2.2 Units of analysis

In the first instance, the basic transcription unit is usually the manual sign. That is, the recording is transcribed sign for sign. At the grammatical or discourse level these signs combine to form larger units, i.e. clauses, utterances, turns etc. According to the research questions these larger units may be significant as units of analysis. For each type of analysis unit, cleat criteria are needed which define the unit chosen and the process of segmentation. The definition of a unit of analysis can determine the amount of data obtained from the recording. If, for example, subordinate clauses are counted as part of an utterance there will bc fewer utterances in the data. This has important repercussions on the length of recording needed to obtain the required sample (see 2.3.5). Some possible units of analysis are discussed below:

2.2.1 Discourse topic

Within a study of conversational skills the unit of analysis can be a sequence of utterances having a unitary topic. A change in topic marks the start of a new unit. How frequently a child changes topic would then be indicative of conversational ability.

2.2.2. Turn

In research on pragmatic development, the unit of analysis can be a turn. Turns are usually signalled by a change in signer or by a tong pause between utterances produced by one signer. The number of turns the child takes and the length of turn indicate the pragmatic and linguistic ability of the child. The type of turn also shows the level of participation by the child in the interaction. Turns can be classified as reaction turns where a child maintains the same subject or topic of conversation as the adult; imitation turns, where a child in her turn directly imitates a part of l the preceding signs of the adult or herself or initiative-turns, where the child introduces a new subject or topic of conversation in her turn.

A balance between reaction turns and initiative turns reflects a good level of participation by the child, although obviously the role of the adult can be crucial here.

2.2.3 Utterance

When the research study focuses on morpho-syntactic development, the unit of analysis is often the utterance. Different definitions of an utterance can be chosen, for instance Hunt (1970:4) defines an utterance as "one main clause plus any subordinate clause or non clausal structure that is attached to or embedded in it". A problem with

such a definition however, is that it relies on a further definition of main clause, subordinate clause and non clausal structure. In the study of arguments in early syntax the utterance was the chosen unit of analysis The utterance was also the unit of analysis in the study of attentional strategies; for each of the mothers utterances an attentional strategy was coded together with an indication of whether or not the child responded so that it could be established how much input a child was able to receive.

Segmentation of language production into utterances is done on the basis of a number of markers. At least some of these have to be present, but they are not all necessary. Grammatical unity and semantic cohesion are important. One marker is the use of pauses: between utterances there is usually a relatively longer) pause than within utterances. In spoken languages another such marker is the pattern of intonation. At the end of a statement the pitch accent will usually fall; at the end of a question the pattern will usually rise. In sign languages the intonation-marker is not available, but alternatives in SLN include(cf. Baker & Padden, 1978): the use of explicit 'end of utterance' markers such as FINISHED; the use of PU (palms up); relaxation of one or both hands and/or drop below chest level; change in facial expression or eye-gaze direction; extension of the duration of the last sign the duration of mouthings at the end of an utterance (Bos, 1997)

The difficulties with these criteria lie in the fact that they can occur within utterances as well as at the boundary. They should only be used as criteria in combination with grammatical unity and/or semantic cohesion.

2.2.4 Clause

A clause can be defined as the smallest possible syntactic unit which can occur independently and consists minimally of two linguistic elements and their grammatical relation, for example BALL RED. This unit is useful in studying early syntax since it

avoids the difficult problem of deciding when subordination is present. This is a problem in adult signing where no explicit conjunction is used, but is particularly difficult in child language, since the markers of subordination are also often omitted or not correctly produced.

2.2.5 Sign

In a study of semantic development or phonology the unit of analysis can be a sign. The beginning of a sign usually corresponds to the first video-frame in which the handshape is fully formed; the end of a sign is the last video-frame in which the handshape is fully formed (Baker-Schenk, 1983); under certain circumstances the beginning and end of the movement of the sign can be used for segmentation.

2.2.6 Parameter

In a study of phonetic/phonological structure one or more parameters can be the unit of analysis. For instance if the focus is on possible movements in body-anchored signs, the parameters of movement and place of articulation will be appropriate units for analysis.

2.3 Transcription Method

In this section we will deal with a number of practical aspects relevant to transcription which have to be thought about before commencing transcription. The decisions taken on these points should be documented in a coding manual.

2.3.1 Organisation

The best equipment for transcribing allows for slow-motion reproduction which enables frame-by-frame viewing. Storing video data on computer (via hard-disc or CD--ROM) is preferable, since access to frames is more straightforward then searching on a video cassette. Since transcribing is both time-consuming and intensive work, the positioning of the monitor and keyboard with regard to lighting and distance from the transcriber must be carefully planned. The monitor should not have backlight or direct light; optimally it should stand sideways to the window, arid at a comfortable distance to permit viewing and transcription. The height of the chair should be adjustable so that the transcriber can sit uptight in a relaxed position. It is advisable to take pauses during transcribing and transcribers should not work for longer than an hour without a break.

Before starting to transcribe, it is necessary to decide in what form the transcription will be kept. The information needs to be organised in a legible form on the basis of the features which will be transcribed. This can be done best by designing a transcription form for either paper or computer use.

A transcription form needs to include information about the child and the situation of the recording (see 2.4.2) The notes made during the recording (see 2.3.4) about the child and his or her conversational partner can turn out to be very helpful in interpreting their language production. Notes about the specific toys used, the photos/pictures the child is looking at, or signs and utterances produced can be used as evidence to assist in interpreting an unclear or ambiguous utterance.

Although information about the context should be available in note form it is advisable to transcribe a recording as soon as possible if the transcriber was present at the recording (see 2.3.5).

The recording should first be viewed as a whole in order to get an idea of the overall language production and the topics the child and conversational partner are communicating about. Once this is clear transcription can begin. The first five or ten minutes of the recording are usually excluded from transcription because the language behaviour will not be representative until the subjects have become familiar with the setting (see 2.3 3 and 2 3 4). The recording must therefore be long enough to provide the data necessary (see 2.3.5).

In order to make an accurate transcription of sign language, short sequences of the recording should be watched several times at normal speed and then in slow-motion. It is useful to mark (sequences of) signs on the transcription form that are not understood at first viewing. In some cases there may be a clue about their meaning later on in the recording which will help to understand the sign or utterances.

Transcribing is a labour-intensive activity. Using a gloss-based notation system (see 2.3.2). it will take an experienced sign language researcher about one hour to transcribe one minute of language data. On this basis transcribing a 20 minute recording containing approximately 100 utterances from a young deaf child of deaf parents will take about 20 hours. Obviously this is only a rough indication and will vary according to the experience of the transcriber and the age, language level and production of the child.

2.3.2 Notation

No notation system has yet the status of a standard, although such a system would certainly be more efficient and contribute to easier exchange of data (Johnston 1991, 1~~llhler 1994). Nevertheless the most important criterion for selection of a notation system is that it accurately records the data needed in order to answer the research questions.

2.3.3 Glossing

Whichever notation system is chosen there will always be a line including a gloss representation of the signs. Providing a gloss is not as simple as it may appear. The gloss is represented as a word or word combination from a spoken language, and therefore a number of translation issues become involved. In order to translate accurately a sound knowledge of the sign language under study is necessary. These issues will be discussed briefly below.

Lexical equivalence

As is known from any comparison of two languages the meanings of a particular form in one language can be complex and must be translated using different forms in the other language. For example, there are several signs in SLN meaning 'mountain where the gloss MOUNTAIN misses formal distinctions among then, A highly detailed knowledge of a particular sign language is necessary in order to be able to gloss a sign accurately. The researcher has to decide how crucial this lexical information is in the research. It must at C~ times be recognised that the original sign utterance cannot be reconstructed on the basis of the gloss.

Syntactic/semantic category

One of the most frequent problems that the sign researcher encounters when glossing an utterance is the identification of the formal category to which a sign belongs. The formal distinction that is made in a particular sign language between a verb and a derivationally related noun is often not very well documented and may be difficult to perceive in certain contexts. The pair CHAIR (noun) and SIT (verb) in SLN differ in the length of the final hold, but the specific difference can vary in different situations. lit a language acquisition study it is in any case a research question as to when a child acquires such formal distinctions and therefore when they can be used reliably in interpretation. The SLN sign glossed as STAIRS (noun) appears to be identical to the sign glossed as TO-WALK-UP-THE-STAIRS (verb), unless the verb is modified for aspect or manner. This kind of modification is itself the basis for glossing

the sign as a verb. Otherwise the gloss has to be determined on the basis of the linguistic or non-linguistic context. It is advisable to indicate the basis for the gloss in such a case, so that decisions cant be revised if necessary.

The problem of identifying the syntactic category has of course implications for analysis. There are numerous problems in sign linguistics in identifying verbs. For example forms which are close in meaning to prepositions often have vent-like qualities (v. d. Bogaerde; Bos).

In language acquisition studies generally it is a problem to know when a form should be assigned to a particular category since the child is in the process of learning (Deuchar 1996). This implies that the criteria for determining the syntactic category most be extremely clear and explicit.

Classifiers

Verbs which include classifiers that represent specific classes of referents, also described as multi-morphemic predicates, are often glossed using the lexical distinctions in the spoken language. For example the combination of a classifier with a movement can be glossed as Cl $_{'car'}$-DR1VE-ZIGZAG, Cl$_{man'}$-WALK-ZIGZAG or Cl$_{'bike'}$-CYCLE-ZIGZAG. It can be argued however that the verb should have a general gloss, in this case ZIGZAG only.

2.3.4 Pilot studies

In all the previous sections, it was indicated that the researcher has to take many decisions about the form of transcription. These decisions are crucially related to the research questions. The transcription system must accurately record me data needed for further analysis. A pilot study is very useful in order to try out a system. As a result of a pilot the system can be adjusted, thus avoiding unnecessary correction later.

2.3.5 Transcribers and reliability

In order to make a reliable transcription of the language under study sufficient knowledge of the language must be available. This can be a problem for the hearing researcher transcribing signing, but also for the deaf researcher transcribing spoken words. Transcription ideally should be done by both deaf and hearing researchers, both with a good knowledge of the sign language. It is also important that the transcribers are clearly instructed in the transcription conventions so that they are consistent.

The consistency of the transcription can be measured using statistical procedures. Variation of transcription within one transcriber or across different transcribers should be kept to a minimum. A clear formulation of the transcription conventions will help reduce variation, but factors such as individual learning rate or fatigue are difficult to rule out (Rietveld & van Hout, 1993). To check the consistency of a transcription it is necessary to double score part of the material. If there is only one person who will transcribe the data the inter-rater agreement can be measured by that person transcribing the material for the second time at a time-interval long enough for the original transcription to have been forgotten. This is less desirable, but must often be done since sign language research is frequently carried out by individuals or very small groups. If there is another researcher available, then this person can re-transcribe the material, following the formulated conventions. The amount of material which needs to be transcribed a second time depends on the total amount of data. A rough guide is ten percent (Rietveld & van Hout 1993). The material should be selected randomly to avoid any bias. Usually all aspects of transcription are included in the agreement test but it is possible to calculate agreement for specific aspects such as glosses or segmentation.

There are different methods for calculating the agreement between the two transcripts (Rietveld & van Hout 1993). One of the most well known is Cohen's Kappa formula (Cohen 1970).

Agreement of approximately 80% is considered acceptable. With a lower score it is necessary to analyse the source of error and to evaluate how this can be corrected. In some cases it is necessary to improve the clarity of the transcription conventions. In other cases the problem may lie in a particular area, such as the glosses. Here a decision needs to be taken as to how crucial such an aspect is for the research question.

2.4 Documentation

As was discussed in the previous section the accuracy of the transcription conventions is important in relation to reliability The conventions should be noted in a coding manual (see 2 4.1) together with an explanation given of the transcription form selected (see 2.4.2).

2.4.1 Coding manual

The coding manual is a way to register the decisions that have been taken about all aspects of transcription, but also about forms of analysis. The manual must contain both a description of all symbols used in transcription and the decision procedures used, for example in segmentation or glossing. With the help of this coding manual other researchers can transcribe and analyse their data in the same way, so that their results will be comparable. This is extremely important in cross-linguistic comparison.

Symbols

Notation systems can be divided into two types: gloss-based and phonetic/phonological. A gloss-based system (cf. Baker & Cokely 1980) depends on an identification of individual signs. A gloss forms a label which refers to a sign. This label is a word from a spoken language and is used for all occurrences of the same form (see 3.3.3). A gloss only gives information about the approximate meaning of a sign, and says nothing about its form. Below is an example of a gloss-based notation, including non-manual signals, speech and non-linguistic behaviour. The transcription line labelled 'signs' contains two glosses of the two signs produced. The convention is that these glosses be represented in capital letters.

Example of a gloss-based notation

time code	1.02.45
signer	mother
non-linguistic behaviour	waves in direction of camera
non-manual signals	pos---
eye-gaze	camera---
signs	MOTHER TOO
speech	mama
gesticulations	
paraphrases	Yes, mummy is coming too
contextual remarks	Mother is making coffee in the kitchen

In the line labelled spoken, a transcription is given of any accompanying spoken word (with or without voice). In this example, the spoken word is represented in orthographic spelling. A more phonetic representation can also be used.

A gloss-based transcription may be appropriate for studies carried out at the sign level, i.e., for studies on lexicon, pragmatics and some aspects of syntax. It is not sufficient for a study which needs information about form at the sub-lexical level, such as a morphological or phonetic/phonological study. Such studies require a highly detailed notation system. There is no internationally recognised

phonetic/phonological notation system for sign languages comparable to the International Phonetic Alphabet (IPA).

Several sign language research centres have devised detailed notation systems but these are all very differently organised. Examples of many of these can be found in the publications of the Intersign network. Hamnosys (Prillwitz & Zienert, 1989) and the KOMVA notation system (KOMVA, 1988) are examples of systems designed for broad phonetic transcription of the manual part of signs.

A system for narrow phonetic transcription is being developed at the university of Leiden (van der Hulst, van der Kooij & Crasborn, in preparation).For non-manual features, the Edinburgh Non-manual Coding System (ENCS, Colville et al., 1984) can be used. The system developed earlier by Ekman and Friesen (1978), Facial Action coding System (FACS) however is still most commonly used. This system is anatomically based and highly detailed, whereas ENCS is more transparent. It is not within the scope of this manual to discuss and evaluate the different notation systems it, detail. For a broad overview of different notation systems. see Miller (1994).

A notation system for sign languages has to be able to cope with sign specific features, most importantly the simultaneous production of linguistic units. The manual features need to be related in time to non-manual features, but also within the manual features the system needs to cover the simultaneous signing of the two hands.

The following list includes some examples of the most frequent symbols used (Baker & Cokely, 1980; Bos, forthcoming; Coerts & Stronks, 1993; Hoffmeister, Moores & Ellenberger, 1978):

a gloss will be noted in CAPITALS

e.g. BOOK

a unit of analysis (see 3.2) will be distinguished from another unit of analysis by a segmentation line in the form of a slash ('/')

e.g. INDEX1 ILL/ MUMMY TOO/

incomplete utterances are indicated with an upward arrow at the end of the utterance:

e.g. MARK TOMORROW↑

fingerspelled elements are written in lower-case letters joined together by hyphens: --

e. g. m-a-r-i-e

repetition of a sign, without a pause between the two identical signs, is indicated with a plus ('+')

e.g. BOOK+++

sign elements which form a compound are combined by a circumflex: ('^')

e.g. NOW^DAY (translation: today)

if several words are necessary for the gloss of one sign, these words are linked by hyphens.

e.g. FINALLY-UNDERSTAND

when a classifier is used this is indicated by the letters 'CI' with a subscript referring to its referent.

e.g. CI$_{'car'}$

Non-manual grammatical markers are indicated by a letter referring to the grammatical function, for example 'wh-q' (wh questions), 'neg' (negation). Non-manual adverbs are indicated using letters which are close to the mouth configuration, for example 'mmm' (with relaxation and enjoyment). The duration of the marker is indicated by a horizontal line above all signs which are simultaneously produced manually.

      _____neg

e.g. MARK CAN JUGGLE / (translation: Mark cannot juggle)

False starts are indicated by round brackets.

e.g. (DADDY) MUMMY GO

Pauses in which the signer seems to be hesitating before continuing are indicated by three dots.

e.g. BOOK ... YESTERDAY ARRIVE/

Where a constituent break is marked by a pause, the lengthening of a sign, or a non-manual topicalisation marker, a comma is used to indicate the position of the break.

      _____t

e.g. YESTERDAY, DADDY ARRIVE/

(translation: It was yesterday that daddy arrived)

Gesticulations are indicated by lower case letters within quotation marks.

e.g. "gone"

non-manual grammatical markers for negation or affirmation without the presence of a lexical sign for affirmation or negation such as: NOT, NO or YES.

e.g. _____neg

POINT$_1$ TALK/ (3 morphemes)

(I don't want to talk about it)

a classifier in a verbal predicate.

e.g. Cl'car'-DRIVE-ZIGAZG (2 morphemes)

(The car drove in a zigzag)

aspectual marking is indicated between square brackets

e.g. LOOK-AT$_{[continuous]}$

Deixis

Pointing gestures are linguistic elements in adult signing. Criteria for including points in the linguistic data within child language acquisition were discussed in a previous section (see 2.1.2). In the coding manual the criteria must be explicit. Points which are linguistic elements are noted as POINT or INDEX. The referent is placed in a subscript. When a point is made to an object in the immediate environment of the signer the referent is named in the subscript. e.g. POINT$_{book}$. Otherwise use is made of a number or letter code corresponding to places in the syntactic signing space. If a point is made towards the conversational partner, this will be noted as POINT$_2$ or POINT$_{f(orward)}$; pointing at oneself as POINT$_1$ or POINT$_{c(entre)}$. Abstract referent points are again indicated by a number or letter. INDEX$_{3a}$ indicates an index to the signers right.

Decisions

As discussed earlier (see 2.3.3) glossing can be based on different elements of the linguistic and non-linguistic context. A coding manual should indicate how such decisions are made in principle. For example, if there are two or more forms with approximately the same meaning, it should be indicated whether the same gloss is used.

A decision has to be taken whether to use the same gloss for forms that are different from the citation form. Person marking, for example, which involves a change in the articulation of the verb sign, can be indicated using subscripts referring to the abstract locations of the signing space. The letter or number system as described above can be used for this, e.g. , $_2$GIVEN$_{3a}$ (you give her). The decision about how to gloss verbs involving classifiers (see 2.3.3) should also be clearly described.

Analysis

A coding manual should also contain information about the analysis procedure. The elements to be included in the analysis must be clearly described and defined, for example whether imitations and mirrors are excluded and how such forms can be identified. Procedures necessary for the analysis need to be documented. Morpho-syntactic analysis in general relies on a measure of complexity, such as the Mean Length of Utterance (MLU). This can be calculated in signs or in morphemes, although the alter is preferable. In that case one has to define the element 'morpheme'. For example, the following forms can count as a morpheme:

point:

e.g. POINT photo

citation form of a sign which is not a compound:

e.g. MILK

Analysis can sometimes involve the classification of forms at a more abstract and general level. An analysis of this type is the labelling of certain signs produced by adults to children as child-directed sign (CDSi). It is known from spoken language research that adults usually modify their language when addressing young children (Snow & Ferguson, 1977; (Gallaway & Richards, 1994). The modifications of the adult language can differ in many ways. Morphological adjustments to words can occur but also non-verbal behaviour can be considered as child-directed speech (CDSp). Furthermore, child-directed speech varies according to the child's age and language level (Snow & Goldfield, 1983, in Gallaway & Lewis, 1995). One characteristic of CDSp in spoken languages is for instance high pitch, which seems to be primarily concerned with gaining the child's attention (Snow, 1986). In sign languages, comparable pitch accent modification does not occur. However, other strategies are adopted such as the conversational patter of the child making phonological, morphological and syntactical adjustments to adult signs. So CDSi in relation to the linguistic environment of deaf children does occur just as easily (Harris et al., 1987). For example the mother may produce the sign CAT on a picture showing a cat instead of making it on her cheek.

It is not exactly clear what adjustments generally come under CDSi. It is advisable to mark on the transcription adjustments in the adult form which might be CDSi. CDSi may be the focus of your analysis if your research question is directed at input. On

the other hand, variation in input such as CDSi features may be crucial for the interpretation of the child's production.

Within the context of this text, it is not possible to give many examples of analysis procedures. These are inextricably linked to the research questions. The coding manual must however make the procedures of the individual researcher clear and explicit.

2.4.2 Transcription form

When selecting a transcription form one needs to make sure that the crucial information for analysis is clearly presented. The amount of information to be included depends upon research questions and possible future research plans (see 2.1). A transcription form must include background information, the project-number or title of the project, the name of the transcriber, details of the child, the recording situation and - where applicable - the conversational partner.

The following transcription lines need to be part of all transcription forms: time code, non-manual linguistic signals, manual signs, speech components, translation and remarks. What information is included precisely on each line must be specified in the coding manual, These may include phonological and morphological details of the articulated sign, whether or not it is a child-directed sign, and details of the context.

Basic information

The following details are usually found: The time code is filled in per sheet of the transcription. Non-manual linguistic signals are included in the basic form since they carry essential linguistic information. The speech component is included because in many sign languages the mouthing of (part of) words from the spoken language is considered part of the sign language (e.g. Vogt-Svendsen, 1981 for NSL; Lucas & Valli, 1989 for ASL; Pimiäa, 1990 for FinSL; Schermer 1990 for SLN; Turner 1995 for BSL).

The chronological order of the communication between the child and her partner is indicated by the transcription being noted from left to right. The turns are not noted under one another, unless they are simultaneous.

Additions to basic form - non-manual information

This basic transcription form is sufficient if the focus is on the grammatical structure of the utterances. This form can be extended with several additional lines; the only limitation is paper. For research on sign language interaction, for example -

attentional strategies- , more information is needed than pure linguistic information. Non-verbal behaviours such as gesticulations or hand-waving become relevant since this behaviour can be an attentional device. Direction of eye-gaze is important as it helps determine whether an utterance has been attended to. In this case, the transcription form is extended in this way for both child and conversational partner. The linguistic information which is globally organised in the basic transcription form can be further specified on separate lines. For example, the non-manual linguistic signal can be specified further in terms of the articulators: face, head, body and eyes. The function can also be specified: grammatical marker, non-manual adjective or adverb. In this case, the transcription form is extended in this way for both child and conversational partner. Although the research question will probably focus on the acquisition of non-manual linguistic signals, the same features are relevant in the conversational partner so that the effect of modelling can be investigated.

2.5 Using a database

The technical developments in software and database design are very swift and difficult to follow. For the most up-to-date documentation on this area we refer to the publications of the [ESF Network Intersign](#).

3. TIME COURSE OF SIGN LANGUAGE DEVELOPMENT AND ASSESSMENT

3.1 Pre-linguistic communication

Infants are born with the potential to learn any human language. Which language or languages they actually learn depends on which languages they have access to. The term 'access' is preferred here since for deaf children there needs to be careful and separate consideration of parental language output and child language uptake.
Prom birth to around 8 months in all infants, vocal babbling progresses from vocalic sounds, to syllabic combinations. These later syllabic combinations are influenced by the phonology of the spoken language heard by the baby. When well-formed syllabic combinations begin to appear, parents perceive these as intentional communication on the part of the infant, and respond accordingly. This in turn leads to changes in patterns of adult-child vocal interaction Deaf babies exhibit early vocal babbling which is similar to that of hearing babies, but after the first few months, this decreases. The

decrease is in contrast to the steady increase in quantity and syllabic variability in hearing babies. The absence of the normal babbling pattern in turn may lead to changes in interaction patterns with hearing parents, arid the usual vocal interactive turn-taking may not proceed normally. This impairment of interaction has implications for later social and cognitive development as well as for language development. Recent research has indicated that 'manual babbling' can be observed in infants exposed to sign languages. All infants move their hands and arms, and those infants exposed to sign languages imitate hand and arm movements. Just as hearing/speaking parents respond with changes in their interaction patterns to syllabic vocal babbling, signing parents respond to manual babbling as if it were intentional communication on the part of the infant. Manual babbling thus provides a motivation for both infant and parent to engage in conversations in the same way as vocal babbling does (Petitto & Marentette, 1991).

Early research on child language tended to ignore the role of gesture in the development of language. It is now recognised that all children gesture, that there is a well-structured pattern of gesture development, and that gestures continue to be used in conjunction with language throughout life. Gestures develop from early expressions of deixis (pointing or otherwise indicating objects or people) to referential gestures (labelling or naming of objects and actions). All children also progress to two-gesture combinations such as "there dolly". It has been claimed, however, that only children exposed to sign language develop combinations of referential gestures ("dolly big") (Volterra 1983). Gestures are particularly important in early social interaction with adults, and children use gestures to communicate their wants and interests. Thus all deaf children, including those who are not exposed to a sign language, or who have only limited signed or gestural input show spontaneous and regular use of gestures for communication.

3.2 First words and signs

Because of the difference in modality between gestures and words, the transition from pre-linguistic to linguistic communication appears more clearly in the development of spoken language (although the very first words are better interpreted as vocalic gestures or 'protowords' rather than as true linguistic structures) (Volterra & Caselli, 1985) For a child learning sign language, the transition is obscured by the identity of modality between gesture and sign. This led some researchers in the

1980s to claim that sign language is acquired much earlier than spoken language (Prinz & Prinz 1979). However, research on the development of pointing in children exposed to sign language provides evidence of discontinuity between gestures and signs, even when they have the same surface forms (Abrahamsen et al., 1985). Gestural pointing appears at about 9 months of age and is used independently and as an accompaniment to speech throughout life Children exposed to sign language initially use pointing to indicate people, objects and locations, as do all children. From about 12 to 15 months of age, however, it has been reported that signing children do not use pointing to refer to people, although they continue to use pointing to refer to objects and locations. Pointing to people returns at around 15 months, but is assimilated to the linguistic requirements of personal pronouns in sign language, and thus appears to be recategorised as a linguistic, and not gestural form.

Some studies have reported that children learning to sign have larger vocabularies during the first 2 years than children learning spoken languages (Ackerman et al 1990). Any such difference is only transitory. Hearing children generally have a lexicon of about 10 words at 15 months and 50 words at 20 months; studies of ASL report that children learning to sign have similar-sized lexicons.

It has been suggested that iconicity in sign language might make it easier to acquire signs. As we saw above, gestures and signs may appear identical in form and thus difficult to differentiate. Research on ASL has demonstrated however, that children of normal abilities find visually-motivated signs no easier to learn than arbitrary signs. It is also important to remember that signs which appear iconic to an adult may not be iconic to a child: the visual motivation of the sign MILK, which is historically derived from the action of hand-milking a cow, is likely to be opaque to a child growing up in Britain.

3.3 Acquisition of grammar

Signs and words also begin to be combined at similar ages. Although there are individual differences, children acquiring a given spoken language usually go through similar stages of development, with most of the syntax and morphology acquired before starting school, although development of the full use of discourse structures is not completed until the end of the primary school years, and there is evidence that the acquisition of some syntactic structures is also extended through the first l0 years of life.

English is the language whose acquisition has been most studied and the pattern of English language development in normally-hearing populations is well-described. Deaf children acquiring English generally do not follow the normal pattern of acquisition in one or more areas of morphology, syntax and pragmatics, especially if language acquisition is delayed. Apart from deviant phonology, which can be ascribed to difficulties in hearing sound contrasts, other linguistic areas may not reflect the usual patterns. Productive vocabulary often reflects the different language experience of the deaf child; parents may have explicitly taught colour terms, for example (Ackerman et al., 1990). The vocabulary is also likely to reflect the child's chronological, rather than linguistic age, and so may not be comparable to that of a much younger hearing child with the same level of language development. It is beyond the scope of this paper to discuss in detail the numerous studies of English language development in deaf children. It is important however, to note that it seems unlikely that language delay can ever occur without a greater or lesser degree of deviance from the normal pattern (Geers et al.,1984; Geers & Schick, 1988). The remainder of this section will describe studies of sign language development.

3.4 Chronology of sign language development

There have been a number of studies of normal sign language development from birth to 13 years and the results of these studies have allowed us to begin to describe milestones in the same way as has been done for English.. It should be noted that studies of normal sign language development are based on research with children of deaf parents, who are exposed to sign language from infancy. It may be expected that children of parents not fluent in sign language may not follow this pattern exactly, although preliminary evidence from children in hearing families where there are alternative models of sign language from an early age (enrolment in bilingual early intervention programmes with fluent signers in the environment) appear identical to deaf children of deaf parents, and research on ASL fluency has found no difference between children exposed to ASL from infancy and those exposed to fluent ASL from 2 years of age (Mayberry & Eichen, 1991).

Loew and Kegl have compiled a chronology of ASL development, and in the table below this has been combined with data from several European sign languages to produced a list of selected linguistic features whose development is characteristic of these age bands.

STAGES OF SL ACQUISITION

0-9 months

Babbling and gestures

- As discussed above, within the first 9 months sign babbling and the first copying of sign-related gross motor gestures of parents occur.

- Independent gestures (including those which are sometimes described as the first signs) occur at the end of this period.

9 months - 1;0

Pointing

- non-linguistic pointing to self, other people and objects appears

1;0 – 1;5

Pronominal reference, vocabulary

- Pointing to people drops out in this period, although pointing to objects is maintained.

- The first true signs appear at this stage. There is often over-generalisation (e g. CAR used to refer to cars and busses).

1;6 - 1;11

Pronominal reference

- Linguistic pointing to other people appears.

Morphology

- Verbs appear in the lexicon, but there is no productive verb morphology, with only citation forms of verbs used (i.e. no subject or object agreement in agreement verbs, no use of pro-forms in spatial verbs).

- There is no use of derivational morphology and consequently no morphological distinction between nouns and verbs.

Syntax

- The first two-sign utterances appear.

- In contrast to adult signing, where verb inflection, for example, is used to mark subject and object on agreement verbs, sign order is used to mark semantic relations.

2;0 – 2;5

Phonology

- Phonology differs greatly from that of adult signers, with regular patterns of reductions of contrast and omissions of phonological features. There appears to be a universal pattern of handshape development, with maximally visually contrasting handshapes (e.g. fist, pointing hand, flat hand) appearing first. There has been less research on location and movement, but it appears that children substitute simple for more complex movements, tend to proximalise movement, and often exhibit perseveration. Some research from ASL suggests that sign location within the centre of the child's visual field (e.g. signs made on the face or body) is mastered earlier than sign location in the periphery (e.g. signs located on the top of the head).

Pronominal reference

- Pointing to addressee (YOU) appears at about 2 years. Some children show evidence of self/addressee reversal errors (e.g. YOU PICK meaning I PICK)

- Pointing to 3rd person begins slightly later, and by 2;5, 1st, 2nd and 3rd person are correctly distinguished

Morphology

- Verbs requiring agreement begin to be used, but are most often produced in citation form, with agreement omitted, or as unanalysed rote forms.

- There is often over-generalisation of the verb inflection rule, with plain verbs inflected, where this is not grammatical in adult SL.

- The first morphological distinctions between nouns and verbs occur, but the contrast is made incorrectly.

2;6- 2;11

Morphology

- first appearance of classifiers used in spatial verbs. However these appear to be unanalysed wholes, with no evidence of productive use. These early classifiers often use unmarked or incorrect handshapes

- Verbs do not yet show morphological marking of manner (either through facial expression or altered movement

- The first productive use of verb agreement occurs at the beginning of this period.

- Noun /verb pairs are distinguished but this is frequently in non-adult ways, for example, by marking one of the pair with a distinctive facial expression, body posture, or speed of movement

3;0 – 3;5

Morphology

- Inflection of spatial verbs for movement or manner occurs, but children do not

- yet combine these. Thus if movement exhibits inflection, manner is signalled

- separately from the verb.

- The first correct use of classifiers occurs at this stage.

- Verb agreement is mastered in sentences where reference is made to objects

- present in the environment . However, omission of verb agreement with abstract spatial loci continues until well after 3;0.

- The first correct use of some number and aspect morphemes is found with spatial and agreement verbs.

3;6 - 3;11

Phonology

- Lexical compounds are used, but these are articulated without the characteristic phonological pattern (i.e., both parts of the compound are stressed).

Morphology

- Spatial and agreement verbs now have both movement and manner, but these are produced sequentially rather than simultaneously; towards the end of this period, there is the beginning of co-ordinated usage of both.

- Verb agreement begins to be found with abstract loci, but this occurs without co-ordinated establishment of referents at those loci.

4;0 – 4;11

Phonology

- Innovative compounds appear, although they are not adult-like either in phonology or in meaning.

Morphology

- Overt establishment of loci associated with referents is still absent in the first part of this stage. A moderate degree of control of the use of abstract loci, including their establishment, use and maintenance, is achieved by 4;11.

- Children still make occasional over-generalisations of verb inflection rules, although agreement with single subject is usually correctly marked.

- The noun-verb distinction is clear, but innovative forms are still seen in addition to correct forms.

5;0 – 5;11

Morphology

- The mastery of most morphology is completed and used with reasonable skill though the most complex polymorphemic forms still cause difficulty.
  Between 6 and 10 years, there is ongoing development of the requirements of narrative. While acquisition of most structures has been completed at the sentence level, the application of grammatical structures to the requirements of narrative, including cohesion, use of narrative role, etc. is still developing during this period.

8;0 – 8;11

Morphology

- The use of classifiers and spatial verbs is largely mastered, although some errors on complex forms are still noted.

9;0 – 9;11

- Mastery of the productive use of classifiers and spatial verbs is completed.

The findings described above have not yet been developed into formal assessments and provisions of norms for sign language acquisition. Because of this, the section above should be regarded as an orientation to the topic rather than as a checklist.

3.5 Assessment

Numerous assessment instruments are currently being developed. The latest review of these is presented in [Haug (2000) on the Intersign](#) website.

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Footnotes

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[2] Affiliation: Sign Linguistics, Universiteit van Amsterdam, The Netherlands (back to text)

[3] Affiliation: NGT Interpreter and Teacher Training, Hoge School van Utrecht, The Netherlands (back to text)

[4] Affiliation: Deaf Studies, City University, London, U.K.(back to text)

[5] see The Berkeley Transcription System (back to text)

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List of workshop papers