Anne Baker and Bencie Woll (eds.)

# Sign Language Acquisition

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Sign Language Acquisition

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# Sign Language Acquisition

*Edited by*

Anne Baker
University of Amsterdam

Bencie Woll
University College London

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# Editors' Preface*

Anne Baker and Bencie Woll
University of Amsterdam / University College London

## The ESF project Intersign

### *Goals*

The papers in this volume were collected within the Intersign Network. This network was financed by the European Science Foundation (ESF) from 1997–2001. The ESF is a European association of 62 national governmental organizations that fund basic research. The main goal of the ESF is to promote all branches of basic science in Europe by funding collaborative research, networks and workshops. Intersign began with its activities in 1998 with the aim of promoting sign linguistics, data exchange and collaboration on cross-linguistic work. Above all methodological and theoretical issues were to be addressed to promote the feasibility of data exchange. The articles were first published in 2006 in a special issue of *Sign Language & Linguistics*. They have been nominally edited for re-publication in this volume.

### *Activities*

The Intersign Coordinating Committee was composed of experienced sign language researchers from six different European countries.[1] They organized

* The editors thank the Netherlands Institute for Advanced Study, Wassenaar, The Netherlands, for the opportunity of finishing off the editing process of this volume.

1. The ESF Intersign network Coordinating Committee members were:

   Anne Baker (Amsterdam, The Netherlands, chair); Brita Bergman (Stockholm, Sweden); Penny Boyes-Braem (Basel, Switzerland); Thomas Hanke (Hamburg, Germany); Harry van der Hulst (Leiden, The Netherlands); Elena Pizzuto (Rome, Italy); Rachel Sutton-Spence (Bristol, UK); Bencie Woll (London, UK).

four different workshops in the years 1998 and 1999 on sign language research dealing with lexical databases, phonology, morphosyntax (text corpora and tagging) and acquisition. A number of researchers including participants from outside the ESF countries were invited to participate in these four workshops[2] resulting in an intensive exchange on these issues.

*Results*

Papers from the first three workshops were published in a special issue of *Sign Language & Linguistics* in 2001 (Bergman, Boyes-Braem, Hanke & Pizzuto 2001). In that issue the topics of databases, transcription and notation, and tagging tools were addressed in a collection of seventeen papers. The editors admit that little consensus was achieved on terms such as notation or transcription but this does not happen in research on spoken languages either. The discussions and resulting articles, however, stimulated much exchange and at the seventh international conference of Theoretical Issues in Sign Linguistics Research (TISLR) in Amsterdam (July 2000) the main theme was cross-linguistic issues (Baker, Van den Bogaerde & Crasborn 2003). In a special edition of *Sign Language Studies* papers on phonology and poetry were included from the second workshop (Sutton-Spence & van der Hulst 2001). This current volume includes papers from the workshop on acquisition.

## Papers in this volume

The papers in this volume are a unique collection, focusing on methodologies for the collection, transcription and analysis of child sign language data, rather than on the outcomes of the application of those methodologies. They include data drawn from a wide variety of sign languages including American, Australian, British, Dutch, Finnish and German Sign Languages. They encompass topics ranging from the methodology of acquisition research through a review of language assessment instruments for use with children and adults and on to transcription and notation of child sign language data, including phonetic transcription tools for the analysis of single signs, and approaches to the transcription of structures at sentence level and beyond. The final two articles move beyond straightforward sign language data to consideration of the transcription and analysis of gestural and spoken components of sign language interaction between adults and children. As a whole, this volume provides a key set of tools both for the researcher embarking

2. Further information on the Intersign Network can be obtained from the website: http://www.sign-lang.uni-hamburg.de/intersign.

on child sign language research and for anyone concerned with evaluating research in this field.

The collection begins with a thorough discussion of methodological issues in relation to sign language acquisition research (Baker, Van den Bogaerde & Woll, *Methods and procedures in sign language acquisition studies*), providing an overview of current approaches and procedures in research design, choice of subjects, data collection, transcription and documentation. The final section of this article contains a brief review of the chronology of development of sign languages, based on data from a number of sign languages. While this chronology will require further research to be complete, it provides a compact summary of the stages and ages of development for children acquiring a sign language as a native language.

The second paper (Haug, *Review of sign language assessment instruments*) is a comprehensive guide to sign language assessment, including discussion of published tools and those which are still under development. Haug provides information on target age groups, linguistic content, background on how and why each instrument was developed, usability (in terms of skills and time needed to code the data), and a summary of strengths and weaknesses. By separately discussing those instruments designed to monitor sign language acquisition, those developed for use within educational settings, and those designed for research purposes, Haug assists the researcher to evaluate the use and role of such tools in child sign language research.

The next two articles, by Takkinen and Morgan respectively, deal with specific topics in transcription. Takkinen (*Some observations on the use of HamNoSys in the context of the phonetic transcription of children's signing*) describes a number of notation and transcription systems developed for the phonetic notation of adult sign languages at the single sign level, with particular emphasis on HamNoSys, considering its applicability to the transcription of children's phonological development. She presents data from Finnish Sign Language acquisition, identifying problematic areas for notation, and suggesting modifications to extend the usefulness of HamNoSys to the coding of phonology in the developmental stage.

Morgan (*Transcription of child sign language: a focus on narrative*) considers the requirements of any notation system used for studies of longer texts, in particular narratives. These should exploit computer technologies for searching and collating coded utterances, and permit the sharing and exchange of data with other researchers working on similar questions both in signed and spoken language. He proposes a dynamic space transcription approach to enable the complexity of child sign language narrative to be coded.

Smith & Sutton-Spence (*Adult–child interaction the BSL Nursery — getting their attention*) move beyond the consideration of sign language data to the transcription and analysis of pragmatic, gestural behaviors in sign language interaction

— specifically, the analysis of attention-getting strategies found in adult–child interaction. By undertaking a detailed analysis, they reveal clear differences between behaviors of adults and children, and differences in the functions and situations in which the various tapping and waving behaviors occur. This in turn provides insight into developmental stages in attention-getting actions.

The final article in the issue (Van den Bogaerde & Baker, *Code-mixing in mother–child interaction in deaf families*), like Smith & Sutton-Spence, moves beyond consideration of child language behavior to that of interaction. Although the sign language development of native signing deaf children with deaf parents is often thought of as occurring in a monolingual setting, they discuss the mixed language input and output in such families, for both hearing and deaf children. They describe the input of deaf mothers as code mixing, or mixed code blending, comprising structures which contain both Sign Language of the Netherlands and Dutch in a form compatible with both languages. Their study emphasizes the need to include the coding of elements from spoken language in child sign language research.

## Future developments

Developments are happening on several fronts in the field of sign language acquisition. The first change has been the dramatic increase in the availability of computer-based tools to support research on sign language acquisition. ELAN (www.mpi.nl) and Signstream (www.bu.edu/asllrp/SignStream/) enable researchers to link video and multi-layered transcription, and to search transcribed material. The Berkeley Transcription system for sign language transcription (Slobin et al. 2001) can be used within the CHILDES international database for child language acquisition (http://childes.psy.cmu.edu/).[3] Signwriting (www.signwriting.org) enables phonetic note-taking. Standardized computer-based tools promise greater opportunities for cross-linguistic research and increased collaboration between researchers working on signed and spoken language acquisition. The development of webcams also may provide for the first time the opportunity to undertake diary studies of sign language development, in which parents can make video 'notes' of their child's progress.

The increased use of bilingual approaches to deaf children's education has created increased demand for assessment of children's progress in both signed and spoken language. This has led to a dramatic increase in the development of sign

3. There exists an European mirroring site organized by Steven Gillis (http://www.cnts.ua.ac.be/childes/, and a Japanese mirroring site organized by Hidetosi Sirai (http://www.cyber.sist.chukyo-u.ac.jp/CHILDES/). (see also MacWhinney 2000).

language assessment tools for use in educational settings. Collaboration between researchers working in different countries is moving the field forward rapidly.

Finally, research on the role of gesture and other para-linguistic components to child language is likely to link more closely in the future with both signed and spoken language research, to create an integrated perspective on early language and communicative development for both deaf and hearing children.

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# Methods and procedures in sign language acquisition studies*

Anne Baker[1], Beppie van den Bogaerde[1,2] and Bencie Woll[3]
[1]Universiteit van Amsterdam / [2]Hogeschool Utrecht / [3]University College London

Sign language acquisition is a relatively new field and is still developing its own good practice. This paper gives an overview of the most common procedures in research design, choice of subjects, transcription and documentation. The paper concludes with a brief overview of the chronology of development of sign languages.

**Keywords:** methodology, sign language acquisition, research design, transcription

## 1. Introduction

This paper aims to give an overview of the most accepted and common good practices in research on sign language acquisition. Investigating a language in the visual-spatial modality shares many problems with the study of a spoken language but also has many challenges of its own related to the modality of sign languages and the relative newness of the field. The first articles appeared in the 1980s on ASL (e.g. Newport & Meier 1985). This paper cannot hope to cover all methodological aspects fully nor to give a complete guide to the most recent references. Key references have been selected to give a reflection of the state-of-the-art.

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* This paper was originally written as a result of a project within the Human Capital and Mobility Program in 1996. It was subsequently expanded within the framework of the European Science Foundation Network Intersign 1998–2000 and a preliminary version by Baker, Van den Bogaerde, Coerts & Woll was published on the internet at <http://www.sign-lang.uni-hamburg.de/intersign/Workshop4/Baker/Baker.html>. Anne Baker and Bencie Woll are grateful to the Netherlands Institute of Advanced Study for the chance to complete this revised version. We also thank Roland Pfau for his support.

Section 2 outlines general aspects concerning design (2.1), the subjects of research (2.2) and data collection (2.3). In Section 3 transcription will be tackled, working from the choice of data to transcribe (3.1), units of transcription (3.2), method (3.3) (see also the papers by Takkinen and Morgan, this volume) and closing with documentation (3.4). In the final section an overview is given of the course of development in a sign language from the pre-linguistic stage (4.1) and early stages (4.2) through to the stage of complex structures (4.3). In 4.4 a chronological overview is given. The section closes with a few remarks on assessment but this issue is addressed fully in Haug (this volume).

## 2. Design and subjects

It is a well-accepted principle that only after formulating the research questions can the research design be completed. Fundamental aspects of design that 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 (see also for reviews of issues in spoken language acquisition Fletcher & MacWhinney 1995; Ritchie & Bhatia 1999).

### 2.1 Design

#### 2.1.1 *Case or group studies*

In order to be able to generalize research results, groups of children are usually chosen for study, rather than an individual child. Generalizability will clearly 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 behavior 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 individual's cognitive profile are unique and therefore must be dealt with as case studies, for example, Woll, Grove & Kenchington's (1996) 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 Morford 1995; Goldin-Meadow 2003). 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 information available on their background (see 2.2). Preferably these children should be followed over a longer period of time. An example of the debate on the complexity of such methodological questions is provided by the discussion on the study of the emergence of Nicaraguan Sign Language (Senghas, Kita & Özyürek 2004; Russo & Volterra 2005; Senghas, Özyürek & Kita 2005).

### 2.1.2 *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 2.2.5). 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 study on input and interaction by van den Bogaerde (2000) is an example of such a longitudinal study. Six children were followed during the period between 0;9, and 3;0 (see also 2.2.5).

However, in a longitudinal study the extended time span required for the collection of the data carries 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, 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 (De Villiers & De Villiers 1973; Porter 1977). 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. 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 2.2) so that any changes in the features under study are attributable to the factor of age only. Sometimes longitudinal and cross-sectional research is combined (e.g. Musselman, Lindsay & Keeton Wilson 1988).

### **2.1.3** *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 program. There are, however, 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 (see Thoutenhoofd et al. 2005 for an overview). 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 (Coerts & Mills 1995). The control group needs to be matched on a number of variables (see 2.2) so that it differs only in respect of the experimental condition, in this case the cochlear implant.

## **2.2** 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.

### 2.2.1 *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 for his or her language development in particular.

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 although the cost-effectiveness of universal screening is debated (Keren et al. 2002). Whether or not such tests are carried out as routine procedures depends on the organization 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 (pre-lingually deaf) or after spoken language is acquired (post-lingually deaf). This distinction is made between 3 and 5 years of age, at the age when 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 upper limit, although it is clear that some aspects of acquisition such as learning of vocabulary continue to develop in the post-lingual years.

The distinction between pre-lingual and post-lingual deafness is clearly relevant for the acquisition of spoken language. Post-lingually deaf children develop spoken language differently from pre-lingually deaf children, because they have had the auditory experience to enable them 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 pre-lingually 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 pre-lingually deaf children (Allen & Osborn 1984; Marschark & Spencer 2003).

The age of onset of deafness also has important consequences for the acquisition of sign language. However it is not clear that the pre-lingual versus post-lingual 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 post-lingually deaf child of deaf parents may acquire sign language without problems,

while a pre-lingually deaf child of hearing parents may not. In general one can say that children who learn a sign language in the post-lingual period do not fully master certain aspects of the sign language such as verb agreement and other morphological structures. There appears to be a critical period and late learners of a sign language as a first language behave much more like second language learners (Newman et al. 2002; Mayberry & Lock 2003).

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 (Van den Bogaerde 2000). 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 (Harris & Mohay 1997; Spencer & Meadow Orlans 2004). 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 behavior and the use of attentional strategies by the conversational partner(s) (Smith & Sutton-Spence this volume). 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 behavior from birth. It is obvious that a child who becomes deaf at age ten years will have had different experiences in this area from a child who becomes deaf at 2;6. 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 pre-lingually deaf and post-lingually 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 (see for a discussion Butler & Hakuta

2004.). If a sign language is acquired after post-lingual deafness, it is automatically a second language and therefore subject to interference. A study, for example, on the production of syntax by children 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.

### 2.2.2 *Degree of hearing loss*

Researchers have used different criteria to determine the hearing status of subjects. There are some differences in the thresholds used to group hearing loss, but the following terms are those used by the Deafness Research Foundation in the United Kingdom. They refer to audiological measurements of unaided hearing in the better ear.

Normal hearing (0 to 25 dB HL)
Mild hearing loss (26 to 40 dB HL)
Moderate hearing loss (41 to 70 dB HL)
Severe hearing loss (71 to 90 dB HL)
Profound hearing loss (greater than 91 dB HL)

Some researchers use the term 'deaf' only for those people with a hearing loss of $\geq$ 100 dB, others include all people with a hearing loss of $\geq$ 60 dB. Thus it is clear that audiological definitions are not uniform.

We would like to emphasize 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 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 not wear a hearing aid and functionally be profoundly deaf.

The cultural definition of deafness is based on membership of the deaf cultural community (recently the term 'deafhood' has begun to be used in relation to this, see Ladd 2002). 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 (frequently 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 should be used carefully 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 (Van den Bogaerde 2000), 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 a 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 NGT and Dutch in the input to their children and also their choice of (or skills in) attentional strategies.

For the subjects in a study of syntax in a sign language, degree of hearing loss would probably not be an important variable, since the acquisition of a syntactic structure is expected to be similar for all children regardless of hearing loss, assuming of course that the input consists of a full adult version of the sign language. However, since most children who learn a sign language are growing up bilingual, whether they are hearing or deaf, the amount of hearing loss may influence the language choice in specific situations.

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) as mentioned above. 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 necessarily be important, but for others, such as a study of attentional strategies, it will be important.

### 2.2.3 *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 programs or audiological services. For example, different causes of deafness in children may have different implications: a child with Usher's syndrome will have a progressive visual impairment as well as a hearing impairment (this may also be progressive depending on the subtype of the syndrome), 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 severely affect language production (see Freeman, Carbin & Boese 1981).

### 2.2.4 *Linguistic background*

It is evident 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 in most Western countries (Quigley & Paul 1984; Schermer 1990). Such 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.

However, 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 Klerk 1996; Young 1999) and involves many decisions including the option of cochlear implantation (Wever 2002) 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 they may choose to learn and use a sign language such as NGT. In this case, they will be using a sign language in communication with their child at the same time as they — and their child — are learning it. Like all second language learners, parents vary in how long it takes to learn the language and 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 (Van den 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 & Newport 2004). Oral deaf parents who do not use a sign language in their home will use spoken language, gesture and home-signs. They 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). However, they may make use of visual attention strategies comparable to those of deaf signers (Swisher 1989).

In studies of spoken language acquisition by hearing children, it is usually easy to describe the linguistic input 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, although 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 to deaf children are currently being investigated (Van den Bogaerde & Baker this volume; Baker & Van den Bogaerde 2008).

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, it may be assumed that 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 code-blending or code-mixing (e.g. Mallory, Zingle & Schein 1993; Baker & Van den Bogaerde 2008). Although it is not clear yet exactly how spoken and sign languages are combined by deaf parents in interaction with their children, we do know from research in the Netherlands that in the early years the percentage of simultaneous utterances averages around 60%.

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

### 2.2.5 *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 ages 2;0, 2;6, 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 (Coerts 2000). 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 2.12) may be necessary.

### 2.2.6 *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 has not yet been established. Although there is no conclusive evidence about differences in language development between girls and boys (see Karrass et al. 2002; 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, but 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 and contradictory literature on the possible influence of socio-economic status of parents on children's language acquisition, although Hoff-Ginsburg (1991), in a large scale study, has shown that the socio-economic status of parents can have an effect on the development of the lexicon.

## 2.3 Data collection

The research questions determine in which way the data are to be collected. The aspects in Table 1 should be considered.

**Table 1.** Practical aspects of data collection situation

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

### 2.3.1 *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-recordings 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.

### 2.3.2 *Spontaneous or 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 behavior 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. Stern & Stern 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. New technology has now made it possible for parents to create video diaries, either by recording their child, or by making a video note (i.e. by imitating an example of their child's communication) and transmitting it via webcam or video file attachment to a researcher. Another way of gathering spontaneous language data is the video-recording of play interaction between adult and children or between children (see <diver.standford.edu> for an example of a multi-camera technology particularly suited to the video recording and analysis of group interaction). Video recording of spontaneous interaction 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, one exploratory study on the use of attentional strategies by deaf mothers (Van den Bogaerde 2000) 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 had 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 discussion the drawback of spontaneous data is that its very nature makes it difficult to control the aspects under study, since the desired structures or interactional aspects may not occur during the specific recording. Therefore it is 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 have more control over the language behavior. 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); the comprehension of sentences involving verb-agreement has been elicited using video-clips (Senghas 2003). There is relatively little structured assessment material available or tests for use with children learning a sign language (see Haug this volume for a review) and there are issues to be

considered. The use of picture material can result in too much deictic pointing; the use of written language requires considerable competence in reading. Currently many elicitation tasks are being developed, so it is relevant to consider the experience of other researchers in choosing a particular method.

### 2.3.3 *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 setting; 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, setting formality is often accompanied by increasing influence of the spoken language (Deuchar 1984). In countries where sign languages do not have official status 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. 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 an informal setting, most commonly the home. For example, research on the use of attentional strategies by deaf mothers (Van den Bogaerde 2000) demanded a home setting as 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 (see Smith & Sutton-Spence this volume). 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.

### 2.3.4 *Technical aspects of recording*

*Pilot*

Before collecting data for a main study, it is advisable to undertake a pilot video-recording session which will not be used for analysis. The 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 optimize video-recording conditions. In the case of a longitudinal study, a pilot also has the advantage that the subjects become familiar with the procedure. This can even make it possible for subjects to record themselves (see 2.3.6) since the pilot sessions can assist the subjects to learn 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 un-patterned 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 or DVD it is also advisable to have the background as simple and un-patterned as possible to aid compression. 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 behavior under study often determines the number of cameras and their position. In 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 metres from the subjects, with the lens of the camera at the same height as, or a little below, the mother's face.

It is imperative for studies involving input and interaction that both mother and child are visible at the same time, that eyegaze direction can be observed and that both spoken and signed language can be recorded by the camera. As both mother and child often move slightly, they must in practice either be filmed facing the camera (front-position) or in semi-profile (see Van den Bogaerde 2000; Schermer 1996). If they sit opposite one another which is feasible with older children, then a set-up with two cameras as in Figure 1 is a possibility. A microphone on the camera can record all spoken language, so there is usually no need to use an extra microphone.

Some studies require highly detailed information, for example studies of phonological or morphological aspects of sign language, or if research is being done on nonmanual features, since a close-up of the face has to be related to the movements of the hands. In these cases the size of the image has to be increased. This can be achieved through the use of two synchronized cameras (see Figure 2) but note that only one person is filmed in this way. Electronic treatment, allowing selection

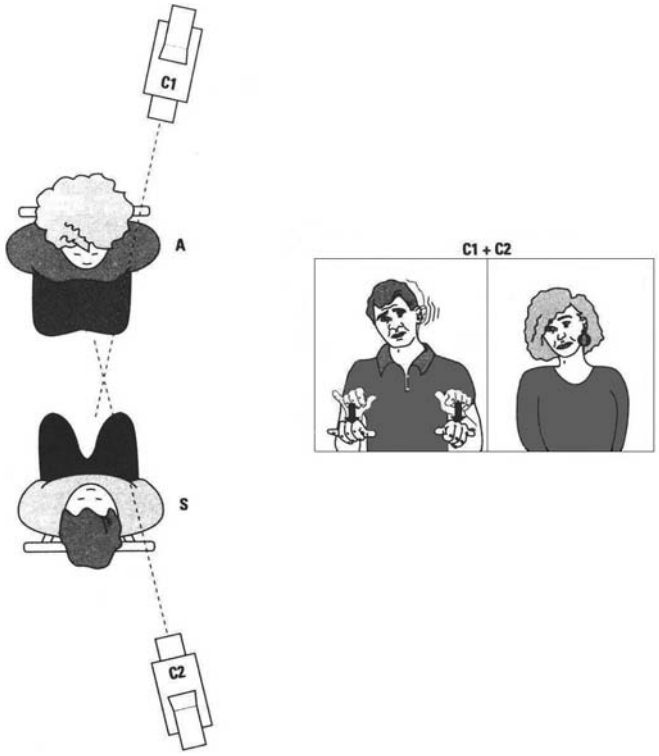



**Figure 1.** Using two cameras to film signer (S) and addressee (A) (from Coerts 1992:91)

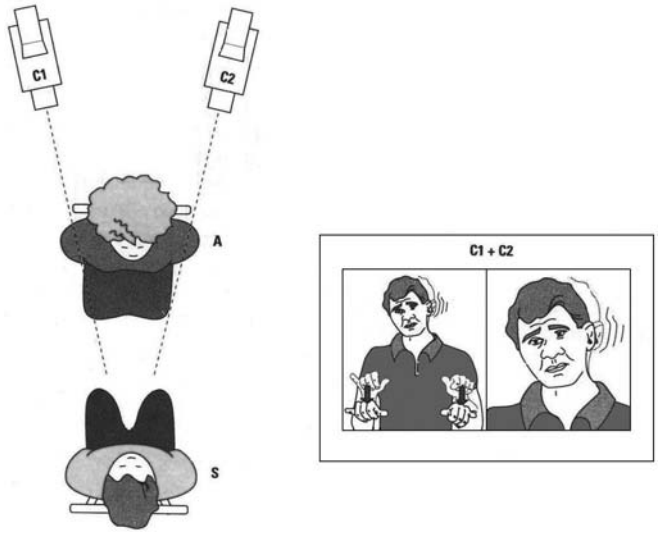



**Figure 2.** Using two cameras to film the signer also in close-up.

of an area within the image for enlargement, is also possible. Digital video recordings (DV tape, cameras with mini-DVD discs that can be recorded onto a hard drive) substantially increase flexibility.

*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 or metadata 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 (Metadata)*
Before the actual video-recording starts it is advisable to record all relevant information. All recordings should be marked with the pseudonyms and/or code number of the subject(s) involved, the date and 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 categorized 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.).

If data is going to be made available to other researchers, as for example the adult signer data from the ECHO project[1] then the cataloguing has to be very carefully done and all issues around privacy (see 2.3.1) resolved.

### 2.3.5 *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; this can be compensated by recording more frequently. If, in collecting

1. http://www.let.ru.nl/sign-lang/echo/

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. While video-recording, it is important to recognize 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 cameras should be running but these initial minutes are not to be included in transcription and analysis.

#### **2.3.6** *Presence of others*

Recording the language behavior 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. Variation occurs 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 (1972) noted:

> 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 mere 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. The presence of any hearing person 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, the 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 mirror.

In some research designs the signer is asked to sign directly to the camera without a conversation partner. Although this avoids the observer's paradox, it has the disadvantage of being unlike natural interaction, which will in turn influence the participant's language production.

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.

## 3. Transcription

### 3.1 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.

#### 3.1.1 *Sign language and spoken language*

Sign languages are almost always languages in contact with spoken languages. This sociolinguistic fact together with the status of sign languages as minority languages usually 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 (see for a review Boyes Braem & Sutton Spence 2001). It is not always clear when a mouthing is a compulsory element in a sign, that is — a loan element — and therefore has become a part of that sign language, since 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 realize 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 (see Van den Bogaerde & Baker this volume). In the first year of life spoken language can form a substantial part of the total language input offered to children. Sign language acquisition by 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 simultaneously. This can be called code-blending following Emmorey et al. (2005). Such a classification does not distinguish between loan mouthings and code-mixing. In some instances of code-blending the semantic content of the sign part and spoken part is semantically incongruent. That is, both parts contribute to the full proposition (see Van den Bogaerde & Baker this volume) To consider only the sign part would be to miss part of the proposition, as shown in Example 1.

(1) 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 organization 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 code-blended utterances and to keep them separate from 'sign-only' utterances in the analysis.

### 3.1.2 *Non-linguistic and linguistic elements in sign language*

Sign linguists, whether describing adult or children's language, have to decide which manual or nonmanual 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 sign language. For example, the 7-hand (little and ring fingers extended), which is part of the phonological system of BSL, is not part of the phonological system of NGT (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; 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 and referring to more than one object. These

properties are used in spoken language to distinguish between vocalizations 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 deaf and hearing children use similar gestures in the first year (Bates et al. 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 (1985) and Petitto (1988) 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. 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 recognizable sign by 9 months of age (Bonvillian et al. 1990; see also Meier & Newport 1990). 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 Goodwyn & Acredolo (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.

Volterra & Iverson reserve the term 'linguistic' for symbolic elements when they are used in combination within the same modality, that is when syntax begins to emerge. The first of these criteria is not commonly used in spoken language acquisition and it may be that it is too strict since 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, however, 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 analyzed 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 et al. 1990). It is then often indicated as INDEX.

The use of a point or INDEX 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 head nods and head shakes. These nonmanual 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.

### 3.1.3 *Transcription level*

The detail with which language data are transcribed depends on the research questions and/or hypotheses. Independent of these, it is necessary to include information on the context of utterances and paraphrases of the transcribed utterances. The amount of information included about context will however depend on the research question. In interaction research this aspect is most 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 can be ignored, although if transcribed in at least minimal 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 (Takkinen this volume). 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 realization (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 nonmanual information since nonmanual phonemes form part of the phonological system of sign languages (Coerts 1992; Schermer 1990; Takkinen this volume). This means including at least eyegaze, facial expression, mouth movements and orientation of the head and body (sections 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, although it is usually sensible to consider the role of the input. It may also 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.

## 3.2 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, clear criteria are needed to 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 be fewer utterances in the data. This has important repercussions on the length of recording needed to obtain the required sample (see 3.3.5). Some possible units of analysis are discussed below.

### 3.2.1 *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 will mark the start of a new unit. How frequently a child changes topic would then be indicative of conversational ability. Narratives are usually considered as a whole and, it is argued, need a specific method of transcription (Morgan this volume).

### 3.2.2 *Turn*

In research on pragmatic development, the unit of analysis can be a turn. Turns are usually signaled by a change in signer or by a long 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 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. Overlaps between turns seem to occur frequently in sign language interaction.. How this develops has hardly been studied (but see Baker & Van den Bogaerde 2005).

### 3.2.3 *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 (Mills & Coerts 1990), for example, the utterance was the chosen unit of analysis. The utterance was also the unit of analysis in the study of attentional strategies (Van den Bogaerde 2000); for each of the mother's 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 will usually fall; at the end of a question the pitch will usually rise. In sign languages the pitch intonation-marker is not available, but alternatives include (cf. Baker & Padden 1978; Suttton-Spence & Woll 1999): 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 eyegaze direction; extension of the duration of the last sign; the duration of mouthings at the end of an utterance (Nonhebel et al. 2004). The difficulties with these criteria lie in the fact that they can occur within utterances as well as at the boundary between utterances. They should only be used as criteria in combination with grammatical unity and/or semantic cohesion (Van Gijn 2004).

### 3.2.4 *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.

### 3.2.5 *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 hand shape is fully formed although it can be problematic in child signing to determine exactly when this is. The end of a sign is the last video-frame in which the hand shape is fully formed (Baker-Schenk 1983); under certain circumstances the beginning and end of the movement of the sign can be used for segmentation.

### 3.2.6 *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.

## 3.3 Transcription method

In this section we will deal with a number of practical aspects relevant to transcription that have to be considered before commencing transcription. The decisions taken on these points should be documented in a coding manual. An overview of transcription methods and database construction is to be found in Bergman et al. (2001).

### 3.3.1 *Organization*

The best equipment for transcribing allows for slow-motion reproduction which enables frame-by-frame viewing. Storing video data on computer (via hard-disc, DVD 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, and 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 organized in an efficient and clear 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.

Transcription programs such as ELAN[2] or SignStream[3] allow the possibility of linking the transcription in time to the video-frame and are highly recommended. A transcription form needs to include information about the child and the situation of the recording (see 3.4.2). 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 3.3.5).

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 behavior will not be representative until the subjects have become familiar with the setting (see 3.3 3 and 3 3 4). The recording must therefore be long enough to provide the necessary data (see 3.3.5).

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 labor-intensive activity. Using a gloss-based notation system (see 3.3.3), 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.

### 3.3.2 *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 (Bergman

**2.** This M ulitmedia annotator program can be downloaded free of charge from <http://www.mpi.nl/tools/>

**3.** More information can be obtained about this program from <http://www.bu.edu/asllrp/SignStream/>

et al. 2001). 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 (see Takkinen and Morgan this volume).

### 3.3.3 *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 thorough 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 NGT meaning 'mountain'. A single gloss MOUNTAIN misses formal distinctions among them. The researcher has to decide how crucial this lexical information is for the research. It must at all times be recognized 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 language researcher encounters when glossing an utterance is the identification of the formal category to which a sign belongs. For example, the formal distinction that may be made in a 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 BSL differ in the length of the final hold, but the specific difference can vary in different situations. With regard to 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 NGT 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 can be revised if necessary.

The problem of identifying the syntactic category of a sign has of course implications for analysis and the only procedure is to record and report the criteria

chosen for making decisions. 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 must be extremely clear and explicit.

*Classifiers*
Verbs which include classifiers that represent specific classes of referents, also described as poly-componential 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'-DRIVE-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. The Berkeley Transcription System is particularly concerned with glossing of these forms (Hoiting & Slobin 2002).

### 3.3.4 *Pilot studies*
The researcher has to take many decisions about the form of transcription and these are crucially related to the research questions. The transcription system must accurately record the 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.

### 3.3.5 *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, each having 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. Variations in transcription by 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 transcribing 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 research 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.

Agreement of approximately 80% is considered acceptable. With a lower score it is necessary to analyze 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.

## 3.4 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).

### 3.4.1 *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 followed, for example in segmentation or glossing. With the help of this coding manual other researchers can transcribe and analyze their data in the same way, so that their results will be comparable. This is extremely important in cross-linguistic studies.

*Symbols*

Notation systems can be divided into two types: gloss-based and phonetic/phonological. A gloss-based system (cf. Sutton-Spence & Woll 1999) 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 provides no information about its form. Below is an example of a gloss-based notation, including nonmanual signals, speech and non-linguistic behavior. The transcription line labeled 'signs' contains two glosses of the two signs produced. The convention is that these glosses be represented in capital letters.

(2) gloss-based notation

| | |
|---|---|
| time code | 1.02.45 |
| signer | mother |
| non-linguistic behavior | waves in direction of camera |
| nonmanual signals | pos — |
| eyegaze | 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 labeled 'spoken', a transcription is given of any accompanying spoken words (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 recognized phonetic/phonological notation system for sign languages comparable to the International Phonetic Alphabet (IPA).

Several sign language research centers have devised detailed notation systems but these are all very differently organized. Examples and discussions of these can be found in Bergman et al. (2001). The HamNoSys transcription system (Prillwitz & Zienert 1990; see also Takkinen this volume) and the KOMVA notation system (Schermer 1988) are examples of systems designed for broad phonetic transcription of the manual part of signs.

A system for narrow phonetic transcription has been developed: SignPhon (Crasborn et al. 2001). For nonmanual features, the Edinburgh Nonmanual Coding System (ENCS, Colville et al. 1984) can be used. The system developed earlier by Ekman and Friesen (1978), the Facial Action coding System (FACS), is still commonly used (see Boyes Braem & Sutton-Spence 2001). 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 in detail. For a broad overview we refer again to Bergman et al. (2001).

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 nonmanual 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 frequently used symbols:

- 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 (/) or by a period (.)
  e.g. INDEX1 ILL/ MUMMY TOO/ or INDEX1 ILL. MUMMY TOO.
- incomplete utterances are indicated with an upward arrow at the end of the utterance:
  e.g. MARK TOMORROW$^{\uparrow}$
- fingerspelled elements are written in lower-case or upper-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 'CL' with a subscript referring to its referent.
  e.g. $CL_{CAR}$
  Sometimes the form of the classifier is indicated by referring to the hand shape involved.
- Nonmanual grammatical markers are indicated by a letter referring to the grammatical function, for example 'wh-q' (wh questions), 'neg' (negation). Nonmanual adverbs are indicated using letters which resemble the mouth actions, for example 'mmm' (with relaxation and enjoyment). The duration of the marker is indicated by a horizontal line above all manual signs which are produced simultaneously with the nonmanual element, e.g.

  neg
  MARK CAN JUGGLE /
  (translation: 'Mark cannot juggle')

- False starts are indicated by curved parentheses.
  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 nonmanual topicalization 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"
- nonmanual grammatical markers for negation or affirmation without the presence of a lexical sign for affirmation or negation such as: NOT, NO or YES are marked with a horizontal line and count as a morpheme.
  e.g. neg
  INDEX1 TALK/ (3 morphemes)
  (translation: 'I don't want to talk about it')
- a classifier in a verbal predicate is labeled as CL and counts also as a morpheme.
  e.g. $CL_{CAR}$-DRIVE-ZIGZAG (3 morphemes)
  (translation: 'The car drove in a zigzag')
- aspectual marking is indicated between square brackets
  e.g. LOOK-$AT_{[continuous]}$ (2 morphemes)

*Deixis*

Pointing gestures are treated as linguistic elements in adult signing (although see Liddell 2003 for discussion of whether all elements in sign languages should be treated as linguistic). 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 (IX). 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 $POINT_{c(enter)}$. Abstract referent points are again indicated by a number or letter. $INDEX_{3r}$ indicates an index to the signer's right. (See Figure 3.)

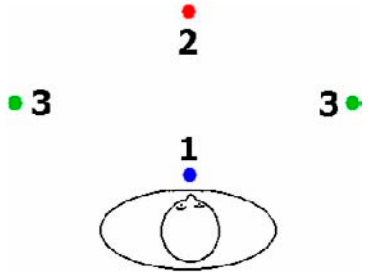



**Figure 3.** The use of indices in the signing space.

*Decisions*

As discussed earlier (see 3.3.3) 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$_{3r}$ ('you give her'). The decision about how to gloss verbs involving classifiers (see 3.3.3) 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 utterances mirroring the signer 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, the first is the easier but the second is preferable. In that case one has to define the element 'morpheme'. For example, the following forms can count as a morpheme (see also points in the list above):

- point:
  e.g. INDEX$_{photo}$
- 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 labeling of certain signs produced by adults to children as child-directed sign (CDSign). 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 behavior can be considered as included in child-directed speech (CDSp). Furthermore, child-directed speech varies according to the child's age and language level. 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 modification does not occur. However, other strategies are adopted by adults including phonological, morphological and syntactical adjustments. So CDSign in relation to the linguistic environment of deaf children does occur just as easily (Van den Bogaerde 2000). For example the mother may produce the sign CAT on a picture showing a cat instead of articulating it on her cheek.

It is not yet known exactly what adjustments generally come under CDSign. It is therefore advisable to mark on the transcription any adjustments in the adult form which might be CDSign. CDSign may be the focus of analysis if your research question is directed at input. On the other hand, variation in input such as CDSign features may be crucial for the interpretation of the child's production.

Within the context of this text, it is not possible to give extensive 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.

### 3.4.2 *Transcription form*

When selecting a transcription form or creating the transcription tiers in a computer program, you need 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 included in all transcription forms: time code, nonmanual linguistic signals, manual signs, speech components, translation and remarks. What information is included on each line must be specified in the coding manual. This may include phonological and morphological details of the articulated sign, whether or not it is a child-directed sign, and details of the context.

**Table 2.** An example of a basic transcription form.

| Project number…… session:…… child:…… age:…… page:……<br>Researcher's name: …… tape number:……<br>timecode:…… | |
|---|---|
| **MOTHER** | |
| time | |
| nvb | |
| morph | |
| cds | |
| gest | |
| expr | |
| gloss | |
| oral | |
| trans | |

| **CHILD** | |
|---|---|
| time | |
| nvb | |
| morph | |
| | |
| gest | |
| expr | |
| gloss | |
| oral | |
| trans | |

Explanation:

| | |
|---|---|
| Time | timecode |
| Nvb | non-verbal behavior |
| Morph | morphology line — here all morphologic information can be written |
| CDS | any characteristics of Child Directed Signing is to be mentioned here |
| Gest | gestures are written here |
| Expr | Nonmanual markers and/or eyegaze direction |
| Gloss | name for a sign in the spoken language can be noted here |
| Oral | mouth-gestures and mouthings |
| Trans | translation of the utterance. |

NB one line is empty, so that in the future extra information could be added to the transcription form.

*Basic information*

The following details are usually found: The time code is filled in per sheet of the transcription, if done on paper. Nonmanual linguistic signals are included 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 (see Boyes-Braem & Sutton-Spence 2001 for a review).

The chronological order of the communication between the child and her partner is indicated by the transcription from left to right. Turns are not noted under one another, unless they are simultaneous. See Table 2 for an example of a basic paper form.

This basic transcription form is sufficient if the focus is on the grammatical structure of utterances. This form can be extended with several additional lines. Using a computer-based transcription form enables the easy insertion of additional lines (see Figure 4). In this example the transcription of the right hand (RH) and left hand (LH) are separated. Several nonmanual features are transcribed; for example there are lines for the head, eye aperture, eyegaze. More lines can easily be added.

For research on sign language interaction, for example, on attentional strategies used between the mother and her child, more information is needed than purely linguistic information. Non-verbal behaviors such as gesticulations or hand-waving become relevant since these behaviors can be attentional devices.

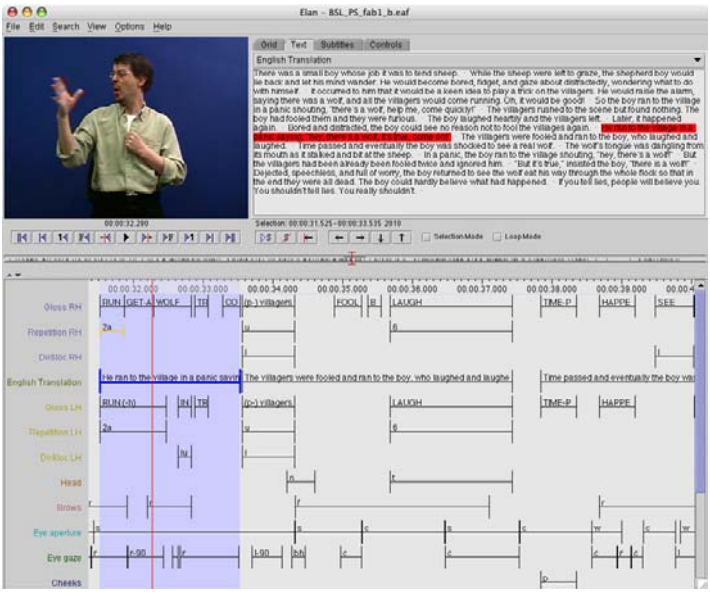



**Figure 4.** A screen grab from an ELAN transcript showing part of a analysis of a BSL signer telling the fable 'The Boy who Cried Wolf'.

Direction of eyegaze is important as it helps determine whether an utterance has been attended to. In this case, the basic transcription form is extended for both child and conversational partner.

The linguistic information which is globally organized in the basic transcription form can be further specified on separate lines. For example, nonmanual linguistic signals can be specified further in terms of the articulators: face, head, body and eyes. The function can also be specified: grammatical marker, nonmanual adjective or adverb. Although the research question will probably focus on the child's acquisition of nonmanual linguistic signals, coding this information for the conversational partner enables the effect of modeling to be investigated.

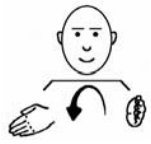
## 3.5 Illustrations

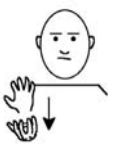
When presenting research results it is often impractical to use a detailed transcription of data. An illustration is clearer. It is sometimes possible to use a screen grab as in Figure 4 but this is not always clear enough and there can be problems with privacy (see 2.3.1). In this case alternatives are line-drawings (see Figure 5) or a computer based drawing program such as Salute (see Figure 6). In the Salute program[4] it is possible, for example, to indicate body contact and a number of phonetic features.

NGT sign for SUMMER
Arrow indicates movement x indicates contact with the forehead

This picture is taken from the website: www.effathaguyot.nl/gebaren

**Figure 5.** Line drawing of an NGT sign





$_{\text{links}}$BEZOEKEN$_{\text{rechts}}$
"he visits her"

WILLEN
'want'

**Figure 6.** Salute drawings of NGT signs

4. For full information on this program see <http://www.salute-software.com/en>

### 3.6 Using a database

Technical developments in software and database design and management are very rapid. For the most up-to-date documentation on this area we refer to Bergman et al. (2001), and the ECHO project.[5]

## 4. Time course of sign language development and assessment

### 4.1 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.

From 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 (Clement 2004). 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, and 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).

5. http://www.let.ru.nl/sign-lang/echo/

Early research on child language tended to ignore the role of gesture in the development of language (see discussion in 3.1.2). It is now recognized 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. As discussed earlier, gestures develop from early expressions of deixis (pointing or otherwise indicating objects or people) into referential gestures (labeling 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.

## **4.2** 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 use of the same modality in gesture and sign. This led some researchers in the 1980's 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 re-categorized as a linguistic, and not a gestural form.

Some studies have reported that children learning to sign have larger vocabularies during the first 2 years than children learning spoken languages (Kyle & Ackerman. 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 (Morgan & Woll 2002).

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 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 children growing up in non-rural areas.

### 4.3 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 at approximately age five years. However 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 ten 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 color terms, for example (Kyle & Ackerman 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.

## 4.4 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 spoken language. 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 (see 2.2). 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 programs 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 (no date) have compiled a chronology of ASL development, and in Table 3 this has been combined with data from several European sign languages to produce a list of selected linguistic features whose development is characteristic of these age bands.

**Table 3.** Stages of Sign Language Acquisition

| | |
|---|---|
| < 0;9 | *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. |
| 0;9–1;0 | *Pointing* |
| | Non-linguistic pointing to self, other people and objects appears. |
| 1;0–1;5 | *Pronominal reference, vocabulary* |
| | Pointing to people may drop out in this period, although pointing to objects is maintained. |
| | The first true signs appear at this stage. There is often over-generalization (e g. CAR used to refer to cars and buses). |
| 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 proximalize movement, and often exhibit perseveration. Some research from ASL suggests that sign location within the center 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 unanalyzed rote forms.

There is often over-generalization 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 unanalyzed 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 signaled separately from the verb sequentially rather than simultaneously.

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 coordinated usage of both. |
| | Verb agreement begins to be found with abstract loci, but this occurs without coordinated 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-generalizations 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 poly-morphemic 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. |

With few exceptions, the findings described in Table 3 have not yet been fully developed into formal assessments and provisions of norms for sign language acquisition (see Haug this volume). Because of this, the section above should be regarded as an orientation to the topic rather than as a checklist.

### 4.5 Assessment

Numerous assessment instruments are currently being developed but there are few that fulfill criteria for reliable use such as being based on a normative population, tested for reliability etc. The latest review of these instruments is presented in Haug (this volume).

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# Review of sign language assessment instruments*

Tobias Haug
University of Applied Sciences for Special Needs, Zurich

This article reviews and discusses existing sign language assessment instruments and those that are still under development. There are three groupings of sign language assessments: (1) instruments to assess and monitor the process of sign language acquisition in deaf children, (2) assessments for educational purposes, and (3) instruments for linguistic research. These will be discussed individually with regard to a range of issues, such as target age group, linguistic content of the assessment instrument, background of the instrument and development, usability and availability, and strengths and weaknesses. The article concludes with an evaluation of the reviewed instruments.

**Keywords:** deaf, sign language assessment instrument, test, review, reliability, validity

## 1. Introduction

Language assessments are designed to answer questions regarding the linguistic ability of language users, most often children. Language assessments have been

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Acknowledgements to Rosalind Herman and Bencie Woll for permission to reprint an example from the *BSL Receptive Skills Test* (Figure 1) and to Adam Schembri for permission to reprint an example of the *Test Battery for Australian Sign Language Morphology and Syntax* (Figure 2).

used, for example, to determine the linguistic functioning of bilingual children, second language learners, and users of non-mainstream dialects (Menyuk 1988).

Sign language assessments also have a specific function with respect to deaf children's language. They can be used to assess and subsequently monitor and plan intervention in relation to a deaf child's sign language acquisition or for educational purposes, for example to investigate the relationship between a sign language as a first language and literacy skills in a second language. Assessment instruments are also used for linguistic research in order to obtain information about how a specific linguistic feature is used by an adult signer.

In the following sub-sections of Section 1 various general features of language assessment instruments will be discussed briefly. In Section 2 the individual instruments are presented in more detail. In Section 3 the instruments are evaluated.

### 1.1 Purposes of assessment instruments

The instruments under review have been grouped into categories according to their different purposes.

#### 1.1.1 *Instruments for assessing sign language acquisition and for planning intervention*

Instruments that can be used to assess deaf children's sign language acquisition and plan intervention, if needed, are the *American Sign Language-Proficiency Assessment*[2] (*ASL-PA*; Maller, Singleton, S. Supalla & Wix 1999); the *British Sign Language Receptive Skills Test* (Herman, Holmes & Woll 1999); *Australian Sign Language Receptive Skills Test* (*PARST*; Johnston 2004), the *Signed Language Development Checklist* (Mounty 1993, 1994); the *Assessment for Sign Language of the Netherlands* (Jansma, Knoors & Baker 1997); *The Developmental Assessment Checklist for Sign Language of the Netherlands* (*NGT-OP*; Baker & Jansma 2005); and the *Aachen Test for Basic German Sign Language Competence* (*ATG*; Fehrmann, Huber, Jäger, Sieprath & Werth 1995a, 1995b). The *ATG* can also be used with adults.

#### 1.1.2 *Instruments for educational purposes*

Instruments for educational purposes are *the American Sign Language Assessment Instrument* (*ASLAI*; Hoffmeister 1999, 2000) and the *Test of American Sign Language (TASL*; Strong & Prinz 1997, 1999; Prinz, Strong & Kuntze 1995). Both tests have been designed and used in studies investigating the relationship between ASL knowledge in deaf children and their English literacy performance.

2. For an overview of abbreviations of sign language instruments, see Appendix A.

### 1.1.3 *Instruments for linguistic research*

There are three tests in this group: the *Test Battery for ASL Morphology and Syntax* (T. Supalla, Newport, Singleton, S. Supalla, Coulter & Metlay, unpublished); the *Test Battery for Australian Sign Language Morphology and Syntax* (Schembri, Wigglesworth, Johnston, Leigh, Adam & Baker 2002), which is a version of the Supalla et al. ASL test adapted for Australian Sign Language (Auslan); and the *Grammatical Judgment Test for ASL* (Boudreault 1999; Boudreault & Mayberry 2000). The first two are primarily designed to obtain information about how specific morphosyntactic structures are produced by deaf adult signers. Although they have been designed for linguistic research, sub-tests from the *Test Battery for ASL Morphology and Syntax* are included in two tests used for assessment and education: the *Verbs of Motion and Production Test A* is used in the *ASLAI* and the same sub-test and *Sign Order Comprehension* test have been adapted for use in the *ASL-PA*.

The *Grammatical Judgment Test for ASL* was developed in the context of a research project investigating the effects of age of acquisition of ASL on grammatical processing by deaf ASL users.

## 1.2 Screening or deeper investigation

Screening is defined as "a brief assessment procedure designed to identify children who should receive more intensive diagnosis or assessment" (Committee on Children With Disabilities 1994: 863). Law, Boyle, Harris, Harkness & Nye (1998: 9) define screening as a "systematic procedure to select individuals from a given population at risk for an impairment".

Language screening instruments are usually short and consist of only a small number of items compared to a diagnostic assessment. A screening test may cover a range of linguistic features, each represented by only a few items, although it also may be used to explore specific linguistic areas that are known to be problematic. One example of a screening instrument is the *ASL-PA* that assesses different linguistic features, but which includes only 23 items.

## 1.3 Target groups

Instruments have been developed for use with different age groups. The *ASL-PA* focuses on the age group of 6–12 year old children. The *BSL Receptive Skills Test* includes younger deaf children, aged 3–11 and *NGT-OP* focuses on communication in 2–5 year old children. The *PARST* has been used with deaf children aged

4–15 years. The *ASLAI* and the *TASL* have been used with deaf children aged 8–16 and 8–15 years, respectively.

The instruments developed for linguistic research have been used with a wide age range. The *Test Battery for ASL Morphology and Syntax* has been used with signers aged 3–75 years (Maller et al 1999). The Australian version, the *Test Battery for Australian Sign Language Morphology and Syntax,* has been used with adult deaf native signers aged 16–58 years. The *Grammatical Judgment Test for ASL* has been used with deaf subjects in the range 18–84 years.

In principle all instruments can be used with any deaf and hearing children or adults learning a sign language.

### 1.4 Content of the instruments

The instruments assess language comprehension (e.g. the *BSL Receptive Skills Test*), language production (the *ASL-PA*) or both, (e.g. the *ATG*). Most tests assess specific linguistic areas within a sign language. For example the *ASL-PA*, the *BSL Receptive Skills Test*, the *ATG*, the *ASLAI*, and the *TASL* focus in large parts of their test on morphological and syntactic structures and processes. The *Test Battery for ASL Morphology and Syntax* and its adaptation to Auslan focus only on morphological and syntactic structures. Phonology is only assessed by the *Sign Language Development Checklist* and *NGT-OP*.

Other tests also include testing of lexical knowledge, such as the *Assessment for Sign Language of the Netherlands* (NGT: Nederlandse Gebarentaal) and the *ASLAI*. Some tests assess the communicative competence of the subject, as well as selected linguistic structures, e.g. the *ATG*, the *Signed Language Development Checklist*, and the *NGT-OP*. The *ASLAI* has one task relating to semantic processes. Some tests also assess the narrative skills of the subject, e.g. the *ASLAI* and the *TASL*. The *ATG* also focuses on larger linguistic units in German Sign Language (DGS: Deutsche Gebärdensprache).

### 1.5 Background of the instruments

The majority of instruments, in particular those developed for ASL, have been based on linguistic research on ASL in general and on the acquisition of ASL, for example the *ASL-PA* and the *Signed Language Development Checklist*. While some of the tests provide information on their research source, some tests do not. The *ATG* is largely based on linguistic research on other sign languages. Some tests are adapted from either another sign language test, (the Auslan test battery is translated from the ASL test battery) or adapted from tests of spoken language. The

*NGT-OP* uses both translation and adaptation and its origins are documented in a number of publications (Jobse 2002; Faber 2003; Visser 2005). There are obvious problems in translating an instrument from one language into another since the two languages will differ in grammatical and lexical structure. There are also some problems specific to translating from a spoken to a sign language. For example, one of the major issues in translating a lexical picture task from spoken Dutch into NGT for the *Assessment for Sign Language of the Netherlands* was how to reduce the facilitating effects of iconicity in the NGT lexical tasks.

## 1.6 Test development and standardization

As well as the linguistic content and target groups, consideration must be given in test development to standardization issues: whether a test should be norm-referenced or criterion-referenced. Norm-referenced tests are tests "measuring performance against standardized norms for chronological age" (Law et al 1998: 8). Criterion-referenced tests are concerned with how a subject performs relative to a specific criterion of mastery, for example on a language scale or checklist. Some of the tests presented in this paper are norm-referenced tests, e.g. the *BSL Receptive Skills Test.* Other tests like the *ASL-PA*, the *ATG*, and the *Signed Language Development Checklist* are criterion-referenced tests.

The psychometric properties of tests, that is, their validity and reliability, are of importance. There are different types of validity: construct, content, face, and concurrent/predictive validity (McCauley & Swisher 1984). Only a few of the tests described here report data on validity, e.g. the *ASL-PA*, the *ASLA*I, and the *BSL Receptive Skills Test.*

Reliability refers to "the degree of stability of measurement that exists when a measurement is made repeatedly under different conditions or by different observers" (Law et al 1998: 9). There are different ways to examine reliability: test-retest reliability, inter-scorer reliability, and measures of internal consistency (McCauley & Swisher 1984). This issue has been addressed for the *NGT-OP* (Visser 2005) where it was shown that the training background of the observers and knowledge of NGT were crucial factors in obtaining consistency.

Standardization is a very important issue in developing a test. Both norm-referenced and criterion-referenced tests can be standardized. The standardization process involves a number of issues, such as using a standardized testing format (for example, administration of the test on video or even a computer-based test), standardized tools for data coding and analysis (e.g., scoring sheets), the reporting of the psychometric properties of validity and reliability, as mentioned above, and compiling age and/or proficiency norms. An additional aspect is who should

be included in the standardization population. Herman, Holmes & Woll (1998) report on the standardization procedure used for their *BSL Receptive Skills Test*. Even though the assessment will be used most often with deaf children of hearing parents, the test was standardized on the more homogeneous group of children with a native signing background: deaf and hearing children with deaf parents; deaf children with deaf siblings; and deaf children who were enrolled in early bilingual programs. Few of the tests discussed here are standardized.

### 1.7 Usability of the tests

Important aspects contributing to the usability of sign language assessment instruments are administration procedure, scoring procedure, and time costs in relation to administration and analysis. An instrument designed for use in a school for deaf children should not take hours to administer, score, and analyze.

Assessments for diagnosis and intervention should have an easy to understand administration procedure. The assessor must understand how to administer the test, and the subject must understand what to do. The qualities and skills required from the assessor are of importance. Some tests specify that the instrument administrator should preferably be a deaf native signer. The user may need to be a trained linguist in order to analyze the test results. It may be difficult to train people to administer the test in schools. Maller et al (1999: 264) report: "plans are under way for school-based field testing of the ASL-PA with non-research assessors".

Other issues are the length of the test and the efficiency of scoring and data analysis. For example, Maller et al (1999: 263) report for the *ASL-PA* that it takes "less than a half-hour to administer and less than 2 hours to code and score". Hoffmeister reports for the *ASLA*I that the expressive and the receptive tasks take approximately 30 minutes each, but that analysis of the expressive tasks takes up to 20 hours per child (R. Hoffmeister, personal communication). Computer-based (receptive) sign language tests have the advantage that test results can be stored/saved automatically and subsequently exported to a statistics software package for analysis (Haug & Mann 2005).

### 1.8 Availability of the instruments

Only a small number of tests are available, and one of the few tests commercially available is the *BSL Receptive Skills Test*. The *Test Battery for ASL Morphology and Syntax* was "in press" for an extended period. Most of the other tests are not publicly available, but researchers have generally made their tests informally available to researchers wishing to adapt them to other sign languages.

## 1.9 Strengths and weaknesses of the instruments

Instruments may be assessed in terms of whether they have the following positive qualities:

1. robust psychometric properties
2. clarity as to whether the test is a global assessment or designed to explore specific linguistic structures
3. choice of items/target features supported by linguistic research
4. language samples elicited from varied discourse contexts
5. design permitting efficient administration and analysis
6. possibility of use in educational settings serving deaf children
7. possibility of use for research purposes
8. assessment of expressive and receptive language skills
9. development with the assistance of deaf researchers
10. broad applicability to deaf and hearing subjects: children and adults
11. suitability for a broad age range
12. assessment of both communicative competence (overall language ability) and specific linguistic structures
13. general availability
14. possibility of using for diagnostic assessment (tests for educational purposes only)
15. adaptation to issues such as the possible facilitating effect of iconicity
16. availability of age norms

Instruments may have the following weaknesses:

1. limited age range
2. requirement that a highly skilled user with detailed knowledge of the linguistic structures of a sign language administers the instrument
3. no large sample norms available
4. no report of psychometric properties
5. unsuitability for use in an educational setting because the test takes too long to administer, code and analyze
6. reliance on linguistic features identified in research on other sign languages
7. limited availability

In Section 2, each assessment instrument will be discussed individually.

## 2. Discussion of individual assessment instruments

### 2.1 Instruments for sign language acquisition, diagnosis, and intervention

In this section instruments that can be used for diagnosis and intervention will be discussed individually with reference to the categories presented in Section 1.

#### 2.1.1 *The American Sign Language Proficiency Assessment (ASL-PA)*

The *ASL-PA* (Maller et al. 1999) was designed as an instrument for assessing the level of ASL skills in non-native signing children aged 6–12 years, and for monitoring their progress in sign language acquisition. The *ASL-PA* is a screening instrument, rather than a tool for in-depth linguistic investigation, being fairly short, and comprising a broad range of linguistic structures. The *ASL-PA* provides no insight into potential problems in the language acquisition process. It can be used to observe and monitor the deaf child's acquisition of sign language over time, but it does not provide deeper analysis tools. Only expressive language skills are assessed. Maller et al. state that in order to:

> "keep the instrument simple, and oriented towards children's language use, we chose to focus only on morpho-syntactic linguistic structures supported by empirical studies of children's [sign language] acquisition and use". (1999: 251)

The authors reviewed seventeen ASL acquisition studies, and eight morphosyntactic structures of ASL were identified and organized in terms of the order of their acquisition. The eight linguistic structures are: (1) one-sign/two-sign utterances, (2) nonmanual markers (questions, topics, conditionals), (3) deictic pointing (real world and abstract indexing), (4) referential shifting, (5) verbs of motion, (6) aspect and number, (7) verb agreement, and (8) noun–verb pairs. Twenty-three target features are identified.

*Procedure:* Subjects are recorded taking part in three types of discourse: (1) Interview: the assessor asks the children questions that are likely to elicit natural conversation, and that require a detailed response. (2) Peer Interaction: two children are required to ask each other questions. (3) Story retelling: children are shown 'The Tortoise and the Hare' cartoon, and then required to retell the story in ASL.

*Standardization* is based on 80 deaf children, aged 6–12 years, divided into three groups: (1) native ASL signers with deaf parents, (2) deaf children with hearing parents, using ASL in educational settings, and (3) deaf children of hearing parents, using manually coded English). An item analysis was undertaken, and three levels of ASL proficiency established. Reliability was established in a variety of ways, including inter-rater reliability

The *ASL-PA* is a criterion-referenced test "that is useful for assessing a child's individual expressive ASL skills against some predetermined level based on language mastery objectives or the child's own past performance on this scale" (Maller et al. 1999: 264).

*Usability:* The *ASL-PA* takes a half-hour to administer and about one to two hours to score. The assessor needs to have linguistic knowledge of ASL. The authors anticipate that the collection of more language data will enable the establishment of norms for children of different ages and from different language backgrounds.

*Availability:* The test has been developed in the context of a research project and is not yet publicly available.

*Strengths:* (1) it is a global assessment of a child's expressive ASL proficiency level, (2) it has items/target features based on ASL acquisition studies, (3) language samples are elicited from varied discourse contexts, (4) it is efficient to administer and analyze, (5) psychometric properties are reported, (6) it can be used in educational settings, (7) it can be used for research purposes, for example to analyze the development of nonmanual markers, and (8) it has been developed in close cooperation with deaf researchers.

*Weaknesses:* (1) it is limited to the age range 6–12 years, (2) a skilled user is required, and (3) no large sample norms are presently available.

### 2.1.2 *British Sign Language Receptive Skills Test*

The goal of this project was to design, produce, and standardize an instrument for measuring British Sign Language (BSL) development for children aged 3–13 years (Herman et al 1999). The goals were to make baseline assessments, identify language difficulties, and evaluate the outcomes of therapy programs (Herman et al 1998; Herman 1998).

The assessment focuses on morphology and syntax of BSL; it consists of both (1) a vocabulary check (production) and (2) video-based receptive skills test.

1. Vocabulary check: The vocabulary check is designed to ensure that the children understand the vocabulary used in the receptive skills test by means of a simple picture-naming task.
2. Video-based receptive-skills test: this consists of 40 items, organized in order of difficulty and presented by a signer on video. The items assess children's knowledge of selected BSL morphological and syntactic structures.

Three main questions were addressed in the early stage of the project: (1) which aspects of BSL should be assessed; (2) which form the assessment should take; and (3) which sample of deaf children should be included in the standardization of the test.

Research studies of BSL and ASL acquisition were reviewed. Based on those studies, a number of grammatical features in BSL were identified for inclusion in the assessment battery.

In selecting target pictures, consideration was given to easily recognizable illustrations that were appealing to children in the target age range, and distracter items were carefully designed to reduce guessing. Other considerations included using only known vocabulary, avoiding excessive memory load, and keeping the test at a reasonable length. The entire test, including test instructions, practice items, and individual test items, is on video to guarantee a standardized presentation of the test.

*Procedure:* The test procedure is explained on video. The children respond to the items on the video by selecting the most appropriate picture from a choice of three or four in a color picture booklet (see Figure 1). The target item in this example is CAR-ROW-BOTTOM-LEFT (picture 1); the distractors are a row of cars further away (picture 2), two cars (picture 3), and one car (picture 4). The test takes between 12 and 20 minutes. Items are scored as pass or fail.

*Standardization:* The goal was to develop a norm-referenced test based on empirical data. Standardization was undertaken using hearing and deaf native signing children with deaf parents, and deaf children from hearing families in early

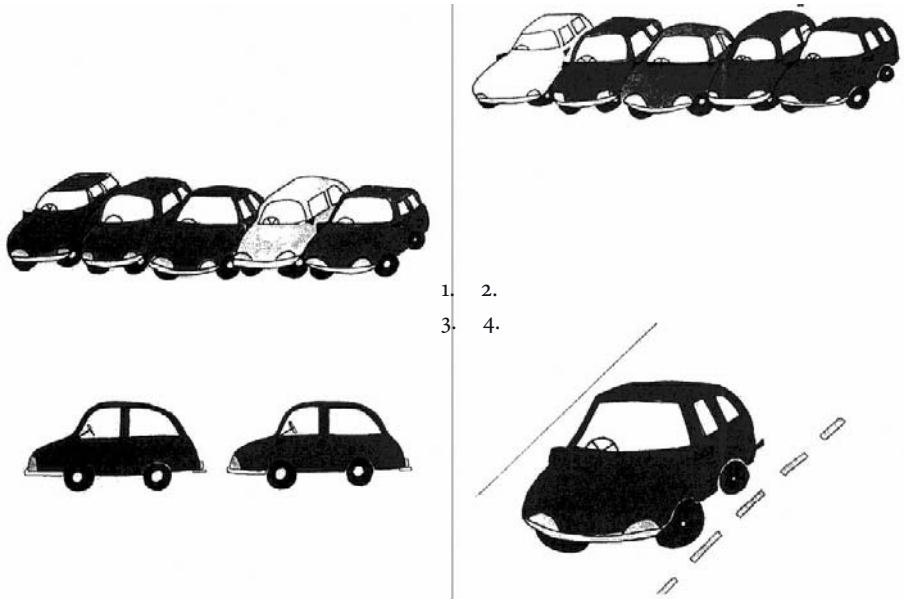


**Figure 1.** Examples from the answer booklet of the BSL Receptive Skills Test
© Herman et al 1999

bilingual programs, a total of 135 children. The deaf and hearing subjects did not perform significantly differently on the receptive test and all were therefore included in the standardization.

In order to establish test-retest reliability for the *BSL Receptive Skills Test*, 10% of the children were retested. The test scores were better on the second testing, but the rank order of scores was preserved. There was also a high correlation (.87) between the test and retest scores. Split-half reliability analysis for the internal consistency of the *BSL Receptive Skills Test* reveals a high correlation (.90) and therefore represents a high internal consistency. The scores from the *BSL Receptive Skills Test* of the children involved in the pilot were compared with those who had not been exposed to the test materials before. There was a slight advantage in the pilot children, but the difference between the groups did not achieve statistical significance (p=0.7).

In order to investigate the validity of the *BSL Receptive Skills Test*, the scores from the receptive task were correlated with the standard scores on a standardized non-verbal intelligence test (SON-R; Snijders, Tellegren & Laros 1997).

*Availability:* The *BSL Receptive Skills Test* is commercially available (Herman et al 1999). Users do not need to be trained linguists. The test is being adapted into various other sign languages, e.g. Auslan (Johnson 2004), NGT, DGS, French Sign Language, Danish Sign Language, Italian Sign Language, and Maltese Sign Language (for a comprehensive review on issues of sign language test adaptation, see Haug & Mann 2008).

*Strengths*: (1) the tested items are based on empirical data, (2) the test has robust psychometric properties, (3) there is a standardized procedure for the assessment, (4) it covers a broad age range (3–11 years), (5) the test is commercially available, (6) it can be used by educators, (7) it is based on ASL and BSL acquisition studies, (8) it assesses specific morphosyntactic structures in BSL, (9) it has been developed with deaf researchers, and (10) age/developmental norms are available.

*Weaknesses:* (1) it assesses only a limited area of BSL morphology and syntax and (2) does not assess vocabulary or communicative competence.

### **2.1.3** *Auslan Receptive Skills Test (PARST)*

The *BSL Receptive Skills Test* was adapted for Auslan (Johnston 2004) in the context of an ongoing research project assessing the Auslan and English proficiency of deaf and hearing children in a bilingual program in Sydney, Australia. For this purpose the introduction, explanations, and the test were re-recorded, although only a small number of lexical items needed to be substituted (PENCIL and DOG), as BSL and Auslan are closely related historically. The pilot version of the *PARST* has been administered to a total of 48 deaf and hearing children, aged 4 to 15 years from the Royal Institute for the Deaf and Blind in Sydney.

All the points mentioned under 2.1.2 apply to this instrument as well, except for the comments on standardization.

*Availability:* The instrument is still being developed and is not yet commercially available.

### 2.1.4 *Signed Language Development Checklist*

The *Signed Language Development Checklist* and its training manual were developed by Mounty (1993, 1994) at the Educational Testing Service in Princeton, New Jersey. This checklist is intended to be used in conjunction with other measurements and assessment techniques and is designed to assess an individual's ASL/ASL-oriented sign language development. Using the *Signed Language Development Checklist* enables an in-depth investigation, rather than just a screening. The instrument has been used for subjects ranging from preschool children to adults, although it was originally designed for deaf school children (Mounty 1993).

The *Signed Language Development Checklist* assesses expressive ASL skills in the following domains: (1) overall language ability (communicative competence); (2) linguistic use, comprising formational aspects (i.e. phonology), morphology, syntax, perspective (role-play); and (3) creative use of the language. The Overall Language Ability rating assesses "the extent to which an individual's language ability serves his/her communication needs" (Mounty 1993: 10). The *Formational Domain* focuses on two basic components of a single sign: (1) handshape and (2) movement. The *Morphological Domain* examines verb modifications: (1) intensifier, (2) manner, (3) aspect, (4) number, and (5) distribution) and noun modifications: (1) intensifier, (2) size, (3) quality, (4) shape, (5) spatial arrangement, and (6) quantification. The *Syntactic Domain* codes the structure and composition of ASL sentences, assessing the establishment and use of spatial reference (indexing). The final two domains of the checklist are the *Perspective Domain* and the *Creative Use of Language*.

The checklist has been based on research on the structure of ASL and its acquisition. It is a criterion-referenced test, with the language performance of the tested subject scored with respect to his/her level of mastery.

*Procedure:* The checklist can either be used during a live observation or with a videorecorded language sample. The latter enables an assessor to code all domains or only selected sections. The possibility of observing across one or more sessions and to choose between live observation and analyzing a video gives the assessor substantial flexibility in assessment. No information about the time required for scoring is provided.

*Standardization:* The present version (pilot study) of the checklist has never been subjected to a large-scale study due to budget constraints (J. Mounty, personal

communication). The checklist has been revised several times and has provided input to an assessment instrument now in use at Gallaudet University, Washington DC. No psychometric properties are available.

*Availability:* The checklist is not available to the public (J. Mounty, personal communication).

*Strengths*: (1) it assesses both communicative competence (overall language ability) and specific linguistic structures, (2) it can be used in an educational setting, (3) it is flexible with respect to which areas are assessed and analyzed, and (4) item development is based on ASL research.

*Weaknesses:* (1) no report of psychometric analyses, (2) only language production is assessed, (3) no age norms are available, and (4) the instrument itself is not generally available.

### 2.1.5 *Assessment of Sign Language of the Netherlands*

The development of tasks for the assessment of NGT is part of a larger ongoing bilingual study of deaf children in the Netherlands (Jansma et al 1997). The overall goal was to develop assessment tasks for NGT in order to be able to assess the NGT proficiency of deaf children and to develop intervention plans if needed. The tasks that have been or are currently under development provide an in-depth investigation rather than a formal screening. The 19 deaf children in the study were aged 4;7 to 8;2.

The tasks under development for assessing NGT proficiency in deaf children focus both on language comprehension and production with respect to acquisition of the lexicon and specific areas of morphosyntax. Three lexical tasks were developed: (1) *Receptive Vocabulary Task*, (2) *Productive Vocabulary Task*, and (3) *Sign Meaning Extension Task.* Morphosyntactic assessment comprises (4) the *Localization Task,* and (5) *Receptive Verb Agreement Task* A test developed by Lillo-Martin, Bellugi, Struxness, and O`Grady (1985) to assess the acquisition of these sub-domains of American Sign Language in deaf children of deaf parents was used as a basis for these last two areas.

The authors report some problems in developing this assessment for NGT, two being a lack of basic research on the grammar and the lexicon of NGT, and a lack of research on NGT acquisition. A number of methodological issues were encountered during the process of developing the *Receptive Vocabulary Task*, which was based on a test developed for spoken Dutch (TAK: Verhoeven & Vermeer 1986). The TAK test consists of 98 items, starting with easy words and ending with the most difficult. As a first step, the Dutch words were translated into signs. Items that involved pointing to the body or fingerspelling in NGT were excluded. A pilot study was conducted with four deaf children, aged 6, 7, 9, and 10, for whom the

percentage of correct answers ranged from 84.5% to 87.6%. This task was also administered to three hearing children, aged 7, 8, and 10 who had no prior knowledge of NGT. They obtained scores ranging from 60.8% to 72.2%. Asked about the basis for choosing a picture, the non-signers often named the iconic relationship between the sign and the picture. The authors conclude that in order to make the test a true assessment of NGT knowledge, it would be necessary to minimize the facilitating effects of iconicity. This is true for any sign language receptive vocabulary test.

*Procedure*

1. *Receptive Vocabulary Task:* Children are shown a sign on video and have to choose one out of four pictures that corresponds in meaning with the particular sign.
2. *Productive Vocabulary Task:* Productive vocabulary is assessed using the original version of the 'TAK Productive Vocabulary Test' (Verhoeven & Vermeer 1986). The children are shown a series of pictures and have to describe each one with just one sign.
3. *Sign Meaning Extension Task:* This task assesses the "deeper lexical knowledge of sign meaning and relations within the semantic network" (Jansma et al 1997: 42). In a clearly structured questionnaire, the children have to describe the meaning of six signs.
4. *Receptive Localization Task:* This task assesses the comprehension of localization, which has been suggested as being a prerequisite for the comprehension of verb agreement (Lillo-Martin et al 1985). The subject is required to answer questions about (1) where a specific referent is localized or (2) which point in space is associated with a particular referent.
5. *Receptive Verb Agreement Task:* Children are required to match an NGT sentence to one of three presented pictures.

As the study is ongoing, no information is yet available about test administration and time cost, although responses are coded as pass/fail to minimize scoring time.

*Standardization:* The results of the data analysis and psychometric properties of the tasks have not yet been reported in the published literature.

*Availability:* The instrument is still being developed and is not publicly available.

*Strengths:* (1) it focuses on both language comprehension and production, (2) it is suitable for children younger than 6 years, (3) it is designed to assess deaf children's NGT proficiency and to develop intervention plans if needed, (4) it focuses

on lexical knowledge (a gap among the tests), and (5) it considers the issue of the facilitating effect of iconicity.

*Weaknesses:* (1) there is limited information on the continuing development of the tasks, (2) no information on psychometric properties is provided, and (3) the test is not available since it is still under development.

### 2.1.6 *The Developmental Assessment Checklist for Sign Language of the Netherlands (NGT-OP)*

This checklist for NGT has been developed over a number of years at the University of Amsterdam and is currently in use in several schools of the deaf in the Netherlands. It is intended for use with children aged between 2 and 4 years of age. It is based (Jobse 2002) on several checklists used for the assessing the development of communication and language and on the *Signed Language Development Checklist* for ASL (Mounty 1993, 1994). It covers eight different areas with varying numbers of items in each area: non-verbal communication, communicative abilities, general language ability, phonology, syntax, morphology, perspective, and creative language use. It has been used with a group of deaf children aged 4 to 7 years and with ten different teachers as scorers.

*Procedure:* The checklist is intended to be completed by the child's class teacher on the basis of at least three months' knowledge of the child. The teacher is provided with instruction on the use of the checklist and handbook. The checklist can be repeated at intervals of six months or more to check the development of the child. It takes on average about one hour to read the handbook and one hour to fill in the assessment instrument (Sturm-Faber 2002).

*Standardization:* The instrument has been studied for its usability (Sturm-Faber 2002) and reliability (Visser 2005), and has been adapted on the basis of the reliability results. An ongoing problem for reliability of scoring is the influence of the background of the class teachers in terms of linguistic knowledge, knowledge of sign language, and general motivation. It has been impossible to find two observers who know a child well enough to use the checklist and who are comparable on all these variables. These variables have an effect on the scoring. There are no norms for the checklist as yet.

*Availability:* The instrument is only available via the authors and has not been published.

*Strengths:* (1) it covers many different areas of the child's language and (2) it can be used to track development in a single child and to compare children.

*Weaknesses:* (1) the scoring is influenced by the teacher's knowledge of linguistics and NGT and general motivation and (2) no norms are available.

### 2.1.7 *Aachen Test of Basic German Sign Language Competence*

This DGS (Deutsche Gebärdensprache) test has been developed by an interdisciplinary team at the Technical University of Aachen (Fehrmann et al 1995a, 1995b; Matthes 1997).

The goal of this test is to measure basic competence in DGS. Basic competence in DGS is defined as the language competence which an adult deaf native signer would consider to be the minimum level of fluency/knowledge required to be considered a fluent DGS user. The basic competence in DGS of a tested subject is determined by the linguistic judgment of a native signer. The *ATG* can be used for the following purposes. (1) diagnosis of language development in children; (2) monitoring of sign language development in school; (3) linguistic self-assessment of deaf adults; (4) DGS assessment of hearing parents of deaf children; and (5) assessment of hearing professionals working in the deaf field, e.g. interpreters, teachers of the deaf, speech therapists etc.

The *ATG* provides an in-depth investigation of specific linguistic structures of DGS. The instrument can be used with children from 6 years upward and with adults, both deaf and hearing. The first part of each subtest can be used with children and adults; the second part only with adults.

The *ATG* consists of nine sub-tests that assess both expressive and receptive language skills, focusing on different linguistic units, such as signs, phrases, and text. Approximately 100 people have been tested with all or part of the *ATG*. This group includes around 16 hearing learners of DGS; a few subjects are hard-of-hearing, and the remainder are deaf. Most subjects were only tested on tasks 1, 2, 6, and 9. Changes in task 2 and in the rating sheets are being undertaken.

*Procedure:* For each task a rating sheet or checklist has been developed; e.g. for task 1, five criteria were established for scoring based on quantitative distribution and correct use of DGS devices. Test instructions are given by the test administrator, and can be adapted to the language level of the subject (deaf or hearing). Hearing subjects with only a basic knowledge of DGS are provided with additional written test instructions.

*Task 1:* expressive language skills in spontaneous signing. The task is video-recorded for later analysis.

*Task 2:* receptive skills. The test consists of a video with 60 still images of objects, living creatures, and situations (30 for children). For each stimulus item five to eight DGS signs are presented as moving images on the video. Subjects are required to judge on a four-point scale how well a given sign represents the meaning of the picture. From the five to eight still images provided, one always represents part of the meaning of the moving image and one, the entire image.

*Task 3:* comprehension of phrases. This task requires acting-out of a signed phrase, and assesses receptive language at the lexical, morphological, and syntactic level. Subjects are shown a stimulus video consisting of signed phrases (15 for the children's version and 21 for the adults' version) and are given dolls with which to mime the signed phrase. This test also includes discrimination of topographic and non-topographic use of signing space.

*Task 4 & Task 5:* grammar and word order preferences. These tasks require the subject to describe and name picture cards. Subjects are given 60 picture cards (30 for children) with drawings, similar to those in task 2. The subjects are first required to describe the content and then name the picture. If the description is judged insufficient, the subject is asked to describe the picture again.

*Task 6:* understanding of texts. This task requires acting-out. Phrases from task 3 are presented as DGS texts, which the subjects have to act out with dolls. Each text consists of eleven (adult version) or eight (children's version) DGS phrases. The stimulus video is shown to the subjects twice. Unlike task 3, not all referents are named using nouns; some of them occur as pronouns. In order for subjects to correctly mime the texts, they have to have appropriate linguistic knowledge about the principles of simultaneity in sign language and the use of space.

*Tasks 7 & 8:* receptive-expressive language skills at the lexeme and phrase level. These tasks require imitation of single sign utterances and phrases. Task 7 comprises 36 single sign utterances; task 8 comprises 24 signed phrases. The 36 single sign utterances of task 7 are divided into three groups: (1) single lexical signs; (2) combined signs (compounds) functioning as nouns; and (3) predicate signs.

Task 8 comprises four groups of items, each consisting of three phrases: (1) main clause with spatial markers; (2) main clause with tense markers; (3) complex sentences with implicit conjunction; and (4) complex sentences with explicit conjunction. The subjects are not required to reproduce the form of the stimulus, but only the content. The total number of items is 60 for the adult version and 30 for the children's version.

*Task 9:* complex narrative using idioms. This task requires the retelling of stories. The subject is shown six text stimuli on videos (three for the children's version), each shown twice. The subject is required to retell the signed stimuli from the video. The stimuli are more complex than in task 6, and are based on everyday situations which contain unexpected events which are expressed by idioms in DGS. The idioms were selected on the basis that if they were understood literally they would have different meanings in the context of the story. The assumption for this task is that in such circumstances single signs would be fully repeated but the syntactic and lexical structure would not be repeated completely.

The linguistic structures tested by the *ATG* are mostly drawn from linguistic research on ASL and other sign languages. The *ATG* does not measure a specific stage in language learning, providing only a percentage score. The assumption is that a native signer should achieve at least 90% of the total score possible.

The total testing time for all nine subtests is 2 hours for children and 4 hours for adults, although the test can be administered in sections. No information on the time required to analyze the results is provided. It is also not clear if a knowledgeable assessor is required in order to administer the test.

*Standardization* The large number of task items should guarantee a useful psychometric, criterion-referenced scale. The design and the choice of items based on strict linguistic criteria should provide high construct validity. Results for reliability and validity are not yet available (I. Werth, personal communication).

*Availability:* The *ATG* has not yet been published.

*Strengths:* (1) it assesses both communicative competence and a large range of linguistic devices and linguistic units, (2) it has broad applicability to deaf and hearing people, and to children and adults, (3) it tests both language production and comprehension, and (4) it has been developed with deaf researchers.

*Weaknesses:* (1) no psychometric data are available, (2) it is too long to be used as an assessment tool in an educational setting serving deaf children, (3) the linguistic devices included are mostly based on evidence from research on other sign languages, and (4) it is not yet available.

## 2.2 Assessment instruments for educational purposes

Instruments designed for educational purposes will be discussed individually based on the criteria presented in Section 1.

### 2.2.1 *American Sign Language Assessment Instrument*

The *American Sign Language Assessment Instrument (ASLAI)* was developed at the Center for the Study of Communication and the Deaf at Boston University (Hoffmeister 1994, 1999, 2000). Each of its measures is intended to assess a level of development for a particular ASL structure. The *ASLAI* has been developed within the framework of a larger research project investigating the relationship between acquisition of ASL and English literacy skills. The *ASLAI* provides an in-depth investigation of specific linguistic structures through its eight measures. So far, the instrument has been tested on 475 deaf children aged 8 to 16.

The *ASLAI* assesses both language production and comprehension. It consists of nine measures: five for production and four for comprehension.

*Procedure:* The presentation methodology includes video input such as cartoons and non-verbal stories as stimulus items (dynamic), as well as stories depicted by a sequence of pictures (static). The receptive tasks have been developed to resemble those found on typical standardized tests. They measure knowledge of synonyms, antonyms, plurals, and infrequently used vocabulary in ASL, using a multiple-choice format. Each subtest will be discussed individually.

1. *Real Object — dynamic*: The tasks assess children's expressive knowledge of classifiers, including instruments, body parts, primary and secondary objects and their relationships; pluralization; perspective and scale of reference; in particular, measuring the expression of plurals and the arrangement of classifiers in space.
2. *Verbs of Motion Production* (verbs of motion and location) test A — dynamic: This task is adapted from the *Test Battery for ASL Morphology and Syntax*. It measures the expressive use of classifiers within verbs of motion in ASL.
3. *Same Time/While complex sentences — dynamic:* This task uses two and/or three simultaneous occurring events. To accurately depict these events, deaf children must use sentence coordination and subordination structures.
4. *Narrative Production 1– dynamic, & Narrative Production 2 — static:* Two types of story stimuli are presented in the narrative task. The dynamic story consists of the cartoon 'The Tortoise and the Hare'. After watching the cartoon, the child retells the story in ASL. Stories are coded for a variety of ASL language functions: semantic classifiers to depict the characters, verbs of motion, role shifting, and narrator perspective vs. character perspective.

   For the second narrative task, the child is presented with a sequence of pictures depicting a story theme, and is required to retell the story to the assessor.
5. *Complex Sentences — static:* The Relative Clause Task is based on de Villiers (1988); it utilizes three sets of pictures to elicit relative clause structures in ASL and English. Children are scored according to use of coordinate structures (lower linguistic level), embedded structures (higher linguistic level), or topicalization (higher linguistic level).
6. *Synonyms &* (7) *Antonyms:* These tasks consist of a videorecorded presentation of a signed stimulus item followed by four choices. Children are asked to select which choice best reflects either a synonym or an antonym for the stimulus item.
8. *Plurals and Arrangement — static:* Subjects are shown a series of pictures with four sign choices. They are required to choose the one which best represents the stimulus item.
9. *Vocabulary in Sentences:* a receptive task that tests infrequent or rarely used ASL vocabulary within sentences.

Each measure of the *ASLAI* is designed to indicate a level of development for a particular ASL linguistic component. Each of the measures has also been developed to provide information on conversational and metalinguistic knowledge. Administration of the expressive and receptive tests takes approximately 30 minutes each. Analysis of the receptive tasks is relatively rapid, but analysis of the expressive tasks takes up to 20 hours per child (R. Hoffmeister, personal communication).

*Standardization:* All the *ASLAI* receptive tasks have been videorecorded and piloted, and preliminary psychometric analyses have taken place. Tasks were developed in conjunction with a team of native ASL users who are knowledgeable about language development and who were able to suggest appropriate content for each subtest. Each assessment was developed from 50 original items piloted on a group of ten deaf adults. Only items with at least 90% agreement among the pilot subjects were retained in the item pool. The assessment has been administered to 475 deaf children aged 8 to 16. Item analysis has enabled an examination of response pattern, difficulty level, and how well items discriminate among groups of deaf children. Tests for internal consistency (reliability coefficient; Synonyms: 86%; Antonyms: 80%; Plural: 55%) and Split-half reliability (Synonyms: 83%; Antonyms: 80%; Plural: 51%) were conducted on the three receptive tasks. The results will permit further refinement of the assessments, eliminating items which do not correlate well with overall performance or which do not discriminate between children. It is also planned to reduce the number of items in order to shorten the test. For the narrative task, a rating sheet was developed using a rating scale to determine three types of group scoring in addition to individual component scores. The three group scores are: (1) Story Structure, (2) ASL Skills, and (3) Overall Story rating. This scoring permits the rating of individual and general components of story telling. Scoring of the Narrative test produced a 0.90 inter-rater reliability across both deaf and hearing raters.

Content validity is assured by using a group of experts to develop test items, and by eliminating items on which deaf adults do not agree. Evidence for convergent and discrimination validity (concurrent validity) was drawn from correlating performance on the *ASLAI* with the *Stanford Achievement Test* (2002), and the *Rhode Island Test of Language Structure* (Engen & Engen 1983).

Finally, performance has been demonstrated to correlate highly with age, which means that the tests show promise for discriminating age-related language development in deaf children. One of the future goals of the *ASLAI* development team is to obtain a measure which make it possible to determine if a child has a language problem in ASL (R. Hoffmeister, personal communication).

Psychometric analyses of the (1) *Real Objects task*, (2) *Verbs of Motion* and *Production* task, (3) *SameTime/While Complex Sentence* task, and (4) *Complex*

*Sentence/Relative Clause* task are currently being undertaken (R. Hoffmeister, personal communication).

The ASLAI team are in the process of computerizing the entire test procedure. They have designed report protocols that display (1) obtained scores (i.e. correct percentage), (2) scores compared to deaf or hearing parents, and (3) scores compared to age range (R. Hoffmeister, personal communication).

*Availability:* The *ASLAI* is not yet published.

*Strengths:* (1) psychometric analysis for the receptive tasks is good, (2) the test was developed for research purposes, (3) it was developed with the assistance of deaf experts, (4) it tests specific linguistic structures, (5) it tests language comprehension and production, (6) age norms are available, and (7) it is designed to serve as a standardized assessment for deaf children.

W*eaknesses* (1) it cannot (yet) be used for an assessment/baseline assessment in an educational setting because it is too long to conduct and analyze, (2) psychometric analyses of expressive tasks have not yet been undertaken, (3) it is only suitable for children older than 8 years, and (4) the test is not (yet) available.

### 2.2.2 *Test of American Sign Language*

The *Test of ASL (TASL)* has been developed within the framework of a larger collaborative research project between San Francisco State University and the University of California Santa Cruz, investigating the relationship between ASL and English literacy skills (Strong & Prinz 1997, 2000; Prinz et al 1995).

Like the *ASLAI*, the *TASL* provides an in-depth investigation of specific linguistic structures rather than acting as a screening instrument. In the first stage of the project the *TASL* was developed, data collection procedures were refined, sampling procedures planned, and a small sample tested. A draft of the test was sent to five deaf linguists who acted as consultants to review the test and give suggestions as to how to improve it. The final version has incorporated this feedback.

In the second stage, two assessments were administered: the *TASL* and an English literacy test. The subjects of the study were 155 deaf children from the same educational site, divided into two age groups: 8–11 years old and 12–15 years old. The *TASL* consists of two production and four comprehension measures covering classifiers, time, location, and narratives.

The current version of the *TASL* has been expanded and redeveloped to a web-based testing instrument. The goal is to have a tool for diagnostic purposes. In addition, the revised *TASL* is designed as a device to help educators to develop strategies for teaching the deaf. The structure of the original version has been changed to be made more suitable for these purposes. In addition, the new version of *TASL* will be web-based, which will significantly facilitate the process of administering

and scoring the test. The revised version focuses on both comprehension and production. The format of the test items makes it possible to assess participant's ASL skills without relying on video recordings of the test adminstrator's language samples. Pilot testing is currently underway (W. Mann, personal communication).

The discussion below will focus on the original version of the *TASL.*

*Procedure*: the procedure is outlined for each sub-test.

1. *Classifier Production Test:* a five-minute cartoon movie is shown to the subject, and then presented in 10 brief segments. The child is video-recorded signing each segment in ASL. Later, the tape is scored for the presence of size, shape, and movement markers in the classifiers.
2. *Sign Narrative:* Pictures from a children's book without text are presented, and the child is required to sign the story in ASL. This is video-recorded and later scored using a checklist for the presence of ASL grammar and narrative structures.
3. *Story Comprehension:* an ASL narrative presented by a native signer is shown on video. While watching the video, the subject is asked questions about the content and responses are video-recorded.
4. *Classifier Comprehension Test:* pictures with different objects are shown to the subject. A deaf person describes each object in five different ways. On an answer sheet with video stills of each description, the child is required to mark the best description.
5. *Time Marker Test:* six representations of a term referring to a specific time or period of time are shown. On a calendar-like answer sheet, the child is required to mark the corresponding date(s).
6. *Map Marker Test:* a signer describes the location of objects in an environment e.g. vehicles at a crossroads or furniture in a bedroom. For each description, the subject has to select the correct representation from a selection of photographs in an answer booklet.

The instrument is intended for use during school hours. The *TASL* takes approximately one hour to administer and 15–30 minutes to score. The *TASL* should be administered by a deaf researcher, fluent in ASL, with no hearing person present. Test instructions are presented in ASL on video. Signed responses are video-recorded and later scored by a deaf researcher.

*Standardization:* Inter-rater reliability was established for each *TASL* subtest that required subjective decision making; raters scored ten protocols, reviewed them and resolved disagreement and then scored a second set of protocols. Agreement was better than 96%. By dividing the scores into thirds, three levels of ASL proficiency were created: low, medium, and high. Psychometric analysis is being

undertaken for the TASL (P. Prinz, personal communication). The *TASL* has been adapted into other sign languages: Swiss French Sign Language by collaborators at the Bilingual School for the Deaf in Geneva, Switzerland (Niederberger 2004) and Swedish Sign Language (Schönström, Simper-Allen & Svartholm 2003). There are plans to standardize the ASL version so that it can be used as a diagnostic measure (P. Prinz, personal communication).

*Availability:* The *TASL* is not publicly available, and has only been used in the research context and not as an assessment for deaf children.

*Strengths:* (1) it has been reviewed by deaf experts, (2) it has been developed for research purposes, (3) it will be adapted to become an assessment for deaf children, (4) it assesses both language comprehension and production, and (5) it covers a broad range of linguistic features

*Weaknesses:* (1) there is no reported psychometric testing in the published literature (only inter-rater reliability has been published), (2) it is not designed to be used as a baseline assessment in an educational setting, (3) it is designed only for children aged over 8, (4) the test is not publicly available, and (5) it does not present developmental norms.

## **2.3** Tests for linguistic research

In this section tests designed for linguistic research will be presented individually.

### **2.3.1** *Test Battery for American Sign Language Morphology and Syntax*

The *Test Battery for ASL Morphology and Syntax* (T. Supalla et al. unpublished) is designed to allow a thorough analysis of an individual's knowledge and use of specific morphological and syntactic structures in ASL within a linguistic research context. The instrument has been used with over 100 signers aged 3–75 years.

The test battery consists of 12 comprehension and production measures. These are: (1) lexical phonology production, (2) narrative production, (3) verb agreement production, (4) noun–verb production, (5) noun–verb comprehension, (6) verb of motion production, (7) demographic questionnaire, (8) aspect and number inflection production, (9) sign order comprehension, (10) verb reversal production, (11) verb agreement comprehension: single verbs), and (12) verb agreement comprehension: 2-verb sequences. Parts of the test battery have been used in other research contexts, e.g. to test the ASL knowledge of deaf children through the *ASLAI*.

*Procedure*: The instrument takes about two hours to administer and at least 15 hours for analysis (Maller et al. 1999).

*Standardization:* A description of the psychometric properties is not yet available (Maller et al. 1999). Since the instrument has not been published, there is very little in-depth information available .

*Availability* The instrument is not yet publicly available.

### 2.3.2 *Test Battery for Australian Sign Language Morphology and Syntax*

The *Test Battery for Australian Sign Language Morphology and Syntax* (Schembri et al. 2002) is an adapted version of the *Test Battery for ASL Morphology and Syntax*. It was designed to obtain data on morphosyntactic structures in Auslan with the long-term goal of developing an assessment to be used for deaf children and adults learning Auslan as a second language. Twenty-five deaf native signers participated in a pilot study, although only 12 completed the entire Auslan test battery. Their ages ranged from 16–58 years.

Schembri et al (2002) discuss only four subtests: the *Noun–Verb Production* test, the *Noun Verb Comprehension* test, the *Sign Order Comprehension* tests, and parts of the *Verb of Motion Production* test, as these were the only sub-tests to be completed by all 25 subjects.

*Procedure:* The goal of the *Noun–Verb Production* test is to determine if the signer produces a distinction in the number, duration, and/or manner of the movements of derivationally-related nouns and verbs in Auslan. Following presentation of the test instructions in Auslan, subjects watch 35 short 'skits', in which a person performs two separate actions, each action involving a different object. Following each skit, the video is paused and the subject is asked to describe what has just been seen. Responses are videorecorded for later analysis.

The *Noun–Verb Comprehension* task aims to determine whether differences in the number, duration, and manner of movements are interpreted by native signers as signaling a morphological distinction between derivationally related nouns and verbs in Auslan. Subjects watch a short video clip in which a native signer of Auslan produce either a nominal or a verbal form of a noun–verb pair. For each item, the participant sees one sign and then a pair of pictures, taken from the original *Test Battery for ASL Morphology and Syntax*. One of the pictures shows an object while the other picture shows an action related to that object (Figure 2). The subject is asked to identify which of the two pictures represents what has been seen in the video clip.

Certain items elicited variable responses, indicating patterns of lexical variation in Auslan noun–verb pairs, and therefore a need for revision of the materials.

The *Verb of Motion Production* task aims to gather normative data on what constitutes appropriate use of productive verb morphology for manner, path, location, direction, and referent class object. Subjects watch a series of 80 brief

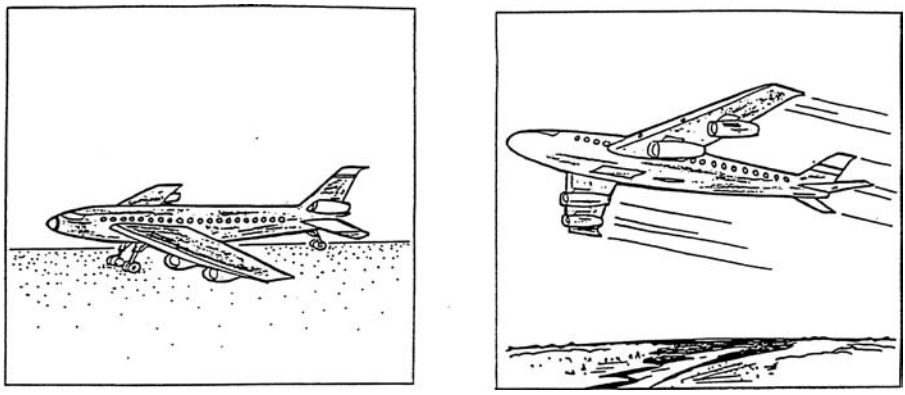

**Figure 2.** AIRPLANE vs. AIRPLANE-FLY


animated films, showing simple motion events involving movements of an object from one location to another. The first 40 animated clips involve a single moving object, referred to as the 'central object'. The remaining 40 clips involved two objects: the central object and a stationary 'secondary object'. In both cases the participant needs to represent the referents by the appropriate classifier handshape morpheme. Responses are videorecorded for later analysis.

Although analysis focused only on semantic classifiers, in contrast to the original *Test Battery for ASL Morphology and Syntax*, in which size and shape specifiers were also coded, the results showed how little is known about how deaf native signers of Auslan produce the various classes of referents in classifier verbs of motion. The results from this sub-test did not provide the kind of normative data required for an assessment tool, due to variations in the possible ways native signers of Auslan represent various classes of referents in classifier verbs of motion. Additionally, the large amount of data and the complex coding process required make it difficult to use as an assessment tool.

The *Sign Order Comprehension* task was designed to gather normative data about sign order in Australian Sign Language. The participants watch a series of video clips, each presenting a single clause in Auslan. Each clause contains three signs, produced in one of three orders (SVO, OSV, VOS). In 18 of the clauses, word order is the only information available to assist in assigning the roles of subject and object. In nine of these 18, the subject was also nonmanually marked as topic. The remaining 18 clauses used a combination of word order other than SVO and nonmanual marking of topicalized constituent to express subject and object roles The verbs were not spatially modified for person and no spatial cues were available to determine the roles of each nominal. After watching the video, subjects were shown a pair of pictures, which differed only in terms of which person was the

agent or patient. Subjects were required to identify which of the two pictures represented the event described in the task, relying on the combination of word order and nonmanual marking cues to determine the meaning of the clause.

*Methodological Issues:* The authors of the Auslan test report that the adaptation of a test from one sign language to another for linguistic research purposes is relatively easy due to the design of the test materials. The original ASL test battery provided background information about the design, administration, and analysis of the test which could be used for the adaptation to Auslan. Picture materials and video-recorded sequences from ASL could be used for test stimuli in Auslan; however, some modifications were needed. Table 1 provides an overview of each of the tests and which modifications needed to be made for the Auslan test battery.

The entire adaptation, including decisions about test items to be used as stimuli and re-filming of the test materials, was undertaken by a hearing sign language researcher who is also an Auslan/English interpreter, working with a deaf native signer. The deaf native signer produced the test instructions, which were video-recorded. A group of three other deaf native signers assisted in the re-filming of the test materials.

**Table 1.** Modifications of the ASL test battery for the Auslan test battery

| **Test** | **Modifications for the Auslan Test Battery** |
|---|---|
| 1: Lexical phonology production | Instructions re-filmed, printed materials adapted |
| 2: Narrative production | Instructions re-filmed, original test stimuli used |
| 3: Verb agreement production | Instructions and test stimuli re-filmed |
| 4: Noun–verb production | Instructions re-filmed, original test stimuli used |
| 5: Noun–verb comprehension | Instructions and test stimuli re-filmed, original printed materials used |
| 6: Verb of motion production | Instructions re-filmed, original test stimuli used |
| 7: Demographic questionnaire | Instructions re-filmed, original printed materials adapted |
| 8:Aspect and number inflection production | Instructions and test stimuli re-filmed |
| 9: Sign order comprehension | Instructions and test stimuli re-filmed, original printed materials used |
| 10: Verb reversal production | Not adapted |
| 11:Verb agreement comprehension: Single verbs | Instructions and test stimuli re-filmed |
| 12: Verb agreement comprehension: Two verb sequences | Instructions and test stimuli re-filmed |

Reprinted with permission of Schembri et al. (2002)

After a draft version of the Auslan test battery was completed, a pilot study was conducted in order to collect data on the suitability of the test materials as a basis for a proficiency assessment of Auslan. Seven out of the initial twelve tasks from the ASL test battery were re-recorded. The *Noun-Verb Production*, *Noun-Verb Comprehension*, and the *Verb of Motion Production* sub-tests need substantial modifications before inclusion in a revised version of the Auslan test battery.

Schembri et al. (2002) identify a number of issues that arose during the project. The original items of the NVP and the NVC task exhibit substantial variation between signers and will need to undergo modification in order to ensure test validity. The large amount of data produced and the amount of time needed to analyze the data mean that it would be difficult to use as an Auslan test battery.

The authors emphasize that an improved understanding of the grammatical features of Auslan are essential if a valid and reliable assessment tool to measure grammatical proficiency in Australian Sign Language is to be established. Versions of this battery could then be used in bilingual programs serving deaf children or in teaching Auslan as a second language. But the development of such an assessment tool still lies in the future.

*Strengths:* (1) the test gathers information on specific morphosyntactic aspects of Auslan, (2) it may allow cross-linguistic comparison on specific morphosyntactic structures in other sign languages, (3) it may be adaptable into an assessment instrument to be used with deaf children and second language learners of a sign language, and (4) it tests both language comprehension and production.

*Weaknesses:* (1) it is so far intended for research purposes only and (2) cannot be used as a baseline assessment with children.

### 2.3.3 *Test for Grammatical Judgment of ASL*

This test was developed within the framework of a research project investigating the effects of age of acquisition of ASL on grammatical processing (Boudreault & Mayberry 2000). Thirty deaf subjects aged 18–84, with ASL as their primary language, participated in the study. The subjects were divided into three groups depending on their age at first contact with ASL: the 'native' group — deaf people where one or both parents used ASL; early learners — deaf people who learned ASL in school between the ages of 4 and 7; and 'late learners', who started to learn ASL between 8 and 13 years.

*Procedure:* In this receptive test, the subjects saw 168 ASL sentences, presented in order of increasing syntactic complexity and were required to judge whether each sentence was grammatical or ungrammatical. Response accuracy and latency were measured. There were six types of sentences.

1. Simple sentences: The sentences consisted of only uninflected signs, using plain verbs. No grammatical facial expression was used or agreement of loci, except for pronouns in signing space. In the ungrammatical sentences the verb was moved to a different position in the sentence.
2. Negative sentences: Only uninflected signs, other than the negative marker, were used, and there was no agreement of loci, other than possessive pronouns.
   Two types of negative inflection were used: (1) the ASL sign NOT preceding the verb and (2) negative facial expression. The sentences were made ungrammatical by moving the sign NOT to a different location in the sentence and by placing the negative facial expression at the beginning of the sentence before the verb was signed.
3. Directional verb sentences: These sentences used uninflected signs with the addition of a single verb inflected for person and number. The sentences were made ungrammatical by moving the verb (i.e. verb and person/number inflection) to another phrase within the sentence.
4. Wh-sentences: The Wh- (question)-sentences included uninflected nouns and a Wh-marker. Half of the sentences had a verb that was inflected, and half of the sentences had plain verbs. The sentences were made ungrammatical by moving the Wh-facial marker or sign from the end of the clause to another location.
5. Relative clause sentences: The relative clause sentences consisted of two verbs, either inflected or plain with one of two types of relative clause marker: (1) relative clause facial marker and (2) THAT/ITSELF manual marker. In half of the sentences the relative clause facial marker and in the other half the relative clause sign was used. The sentences were made ungrammatical by switching the relative clause facial marker and its accompanying clause to the second part of the sentence. Sentences using the relative clause manual marker were made ungrammatical by moving it to an earlier position in the sentence.
6. Classifier sentences: Three types of classifier were used: (1) CLASS–1 (animate and vehicles), (2) CLASS–2 (inanimate and object), and (3) SASS. The sentences were made ungrammatical by scrambling the spatial order of the classifiers.

The stimuli were video-recorded, edited, and recorded onto a CD-ROM for presentation on a computer. A command pad (game pad) was attached to the computer for the testing. Two of the four buttons were used to indicate whether a sentence was grammatical or ungrammatical. The computer recorded the response accuracy and latency. Subjects were tested individually, with testing time varying between 14–60 minutes.

*Methodological issues:* The selection of grammatical structures was based on ASL research and acquisition studies. The stimuli were developed by the deaf investigator and other deaf native signers. In the pilot study, the ASL sentences were video-recorded and shown to three ASL signers to judge if the sentences were grammatical or ungrammatical. Where there was disagreement, sentences were changed until all three ASL signers agreed.

*Availability:* This test is not available, but it has been revised and improved (P. Boudreault, personal communication).

*Strengths:* (1) it has an easy to administer test format, (2) efficient analysis through its computer based format, (3) it has been based on ASL research, and (4) it has been developed with deaf researchers

*Weaknesses:* (1) it has so far only been used in a research context.

## 3. Evaluation of the tests

In this section a general evaluation of the tests presented above will be provided. Potential shortcomings or gaps will be pointed out. At the end, some suggestions will be offered as to priorities for development in the future.

### 3.1 General evaluation of instruments available

Most of the instruments presented clearly identify their purpose. Some tests focus on assessing sign language skills of deaf children, others, such as the *ATG*, have broad applicability.

Assessment instruments for educational purposes, like the *ASLAI* and the *TASL*, are also used for research purposes, but with the longer-term goal of being developed as assessment instruments for deaf children. There is a general gap with regard to instruments that are currently available for use as screening instruments in, for example, schools for the deaf. Another clear gap is in instruments designed for second language learners of a sign language.

### 3.2 Screening tools or tools for in-depth investigation

Given the characteristics of a screening instrument (see 1.2), only the *ASL-PA* and *NGT-OP* fall into this category. Most instruments provide an in-depth investigation of specific linguistic aspects of a sign language. Future research needs to focus on the development of screening tools in order to identify deaf children 'at risk', plan intervention if needed and offer in-depth investigation/diagnosis. Such

screening tools might be adaptations of diagnostic instruments. In an applied field like deaf education, a screening tool that takes little time to score and evaluate would be very helpful.

### 3.3 Evaluation of age group targets

Most of the assessment instruments designed for educational purposes focus on deaf children aged 8–16 years, and those designed for use in assessment and monitoring deaf children's language acquisition focus on deaf children aged 6–12 years. The lack of tests that can be used for younger children is apparent, particularly since it is most important to be able to assess the language acquisition process and plan intervention. Only the *BSL Receptive Skills Test* and the *NGT-OP* can be used with deaf children as young as 3 years.

There is also a lack of instruments for assessing second language learners of a sign language and for deaf children aged 12 years and upward. Only two such tests were found.

### 3.4 Evaluation of the content of the tests

Some tests, such as the *ASLAI* and *ATG*, assess both language production and comprehension. Some tests assess only language production, e.g. the *Signed Language Development Checklist* and the *ASL-PA*.

As discussed earlier, most of the tests assess morphological and syntactic structures, for example the *Test Battery for ASL Morphology and Syntax* and its Auslan adaptation, the *ASLAI*, the *TASL*, *ATG*, and the *ASL-PA*. Some tests also focus on assessing narrative abilities, such as the *ASLAI*. In contrast, areas such as phonology, the lexicon, and pragmatics are not very well covered. Phonology is only assessed through one domain/task in the *Signed Language Development Checklist* and in the *NGT-OP*. Pragmatics is not assessed in any of the instruments; lexical knowledge is only assessed in a few, e.g. the *ASLAI* and the *Assessment for Sign Language of the Netherlands*.

Communicative competence is not assessed in most of the instruments. The *ATG* does test the communicative competence of the subject with the aim of obtaining a first impression of the test taker's language ability/communicative competence to decide if he/she can understand the test demands. Communicative competence in the broadest sense includes how the individual interacts in a language community, including aspects of grammatical competence, sociolinguistic competence, and discourse competence. Communicative competence therefore deserves greater attention. Besides assessing linguistic aspects of a sign language,

communicative competence should also be an important part of the framework of a larger ongoing language assessment for deaf children, not necessarily as a test for its own sake, but as an additional task in a test.

### 3.5 Evaluation of the background of the assessment instrument

A major shortcoming in assessing the existing instruments is that hardly any information is provided concerning the background of the selected items or linguistic structures tested. Certainly it is plausible that items are based on linguistic research, for example the classifier tests in the *ASLAI* and the *TASL*, but little explicit information is given.

Most instruments are based on linguistic research on ASL. If in a sign language insufficient and insufficiently detailed research is available, test developers use data from other sign languages, as in the case of the *ATG* or *NGT-OP*. However, problems may arise as a result of cross-linguistic differences (relevant for test development) when taking an instrument from one sign language and adapting and translating it into another sign language. The Auslan test battery developers have approached this problem by using the test in the first instance to collect data about the morphology and syntax of Auslan and then using that information to develop an assessment for use with deaf children and second language learners of Auslan.

### 3.6 Evaluation of assessment instrument development

One common shortcoming is that many of the instruments do not report psychometric properties. This is in some cases because the instruments are still under development. A specific issue in relation to sign language tests for deaf children is that it is difficult to determine which group or population should be used for standardization (Baker, Van den Bogaerde & Woll this volume). The *BSL Receptive Skills Test* is one of the few standardized instruments currently available. Herman et al. (1998) came to the conclusion during the development and standardization of the *BSL Receptive Skills Test* that even if the instrument is designed for use with deaf children of hearing parents, it should be standardized on a more homogeneous group (deaf children of deaf parents), because of the large variability in the language of deaf children with hearing parents.

### 3.7 Evaluation of the usability of the assessment instruments

Not all of the instruments provide information on issues regarding administration and scoring procedure, i.e. length of the test, time needed to score the test, and

what background knowledge is required by the assessor. The *ASL-PA* and *NGT-OP* devote a good deal of attention to these issues. One of the goals in developing the *ASL-PA* was to develop an efficient instrument in terms of scoring time: no more than one and a half to two hours per child; the *NGT-OP* takes about one hour. Another issue addressed by the authors of the *ASL-PA* (Maller et al. 1999) and the *NGT-OP* (Baker & Jansma 2005) is the qualifications of the assessor. In the initial form of the *ASL-PA*, a knowledgeable assessor was required, although the developers plan to modify the test so that it can be used by non-researchers. In the *NGT-OP* the assessor needs to know the child for at least three months and have some linguistic knowledge. This is an important issue when developing an instrument and making it available: Does the assessor need to undergo extensive training or need to be a person with extensive knowledge of the linguistics of the language? Some instruments provide only limited information on the administration procedure. However, the authors of the tests are aware of some of the potential problems and in order to avoid time-consuming transcription of the data often use pass-fail formats or checklists.

### **3.8** Evaluation of the availability of the instruments

The final problem is that almost none of the instruments are available. One of the few that is available is the *BSL Receptive Skills Test*. Some tests can be obtained by contacting the authors. Other tests have been designed for use in research, and are not publicly available. It is hoped that continuing development of the assessment instruments will result in future availability for use in non-research contexts as well, for example for assessing deaf children's sign language skills.

### **3.9** Conclusion

In summary, a number of sign language tests designed for different purposes have been developed or are still under development.[3] One of the major issues for future development in this field is the creation of tests that can be made available for use in non-research contexts, specifically for use in educational contexts to assess deaf children's sign language acquisition and the sign language skills of second language learners. For most sign languages, tests designed for use in research contexts are more or less a prerequisite for future development of assessment instruments for children, since most sign language test development cannot rely on a large body of linguistic research such as is available in ASL.

3. More information on sign language assessment instruments can be accessed by visiting the following website: http://www.signlang-assessment.info

In the future, attention will need to be given to the development of screening instruments and also to tests for different target groups: younger children (under 3 years), older children (older than 12 and 15 years), and second language learners of a sign language. Tests will also be needed to assess other linguistic aspects besides morphology and syntax, such as phonology.

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## Appendix A:

Test abbreviations (where applicable)

| | |
|---|---|
| 1. ASLAI | American Sign Language Assessment Instrument. |
| 2. ASL-PA | American Sign Language-Proficiency Assessment. |
| 3. ATG | Aachen Test for Basic German Sign Language Competence. |
| 4. BSL Receptive Skills Tests | British Sign Language Receptive Skills Test. |
| 5. NGT-OP | The Developmental Assessment Checklist for Sign Language of the Netherlands. |
| 6. PARST | Australian Sign Language Receptive Skills Test. |
| 7. TASL | Test of American Sign Language. |

# Some observations on the use of HamNoSys (Hamburg Notation System for Sign Languages) in the context of the phonetic transcription of children's signing*

Ritva Takkinen
University of Jyväskylä, Finland

This paper discusses the use of the HamNoSys notation (Hamburg Notation System for Sign Languages) for the transcription of children's signing. The notation system will be briefly described and some former descriptions of the acquisition of sign language phonology presented. The project in which HamNoSys was used is then described briefly, followed by a description of the problems encountered while using the notation. Some proposals as to how to further develop the notation will be made. In conclusion the instrument can be said to be useful and, especially if revised, will be invaluable in further research.

**Keywords:** sign language, phonetic transcription, acquisition of handshapes, phonetic features of handshapes, sign phonology, HamNoSys

## 1. Introduction

Notation of signed languages has been a problem from the beginning of sign language research. Many notation systems have been created thus far. The European Science Foundation (ESF) funded a workshop where sign transcription and database storage were discussed (see Special issue of *Sign Language & Linguistics* 4:1/2 (2001). This paper concentrates on the experiences in using the Hamburg Notation System for Sign Languages (HamNoSys).

HamNoSys was created in the Zentrum für Deutsche Gebärdensprache und Kommunikation Gehörloser at the University of Hamburg. HamNoSys version

* I want to thank Thomas Hanke for giving me technical advice on using HamNoSys, Anne Baker and Bencie Woll for valuable comments during the preparation of this article.

2.0. An Introductory Guide was published in 1989 (Prillwitz, Leven, Zienert, Hanke & Henning 1989). Its purpose was to create a system for sign language research that would facilitate notation of all sign languages in phonetic detail. It was created for Apple Macintosh computers. The font is now also available for PC computers but this does not yet function as smoothly as the Mac version. The newer version 3.0 for Apple Macintosh computer was released on the internet in the middle of the 1990s (http://www.sign-lang.uni-hamburg.de/).[1]

HamNoSys partly follows the tradition of older notation systems (e.g., the Stokoe system: Stokoe 1960; Stokoe, Casterline, Croneberg 1976) but it has attempted to be more accurate, more phonetic. In this system the handshapes are notated in quite a new way. The classification of handshapes is designed to be logically and anatomically consistent; the symbols have iconic relationships to their referents; the system finely differentiates signs within their cohesive framework; and is computer compatible (HamNoSys 1989).

Stokoe et al. (1976) described the structure of a sign in American Sign Language (ASL) with a restricted number of symbols i.e. fifty-five symbols: nineteen for handshapes labeled partly with the same alphabetic symbols as the hand alphabet; twelve for location, and twenty-four for movement. The authors use some additional symbols to make the notation more explicit. This system is not phonetically very detailed because not all handshapes, locations, and movements are represented in this system. Neither orientation i.e. the relation between the hands and the body nor non-manual aspects of a sign were taken into account in this notation. The notation system created by Stokoe et al. was adapted to British Sign Language (BSL) (Brennan, Coville & Lawson 1984) as necessary to meet the needs of researchers analyzing BSL sign structure. It was used also in the first description of Finnish Sign Language (FinSL) (Rissanen 1985).

Bergman (1982) created a transcription system which could transcribe the distinctive units and their most important variants in Swedish Sign Language (SSL). According to Bergman this system could easily be developed further to transcribe also the fine phonetic features of signs. Bergman also remarked that this transcription system could be used for different purposes: to write signs (by reducing the number of symbols) or for a very fine phonetic transcription (by adding symbols). In 1993 Bergman and Björkstrand revised the transcription slightly: some symbols for handshapes, places of articulation, and movements were added. The transcription was also computerized, and it is possible to use it now in this version. Wallin (1996) used it when describing polysynthetic signs in SSL. He developed some

1. Since this analysis of HamNoSys, it has undergone some changes in order to make the description of signs more accurate. The changes in the version HamNoSys 4 do not, however, affect the issues discussed in this paper.

new symbols for handshapes, and many symbols for transcribing the onset and offset of movements.

Johnson and Liddell (1996) developed a very detailed phonetic description of signs. Their system requires a considerable amount of space, and is not as such suitable as a transcription method. It can, however, provide a good basis for creating an accurate transcription of signs and also signed texts because it is able to describe subtle phonetic differences of handshapes.

## 2. The basic idea of HamNoSys

In this section the basic concept and symbols of HamNoSys will be introduced to the reader so that the research study, evaluation of HamNoSys in the notation of handshapes, and other observations on this notation system will be easier to follow. The symbols of HamNoSys (version 3.0, http://www.sign-lang.uni-hamburg.de/Projects/HamNoSys.html) will be briefly presented together with the organization of the symbols related to the different parameters of a sign.

The parameters of a sign are recorded in the following order when using HamNoSys notation:

1. Symmetry operator
2. Non-manual components
3. Handshape
4. Hand Position
5. Location
6. Actions (movement including type, manner, and repetition)

**Symmetry operator** ( ¨ or ˈ ) is used with symmetrical two-handed signs that have the same handshape. Thus it shows that two hands are involved in the sign in question. In the transcription of non-symmetrical signs both handshapes and their relations to each other must be described.

The transcription of **non-manual components** is not developed sufficiently, as the authors themselves report in the internet presentation of version 3.0.

**Handshape** information is composed of 18 basic symbols representing handshape, thumb position, degree of finger extension, and individual finger identification. The symbols for finger parts are also used for the notation of location (see Table 1).

The design of this inventory of symbols should make it possible to create all the handshapes which exist in any sign language. In Table 2 some examples of using these symbols are presented.

**Table 1.** The HamNoSys symbols for handshapes

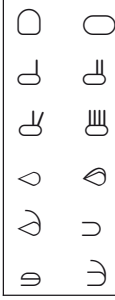
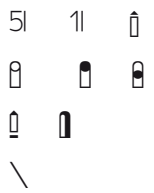
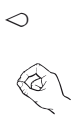
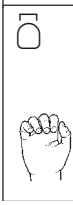
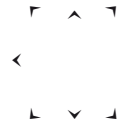
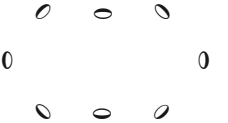
| Handshapes | Thumb position | Diacritic symbols for the values of the finger extension | Numbers for fingers | Symbols for finger parts |
|---|---|---|---|---|
|  |  |  |  |  |

**Table 2.** Examples of using the handshape symbols

| | | | | | |
|---|---|---|---|---|---|
|  | thumb in lateral position |  | index selected and extended |  | index and thumb selected, rounded and in fingertip contact, unselected fingers closed |
|  | fingers flexed from the base joints |  | pinky selected and extended |  | index and thumb selected, rounded and in fingertip contact, unselected fingers open |
|  | fingers rounded from the joints |  | index and pinky selected and extended |  | all fingers and thumb selected, rounded and in fingertip contact |
|  | fingers flexed from the distal joints |  | index flexed but not the thumb |  | all fingers and thumb selected, rounded and the thumb pad in contact with the nails of the fingers |

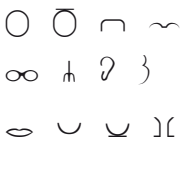
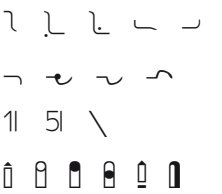
**Hand orientation** is conveyed by coding wrist orientation — that is whether the wrist is bent upwards, downwards, or to the side. Extended finger orientation (coded in terms of relationship to the body) and palm orientation (in absolute terms) are also coded (see Table 3).

**Table 3.** HamNoSys Symbols for orientation

| Wrist orientation | Extended finger orientation / parallel to body | Extended finger orientation / with body referent | | Palm orientation |
|---|---|---|---|---|
|  |  |  |  |  |

The **location** symbols (Table 4) follow those of the Stokoe notation (12 symbols) (Stokoe et al. 1976), but there are additonal symbols in HamNoSys (40) to enable greater accuracy. In contrast to the Stokoe notation that had 12 symbols in total, there are 12 symbols for the locations at the head area, four symbols for locations on the body, and 18 symbols for locations on the arm and the hand. In addition, there are six symbols describing the distance of the hand from the body.

**Table 4.** HamNoSys Symbols for Location

| Head | Body | Arm & hand | Distance from the body |
|---|---|---|---|
|  |  |  |  |

Six different types of **movement** are coded (see Table 5): straight movement parallel to the body, as well as with the body referent (away or towards the body on a horizontal and diagonal plane); circular movement on vertical, horizontal and sagittal planes; curved, wavy, zigzag, and spiral movement. In addition, there are symbols for manner and repetition of movement.

The manner of movement, that is the size (large, small), speed (fast, slow), intensity (tense, lax), and the manner of onset and offset (hold or rest, abrupt halt at the end) are coded. The number of repetitions of movement is added after coding the qualitative aspects of the movement. If a sign involves several movements, the order of movement notation is as follows:

straight or circling movement + type of movement + manner of movement + repetition.

In two-handed symmetrical signs only the dominant hand needs to be described. If the hand positions mirror each other and the movement is symmetrical and

**Table 5.** HamNoSys Symbols for Movement

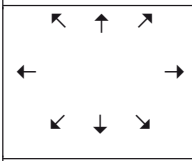
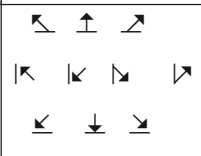
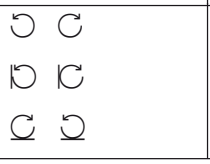
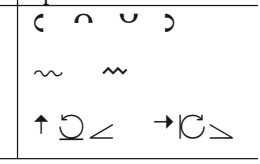
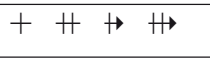
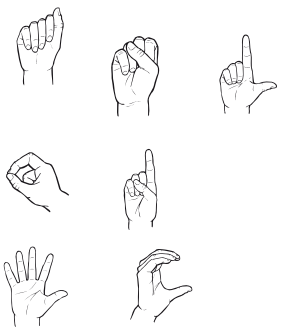
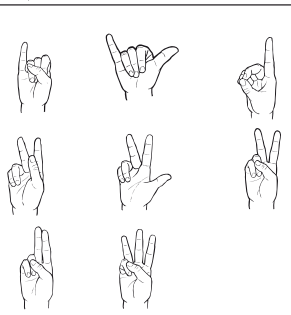
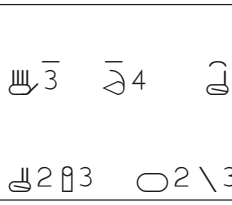
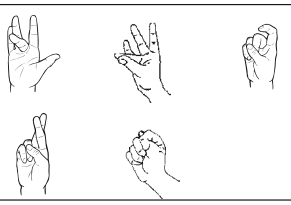
| Straight / parallel to body | Straight with body referent | Circular | Curved, wavy, zigzag, spiral |
|---|---|---|---|
|  |  |  |  |
| **Manner of movement** | | **Repetition** | |
|  | |  | |

**Table 6.** The phases of handshape acquisition in ASL according to Boyes-Braem (1990)

| | | | |
|---|---|---|---|
| phase I | A, S, L,<br>bO, G,<br>5, C |  |  |
| phase II | B, F, O |  |  |
| phase III | I, Y, D,<br>P. 3, V,<br>H, W |  |  |
| phase IV | 8, 7, X,<br>R, T |  |  |

mirrored, two dots next to each other ( ¨ ) are placed before the notation sequence. The colon ( ˸ ) is used when there is parallel location and movement of the hands. Alternating movements of symmetrical signs are indicated using the symbol ( ⁀ ). For all other two-handed signs both hands are described: first the non-dominant hand, then the dominant hand.

## 3. Transcription of child sign phonology in previous research

The acquisition of the phonology of sign languages has not been extensively studied to date with research mainly concentrated on handshapes (Boyes-Braem 1990; McIntyre 1977; Marentette & Mayberry 2000; Siedlecki & Bonvillian 1997). Some researchers have also studied the acquisition of location and movement (e.g., Takkinen 1988, 1990, 1994, 1995; Siedlecki & Bonvillian 1993; Conlin, Mirus, & Meier 1996, 1999). Table 6 shows the stages of handshape acquisition in American Sign Language (ASL) as described by Boyes-Braem (1990). The levels of handshape acquisition of ASL presented by Siedlecki and Bonvillian (1997) are presented in Table 7. In these tables, Stokoe notation and HamNoSys notation, as well as the pictures of the handshapes, are given in order to make it easier to compare the different notation systems. It can be seen from the tables that the number of the handshapes documented by the researchers is fairly small since phonetic features are not taken into account.

No group of researchers has differentiated between handshape variants produced by children in an accurate manner. Boyes-Braem (1990), for instance, uses the symbol L to refer to the handshape where the index is selected and extended and the thumb is spread laterally in a lax manner. In so doing she does not differentiate between the lateral and the unopposed position of the thumb. Siedlecki and Bonvillian (1997) use only 26 handshapes in their analysis (most of them are shown in Table 7) which indicates that many of the phonetic features have been collapsed in their description. They have used the symbol C, for example, to refer to the first handshape in the ASL sign MILK (see Figure 8) although the extension degree of the fingers should be described as 'closed rounding', not as simply 'rounding' as for example Johnson and Liddell (1996) remarked.

**Table 7.** The levels of handshape acquisition in ASL according to Siedlecki & Bonvillian (1997)

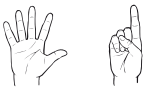
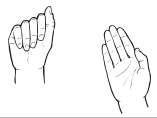
| | | | |
|---|---|---|---|
| 1st level | 5, G, |  |  |
| 2nd level | A, B |  |  |
| 3rd level | C, L, O |  |  |
| | bO |  |  |
| 4th level | E, H, K, |  |  |
| | 3, V, X |  |  |
| 5th level | F, I, R, |  |  |
| | T, W, |  |  |
| | Y, 8 |  |  |

**Figure 1.** Handshape change in the ASL sign MILK

## 4. The study of phonological acquisition in Finnish Sign Language

The aim of this recent study was to examine, by using phonetic features, the developmental course of handshape acquisition in Finnish Sign Language (FinSL), and what types of features appear to vary in the handshapes produced by children. Here I shall just briefly describe the method and findings (see Takkinen 2002, 2003 for a full description).

### 4.1 Methodology

The subjects of this study were three deaf children of deaf parents. One of them was observed at the ages of two, three, five, and seven, the other at the ages of two and three, and the third at the ages of five and seven. The native language of all the children was FinSL.

The data were gathered by videotaping the children while playing with toys and interacting with their parents or a deaf kindergarten teacher. The signing was transcribed by glossing the signs onto a computer. The signs of the children were notated using the HamNoSys transcription system. The target handshapes and the produced handshapes were then compared and the features of the actual handshapes produced were analyzed. In the analysis of the developmental features Johnson & Liddell's phonetic description of signs (1996) was used.

Transcribing signed text, and the signing of children, creates additional problems compared to the notation of basic forms of signs in adults. The movement of the sign is complex, for example, since in young children it may be quite unlike the adult form or broken down into smaller movements. Another complex aspect in acquisition is handshape because handshapes can be incomplete and children produce handshapes that do not occur in the sign language they are acquiring or even ones that must be considered 'impossible' handshapes. Every type of innovation can be found. This analysis concentrated on handshapes.

### 4.2 Results

The findings showed that handshape features developed in a certain order. At the youngest age the index or all fingers, and the thumb were among the selected fingers. At the age of three the number of selected fingers and their combinations increased; at the ages of five and seven years the options for selected fingers were as great as in adult FinSL.

The earliest form of finger and thumb extension was the extension of both of the joints (distal and proximal joints). At the age of three, both of the joints were

also flexed. The flexion of the distal joints was acquired last as would be expected (Van der Kooij 2002). The earliest finger configuration was linear. Non-linear (crossed and stacked) configurations appeared in one of the children as early as the age of three but in another child, at the age of five. The first acquired positions of the thumb were an unopposed position beside the fingers, a lateral position, and a neutral position on the flexed fingers. Other positions, opposed and beneath the fingers or against the palm, occurred at the age of three. The important contact of the thumb appeared first in the opposed position with the finger next to the thumb, then in the opposed position with the fingertips. The phonologically important presence of the forearm or only the fingertips in a sign occurred in one of the children at the age of three and in the other young child not until the age of five.

The three most common features that were different from adult forms were finger spreading in handshapes where they should be unspread, or vice versa, the slight rounding of the fingers in the handshapes where they are extended in target forms, and variation in the number of selected fingers. Thumb features, as a combined classification, formed one of the most common ways in which the child forms differed from adult forms. Other common variants included variations in extension, flexion and rounding of the fingers, flexion of the wrist instead of flexion of the fingers, the imperfect flexion of the fingers, and use of more than two finger configurations in one sign. Occasionally, the children produced forms with addition or deletion of handshapes, asymmetry in handshapes where the target sign is a symmetrical two-handed sign, or a variation of the target handshape of the dominant or non-dominant hand or both hands in non-symmetrical two-handed signs. A rare variation was assimilation of the handshape of one hand to the handshape of the other hand or to the handshape of the preceding or following sign.

When handshapes were analyzed on the basis of their phonetic features, handshapes in child FinSL were identified that had not been previously described in adult language. Nevertheless, it is important to identify and describe them so that there is a basis for comparing child production with adult articulation of the signs. Therefore, a new handshape inventory was made for FinSL (Takkinen 2002).

In conclusion, children acquired the features of FinSL handshapes in a hierarchical order. This knowledge is useful at the theoretical level for discussions on markedness etc. as well as in research on acquisition, and for the assessment of language skills and language problems. In addition, the identification and presence of variation in the phonetic features of handshapes, in children and adults is an important topic for future research.

## 5. Critical evaluation of HamNoSys in the notation of handshapes

In earlier research with FinSL (Takkinen 1988,1990, 1994, 1995) a notation system very similar to the Stokoe notation was used. In the author's more recent research (Takkinen 2002, 2003), however, the finer phonetic features of handshapes were the focus. For that purpose a more detailed notation tool than the Stokoe notation was necessary. The HamNoSys notation system was chosen for transcribing the children's data because it was the most logical, systematic, and multi-faceted of the existing notation systems. Its design for use on the computer is also important. HamNoSys has a systematic way to represent handshapes with respect to selected fingers, degree of finger extension, and thumb position. This design is comparable to the use of the phonetic alphabet (IPA, International Phonetic alphabet) (e.g.Iivonen 1993; Vihman 1996) to study the phonetic development of hearing children acquiring a spoken language. HamNoSys provides the possibility of an accurate detailed description.

Using the HamNoSys system worked well in many respects in this recent study but some fundamental problems emerged. These will be discussed further in this section.

### 5.1 Status of the thumb

One of the issues on which the logic and clarity of the system breaks down is in relation to how the system deals with the status of the thumb. On the one hand, the thumb is regarded as a finger among other fingers and notated by number 1, on the other hand, its independent flexion is recognized and notated with special symbols. However, this does not provide accurate enough detail. The thumb can be described to be in four different positions:

1. in the rest position near the side of the index finger ()
2. spread to the side (  )
3. in the opposite position compared to the other fingers (  ),
4. on the other fingers which are closed (  ) or against the palm (  ).

The central problem with how the notation of the thumb is handled is that HamNoSys does not permit the flexion of the distal joints to be notated. For example it should be possible to differentiate the handshape consisting of a fist with the thumb beside the fingers and the distal joint flexed (Figure 2a) from the fist handshape in which the distal joint of the thumb is extended (in unopposed position) (Figure 2b). The latter handshape is often a phonetic variant of the handshape where the thumb is in lateral position (away from the other fingers) (Figure 2c), however, not always.

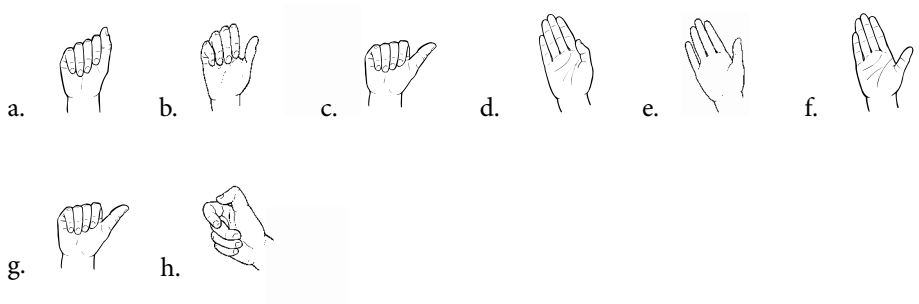



**Figure 2.** Different thumb positions

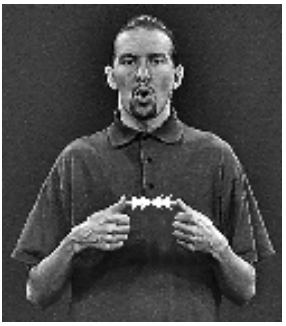


**Figure 3.** FinSL sign for BRIDE

They are distinctive in some signs, at least in stylistic meaning, for example in the FinSL signs BRIDE (handshape Figure 2b, sign Figure 3), HamNoSys cannot differentiate the handshape where the distal joint is extended but the thumb is not in lateral position. The same feature is involved in the handshape (☖). The system does not allow the separate notation of the joints of the thumb. It should be possible to distinguish the handshape in which the distal joint of the thumb is extended (Figure 2e) from the one where the distal joint is flexed (☖) (Figure 2d) and again from the handshape where the thumb is in lateral position (☖) (Figure 2f). Another example is the sign CIGARETTE-LIGHTER. There is a handshape change in the sign. In the 1st handshape both joints of the thumb are extended (Figure 2g), whereas in the 2nd handshape the distal joint is flexed (Figure 2h). A phonetic notation must make it possible to make these distinctions, not only for research purposes but for teaching a sign language as a first or second language.

### 5.2 Finger selection

HamNoSys is not systematic in the way it organises selected and unselected fingers. Handshapes are grouped as (1) fist handshapes, (2) flat hand handshapes,

(3) handshapes of individual fingers, (4) combinations of thumb opposition and fist handshapes as well as (5) combinations of thumb opposition and individual fingers (see Prillwitz et al. 1989). Selected fingers are, in general, extended or have different degrees of flexion, and unselected fingers are flexed in most handshapes. However, for example, in the handshape (  ) which in the HamNoSys classification belongs to Group 3 (handshapes with individual fingers), the unselected fingers are extended.. The handshape (  ) belongs, according to the HamNoSys classification, to the fist handshapes. However, the only difference between these two handshapes is the position of the unselected fingers; the selected fingers (the thumb and the index) are in the same configuration. In this example the presence of extended unselected fingers has resulted in a misclassification of the handshape.

Similarly, the notation of the handshape in which the selected index finger and the thumb are in fingertip contact and the unselected fingers are extended (  ) is quite different from the notation of the handshape (  ) in which the selected middle finger is flexed from the base joint and the unselected fingers are extended. This violates the logic of separating the selected and unselected fingers in the notation. Thus the classification is not always based on the same criterion, i.e., on selected fingers.

The classification of selected fingers is unsystematic in terms of the notation of the handshapes that occur in the ASL manual alphabet: for example the letters 't' (  ), 'n' (  ), and 'm' (  ). The notation does not consistently show which fingers are selected and uses the basic symbol that refers to the selection of none of the fingers (or all the fingers).

A single symbol to indicate three-digit selection, (either index, middle and ring finger, or middle, ring and little finger) is absent in HamNoSys. The notation is different when the selected fingers are spread (  ) and unspread (  ). This choice of notation confuses selected and unselected fingers. The symbol ( ) implies that the extended fingers are unselected and the little finger and the thumb are selected. This, however, is not the case. The notation (  ) is ambiguous because the handshape notation (  ) indicates that the four fingers are extended or flexed as a unit (four unspread fingers), but the notation (  ) tries to indicate that finger number 5 (little finger) is separate from the unit. To avoid this confusion, there should be a separate symbol for three-finger handshapes.

### 5.3 Finger extension

HamNoSys can record only three degrees of extension with respect to the rounding of fingers and notates them by using diacritic symbols; however, this is applied unsystematically. For marking the rounding of fingers, a diacritic symbol

( ⌒ ) is used. For example in the symbol ( ⌒ ) Figure 4b), the diacritic means that the thumb is in the unopposed position and the four fingers are rounded. The symbol ( ) (Figure 4e) refers to the same type of rounding but the thumb is opposed and in fingertip contact with the fingers. This contrasts with the symbol ( ) that refers to the handshape in which the fingers are more flexed and rounded than in the previous handshape. The symbol ( ) refers to the handshape in which the fingers are flexed to form a closed rounding (Figure 4d). However, the main purpose of the diacritic symbol ( ‾ ) in HamNoSys is to indicate flexion of the distal joints. It should also be possible to distinguish rounding where the distal joints are slightly rounded and the base joints are more rounded (Figure 4c) but this is not coded.

In my analysis of handshape acquisition these finely differentiated extension values are important in order to trace the development of features. Also in some FinSL signs, e.g., MILK and SAUSAGE, the phonetic description using only the one rounding specification ( ⌒ ) would be too imprecise (see Figure 1). Teaching of sign languages also requires a more accurate specification of signs with regard to this aspect. Students need to become conscious of the delicate degrees of flexion of the fingers.

As an additional point, the diacritic symbol ( ⌒ ) is used in different ways in the flat hand and individual finger specifications, and in the specification of combinations of the thumb opposition. For example rounding is different in the following specifications ( ⌒ ) and ( ): in the former it means a slight rounding of the distal and the base joints, and in the latter slight flexion of all joints.

A notation system needs to be able to distinguish different degrees of rounding: (1) a minute rounding of the fingers (the extension of the distal joints is slightly reduced) is found in some classifier handshapes (Figure 4a), (2) a handshape with rounding of the fingers (the flexion in distal joints and a extension of base joint are slightly reduced) (Figure 4b), (3) flat rounding of the fingers (extension of the distal joints and slightly reduced flexion of the base joint) (Figure 4c), and (4) closed rounding (flexion of all joints is slightly reduced) (Figure 4d).

An additional problem is the presentation of those non-linear finger arrangements that Johnson and Liddell (1996) call stacking (see Figure 5). It is impossible in HamNoSys to represent handshapes in which each finger, beginning with the thumb side (radial side), is successively more flexed than the previous finger.


**Figure 4.** Different degrees of rounding

**Figure 5.** Stacked finger arrangement

## 5.4 Orientation

The orientation of the (extended) fingers is represented in HamNoSys on three different planes: vertical (parallel to the body), horizontal, and diagonal (both with body referent). On the horizontal and diagonal planes a body referent symbol is used: (⍋) on the horizontal plane and (⍐) on the diagonal plane. This system is accurate and functions well. However, the system does not use the body referent symbols when notating palm orientation. Instead the symbols for vertical plane (parallel to body) are used. This is not a natural approach to the notation of the palm orientation. The creators of HamNoSys (Prillwitz et al. 1989:16) write:

> "Determining the palm orientation is a two-part process: first one must find and move the hand to the appropriate Basic Position, then choose the symbol which best describes palm orientation. The Basic Position of a sign is easily derived from its Extended Finger orientation."

There are two Basic Positions depending on the finger orientation of the sign: A (⍋) where the Extended Finger Orientation is away from the body, and B (⍒) where the Extended Finger Orientation is towards the body. This two-part process is not easy to explain to learners, and an extra mental process must be carried out to read the notation. This two-part process could be avoided by using the body referent symbol together with the symbol indicating palm orientation. The body referent symbol could be used with the palm orientation on the horizontal and diagonal plane just as for finger orientation. I have used this convention with students when notating signs by hand and they have found it easier in this way to learn how to notate both the finger and palm orientation of the hands in signs, as both the notation and reading of notation is less complex. This option should be included in the computer version of HamNoSys.

## 5.5 Movement

Movement is the most complex parameter to transcribe and in the beginning it is useful to restrict the amount of specification, for example with respect to the manner of movement. Straight movement is recorded in the same fashion as for finger

orientation using the body referent symbols when the movement is away from or towards the body (e.g., ↑ ↘ ↙ ↓). Circular movement is also coded with the body referent symbol. However, this symbol is not used when notating curved movements. As with palm orientation, the notation of direction of the curve requires a two-part process. In HamNoSys there are four symbols for curved movement, and even for the main direction on the three planes you would need 12. The use of the body referent symbol would avoid a two-part process to describe direction for curved movements. Therefore I would also suggest the use of the body referent symbol with the curved movement symbols. It has proved easy to notate and read the notation, if the body referent is used with the symbol for curved movement. The notation of location is accurate and has not caused any special problems in the recording of basic forms.

## 6. Conclusion and Discussion

In the context of investigating children's signing the HamNoSys notation was used. This paper has discussed some problems encountered during the use of the notation system and some proposals for improvement have been made. There were problems with handshape notation: the lack of specification of the thumb extension values; insufficient number of values of finger extension (rounding); inconsistent use of the diacritic symbol for rounding. Any means to specify 'stacking' is also totally absent from this system. Further problems were observed in relation to the convention of using the body referent symbol in notating palm orientation as well as for the specification of curved movements. An additional technical problem is that HamNoSys does not function well on PCs. It is difficult for researchers to communicate information in HamNoSys across different operating systems as the fonts differ slightly. In addition, there are problems in using HamNoSys in newer operating systems. These technical problems need to be solved for files with HamNoSys to be transmitted easily.

It is quite clear, however, that HamNoSys is much more accurate in notating signs than those systems (e.g., Stokoe et al.1976) created when sign language research first began. When notation systems are created a balance has to be found between, on the one hand, the affordances of the system for accuracy and, on the other hand, economy. It is important to create a system that is accurate enough for most purposes but not too cumbersome to use.[2] In order to improve economy it

2. The problem of developing a widespread notation system for sign languages has also been discussed by Miller in *Sign Language & Linguistics 4:1/2* (2001). This special volume concentrates on presenting databases and sign notation systems in current use.

might be possible to introduce different levels of complexity of the notation related to users' different research goals. Such different versions should, nevertheless, be consistent in terms of the basic principles and criteria for notating in HamNoSys. The HamNoSys Guide should also be more accurate, and include more examples of notated signs. The Guide should be updated to correspond with new versions of the transcription system.

The HamNoSys notation is a useful tool, and could be even more so if revised with respect to the notation of the basic (phonetic) structure of signs. This would be valuable in research on variation in adults as well as in children. A writing system is also useful in instructional settings in order to demonstrate how signs are composed. HamNoSys could be used in dictionaries of sign languages in order to illustrate the articulation of signs (see Johnston 1998). To a limited extent, HamNoSys can also be used to write down signs in a classroom situation, especially, when studying the basic structure of signs.

It would certainly be useful if HamNoSys were more widely used by sign linguists. There is a need to have a common tool for the notation of the structure of signs in any sign language to enable researchers to discuss sign structure and variation accurately.

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# Transcription of child sign language

## A focus on narrative*

Gary Morgan
City University, London

This paper describes some general difficulties in analysing child sign language data with an emphasis on the process of transcription. The particular issue of capturing how signers encode simultaneity in narrative is discussed.

**Keywords:** sign language acquisition, transcription, narratives

### 1. Introduction

The study of child sign language has emerged from the growing interest in cross-linguistic comparisons of language development, stimulated greatly by the early work on American Sign Language (ASL) (e.g. Newport & Meier 1986). However the modality in which sign language is produced has made it difficult to compare sign languages with each other because of a lack of an agreed normative transcription system to represent child forms of sign languages, articulated through movements of the hands, arms, body and face. Progress has also been hampered by the difficulty in storing transcribed sign data in a format which permits computer-based searches. Despite these early challenges, current research findings on child sign language acquisition are greatly contributing to the study of language acquisition (see Morgan & Woll, 2002, and this volume). This paper outlines some issues in studying child sign language at the level of transcription.

* Parts of this research were presented at the 'Intersign' meeting on Child Sign Language (September 1999) at City University, London and the Linguistics Association of Great Britain meeting (April 2002). An earlier version of this paper appeared as Morgan (2003). The transcription system presented has been the result of discussion with several colleagues. I would like to thank in particular Bencie Woll, Judy Kegl, Elena Pizzuto, Beppie van den Bogaerde, Maria Sidonio Armas Pais and Jim Kyle. I would also like to thank Anne Baker for comments on this paper.

A transcription system can only record selected aspects of the language under study. This is equally true for speech and for sign (Pizzuto & Pietrandrea, 2001). Transcription allows us to capture in a static form one piece of the linguistic puzzle for later coding and analysis. The choice of transcription system used will depend on the specific research question asked. The transcription system adopted will mould the sign language data into a shape that is more accessible; in other words the transcription is not the same as the raw data (see papers in the special issue of *Sign Language and Linguistics* — Bergman, Boyes-Braem, Hanke & Pizzuto 2001).

In much child and adult sign language research there are striking differences between the written transcriptions provided by different authors. Depending on the level of analysis focused on, transcription may include a representation of the sign's form, information on accompanying nonmanual features, and use of sign space. Apart from some standard notation devices such as linked spoken language translations (glosses) and markers of sign modifications (e.g. '+' to mark repetition of a whole sign, or sub- and super-scripts to show agreement relations (diacritics)), very little direct comparison between sign languages is possible based on the written transcription alone. Hoiting and Slobin make these two important points:

> '…a mixed system of glosses and diacritics is inaccessible to computer programs of the sort used in child language research. More seriously, the glosses represent the nearest translation equivalent in the spoken language of the particular community, making it impossible to carry out serious linguistic analysis of the sign language itself.' (Hoiting & Slobin, 2002, p60)

This comment sets the goals for sign language transcription, and as a consequence for child sign language research. A good transcription system should allow researchers to do two main things:

1. Exploit computer technologies for searching and collating coded utterances
2. Share transcribed examples with other scholars working on similar questions both in signed and spoken language.

As an example of how a computer-archived normative transcription system can stimulate research, consider the advances that have been made since the advent of CHILDES (MacWhinney 2000; http://childes.psy.cmu.edu/). Hoiting, Slobin and colleagues, in response to the observed shortcomings of current sign language transcription, have proposed a CHILDES-compatible transcription system to represent sign language morphology (Slobin et al. 2001).[1]

1. This paper focuses on transcription. For a more general discussion of the collection and analysis of child sign language data, see Baker, van den Bogaerde & Woll (this volume).

The structure of the paper is the following: first some special issues relating to child sign language research are reviewed including how child 'errors' are transcribed. I then describe recent work on sign language narrative development and how reference and space are coded and transcribed for in this genre. Limitations of the 'dynamic transcription system' are discussed in the final section.

## 2. The challenge of transcribing children's signing

When an adult sign is transcribed, at least five parameters (handshape, location, movement, palm orientation and facial action) can be recorded, using one of several transcription systems (see Bergman et al. 2001; Takkinen this volume). One of the most popular ways of representing a sign on paper is Stokoe notation (Stokoe 1960) or later modifications (e.g. Brennan et al. 1984). This system works well for presenting the general structure of single lexical signs. Stokoe's system is a notation system rather than a phonological transcription. For example, one of the BSL signs for DOG in Stokoe transcription would be represented as (Fig. 1).

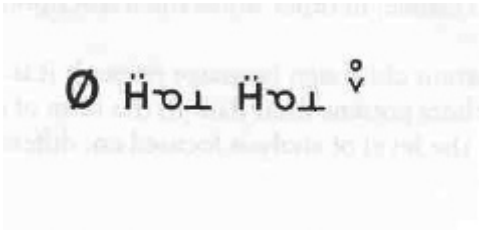


**Figure 1.** BSL sign DOG in a variant of Stokoe notation

This represents the sign's citation form. Underspecification begins with the symbol for location (Ø), which indicates the sign is produced in neutral sign space, that is, in front of the signer's body. Problems arise when it is necessary to transcribe the same sign in connected discourse in the presence of co-articulation. The citation forms of signs are modified in the context of normal communication and the researcher may wish to describe this phonetic modification (see Takkinen, this volume). Furthermore, in acquisition studies, a researcher may wish to note how the citation form of a sign might be produced in a radically different manner as a result of immature development.

Children modify sign forms as they acquire them. The suggested constraints responsible for some of these modifications have been a strong source of evidence for the analysis of signs at the phonological level (e.g. Bonvillian & Siedlecki 1996; Van der Hulst 1996). Young children systematically modify all parameters: handshape, movement, location, hand orientation and facial actions accompanying signs, so

that these differ in form from those produced by adults in the input the children receive. These differences in production are resolved as children grow older.

Some of the features of children's signing that make phonological and morphological transcription difficult relate to the 'phonetic' properties of sign languages: the production of signs through movements of hands, arms and faces. Children have poorer motor control than adults and as a result, a sign or sequence of signs may be produced with extensive changes. For example:

1. Two handed signs may be produced with one hand
2. One handed signs may be produced with two hands
3. Parts of signs may be omitted as they are co-articulated with the next sign in a sequence
4. Manual and non-manual features may be interspersed with general facial, head and body movements

Young children before the age of 3 years, as well as having immature phonetic and phonological development, lack pragmatic knowledge. For example, while signing they may move around, pick objects up, look away from the addressee, or produce signs in locations where they cannot be seen by the conversational partner, for example in the corner of a doll's house ( Baker & van den Bogaerde 2005).

If the researcher is concerned with sign phonology, it will be important to record all phonetic modifications from the adult form in order to explore developmental patterns such as consonant harmony, reduction, assimilation or substitution (Morgan 2006). If the research is concerned with how the child productively uses sign and meaning combinations, then such phonetic detail is superfluous, and English glosses of the child's intended meaning may suffice e.g. DOG MEAT EAT 'Dogs eat meat'. The gloss 'dog' does not encode that e.g. across five tokens the sign was produced differently each time, nor whether there was any developmental progression towards the adult target phonological form across these five instances, but this would not be required for a study of semantic development.

Elaborate transcription methods, such as those referred to above, are in use, but these may be specific to a single research group, not suitable for storage in a database or not amenable to computer search algorithms. As an alternative, in presenting the results of research, many researchers provide line drawings, photos, and computer models of child sign forms or accompany glosses with stylised versions of the signs' movement (see papers in Bergman et al. 2001).[2]

2. It should, however, be noted that there are issues about informant confidentiality when images of children are used (see Baker, Van den Bogaerde & Woll, this volume).

An example of the acquisition of verb agreement morphology in sign languages will illustrate some of the difficulties. Verb agreement morphology involves the movement of a sign between indexed locations in sign space to indicate the subject and object of a verb phrase. Transcription requires the capture of this movement in a static visual form. The exact area of sign space in which the sign moves cannot be captured unless exact map co-ordinates are used; instead most researchers mark the movement with a subscript which indicates only that there was movement between two locations., for example, a glossed verb with diacritics: $_1$GIVE$_2$ 'I give you'. The diacritics refer to person agreement — the verb GIVE moved from the first person location (the signer's own chest) towards the second person location (the addressee). If our research question concerns which category of person agreement morphology emerges first in children's signing (1st person to 2nd person or another combination), this transcription will serve our purposes. This gloss is, however, highly abstracted from the data: it does not tell us what the sign looked like, what the movement looked like and if there were any deviations made by the child from the target adult model. We do not know with this gloss what morphemic structure the sign has; as Hoiting & Slobin (2002) pointed out, we are influenced by the meaning of the English gloss. The gloss does not tell us what part of the sign represents the inflection used for person agreement. This example illustrates again the need for the type of transcription used, to be determined by the research question.

The type of transcription must also be matched to the type of data collected. Data can be naturalistic or elicited; spontaneous conversation or narrative. Different data types present different problems for transcription, since different structures may predominate in different types of data. In the following section narratives and the problems they pose for transcription will be considered in more detail.

## 3. Transcribing BSL narrative devices

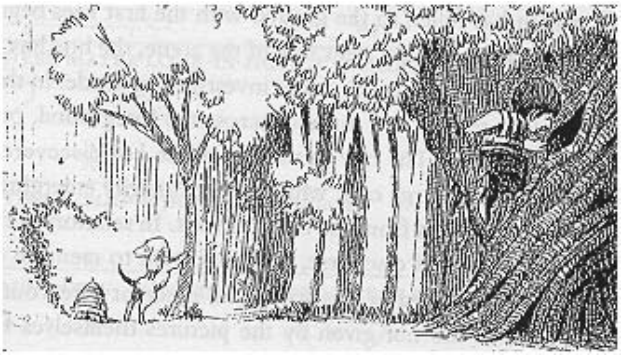
When transcribing signed narratives, the transcription system has to capture glosses of signs at the level of sign meaning, information about sign forms, nonmanual features and also a record of the locations to which different spatial forms are directed through referential devices (e.g. Friedman 1975; Johnston 1991; Engberg-Pedersen 1994; Liddell 1995).

Languages have different linguistic resources for selecting and handling how people and objects are related in sentences and discourse. References to people in English, for example can be through noun phrases — 'the boy'; pronouns — 'he'; or through a verb phrase that relies on a previous overt mention of the referent —

'the boy saw the beehive, then **climbed** up the tree'. In sign languages reference is encoded through grammatical markers that function via agreement with locations in space. BSL, like many other sign languages, uses space to tie pronouns and noun phrases to their dependent referents and verb arguments, thereby indicating who did what to whom (Sutton-Spence & Woll. 1999).

In narrative the sign space is used and reused for referent locations which may continually change during the telling of a story. The ability of the transcription to capture the transitions between different uses of sign space is important when looking at how reference to people and locations are articulated in narrative. One such device is the establishment of overlapping representational spaces to indicate simultaneity. Morgan (1999) describes adult use of sign space in BSL for retelling 'Frog Story' narratives (Mayer 1987). In one particular episode of the Frog Story, simultaneous events occur in the same picture (see pictures 1 and 2 in Figure 2). The boy is searching for his frog in a tree and the dog has upset a beehive in picture 1, and in picture 2 the boy falls out of the tree frightened by the owl that appears while the dog is being chased by the bees. Adult signers normally narrate these events by setting up several interlinked sign spaces in quick succession.

Picture 1



Picture 2

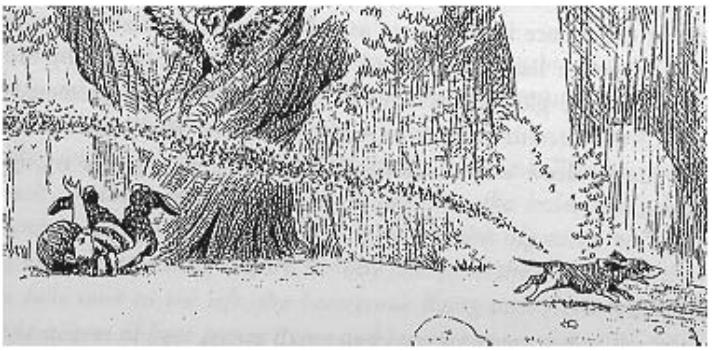


**Figure 2.** Illustrations from *Frog, where are you?* @ Mayer 1987

The encoding of simultaneity in discourse, that is, when two events happen at the same time, reveals the complexity of using sign space (see Morgan 2002). A method for recording this use of sign space, which I call 'Dynamic Space Transcription', has been developed recently (see Morgan 1999, 2002 but also Liddell 1995). Signed discourse viewed in this way consists of a set of overlapping representational spaces. The system is schematised in Figure 3.

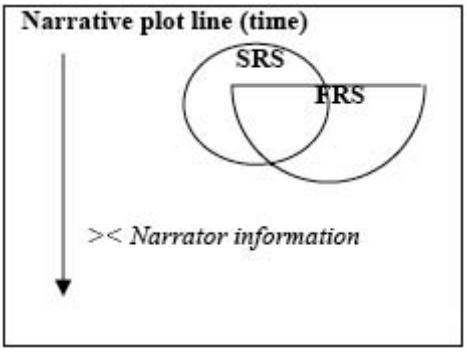



**Figure 3.** Interactions and use of space in narrative

The box in Figure 3 represents the narrative as a whole. Within the narrative, the the plot line is represented by the direction of the arrow. In characterising narrative discourse I have described two different uses of space: for locating referents in a kind of fixed template (Fixed Referential Space (FRS)) and 'role shift' for describing referents from a movable first person perspective (Shifted Referential Space (SRS)) (see Morgan 1999, 2002 for a fuller description of the SRS and FRS). The FRS and SRS can directly map how the signer used sign space, with individual reference forms placed within these two spaces. Included alongside the time line are any discourse markers provided by the narrator to assist in interpretation of the use of sign space (glossed ><). To illustrate how this approach works, consider the sign utterance in (1) (see appendix for explanation of symbols used here and in later examples).

(1) DOG JUMP-UP++ TRY CATCH-HIVE FALL BOY NO-SEE £ LOOK-RIGHT-SHOCKED
'…the dog is jumping up and down again and again, trying to get to the hive hanging from the tree. When it falls onto the ground, the boy, as he didn't see what happened, turns around shocked…'

This part of the Frog Story involves the signer establishing the areas of sign space that will be used to move between the boy and the dog. A fuller gloss captures some of the use of non-manual markers, especially eyegaze and the direction of verb movements in the SRS.

(2) -- ^^ ><

_____ _____ _____

// £ DOG JUMP-UP++ TRY CATCH-HIVE FALL

<<

_____ _____

BOY NO-SEE £ LOOK-RIGHT-SHOCKED

The interaction between sign spaces is not evident in this form of transcription. If we take the sign space out of the transcription and represent it as a dynamic space transcription, interpretation becomes clearer. This is shown in Figure 4.

The movement to the first use of role shift in the SRS occurs when the dog's actions are being described and involves moving the dog to the right of sign space, resulting in an exchange of the two SRS's. This involves a reversal in perspective as the boy's perspective exchanges with that of the dog. The adult signer uses noun phrases to make sure the identity of the SRS's are clear. Once this has been established, the signer uses no further overt identification of BOY. Additional information for interpreting these switches in perspective and sign space is supplied by eyegaze towards the addressee. Eyegaze functions in these kinds of texts as a signal to 'pay attention' as well as being a means of checking for understanding. In young signers (before 5–6 years) these looks to the addressee are absent for the most part. Children both in sign and spoken languages may begin to tell stories assuming that their addressees have full access to the identities of referents (Hickman, Kail & Roland, 1996). Through the school-age years children develop the

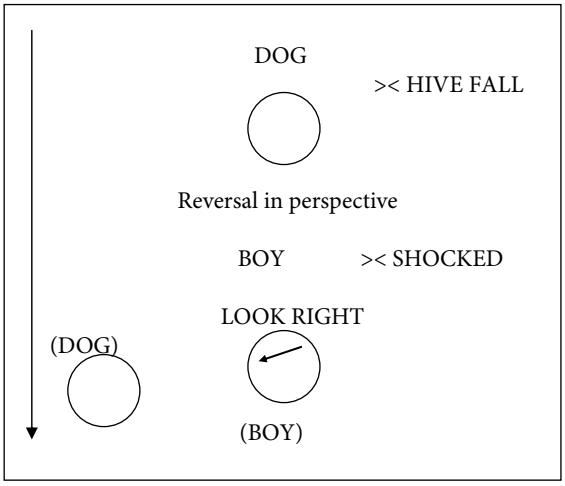



**Figure 4.** An illustration of the dynamic space

pragmatic abilities to enable them to take into consideration other perspectives (see Morgan 2005).

Some work on children's use of simultaneity in BSL narratives has suggested that initially children cannot handle overlapped referential spaces but instead explain what happened to each character, e.g. the actions of the boy and the frog are presented in a linear sequence. This strategy although it does provide information, fails to 'package' both events in the same time-frame (see Morgan 2002, 2005).

This very short piece of signed discourse presents us with many layers of meaning, each of which is required for a full understanding of reference across the discourse. In transcribing these different elements of the story expressed through noun phrases, pronouns, classifiers and role-shift, the real challenge is to show how they are all linked.

## 4. Limitations of the transcription system and future directions

As has become apparent in the discussion of narratives (Section 3), the transcription of signed language is inherently difficult because of the representation is static and does not capture the dynamic nature of the language. However, focusing on uses of the FRS and SRS can permit us to begin to describe the use of sign space in BSL.

Once the transcription assists us to demonstrate how sign space is used and re-used in sign language discourse, we can then move on to look at how children develop the ability to organize and manage this complex level of signing in their narratives.

The use of dynamic space transcription reveals some of the complex transitions that take place in discourse. A major aim for the future is to animate the dynamic space transcription to capture some of the most exciting features of the sign language modality.

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## Appendix. Notation devices used

### *Glosses*

LITTLE-GIRL = approximate English gloss of signs. Where more than one English word is required this is indicated through a hyphenated gloss

t-o-m = fingerspelling

'*…the little girl…*' = English translation, where '…' indicates it is taken from a larger piece of discourse

### *Movement of signs in sign space*

 = from right

 = across body

 = towards body

 = right + up

 = left + down

### *Eyegaze*

SEARCH = scope of eyegaze
>< = mutual
-- = neutral
<< = right
>> = left
W = down
M = up
θθ = closed
<v = down + right
^> = up + left

*Other symbols used*

// = pause
£ = shifted first person
++ = repeated sign for grammatical purposes
CL- = classifier sign
pl- = pluralisation marker
$_{123}$ = syntactic indices

# Adult–child interaction in a BSL nursery — getting their attention!*

Sandra Smith and Rachel Sutton-Spence
Centre for Deaf Studies, University of Bristol

This paper reports on attention-getting strategies during adult–child interaction in a BSL-language nursery. The data come from a small study conducted at the School of Education at Leeds University, in which deaf children in a Deaf nursery run by Deaf adults were filmed. Deaf adults and deaf children both used waving and tapping to gain attention. Deaf adults used waving strategies more than the children did, while the children used more tapping strategies than the adults did. Additional ways of seeking attention and a range of different types of tapping and waving were identified, providing insights into the different uses of waving and the tapping in different situations. Findings also revealed possible developmental stages in attention-seeking.

## 1. Introduction

The research reported here is concerned with attention-getting strategies of Deaf adults and deaf children of nursery age within a nursery setting. It was carried out at the Deaf nursery, a BSL-language nursery run by the School of Education at Leeds University. The project was planned as a pilot study to prepare for a larger study of deaf children's language development within a signing nursery environment. Unfortunately the nursery closed before the larger project could be conducted. Nevertheless, the data collected in the small study provide a wealth of information about the attention-getting strategies used in such an environment. At the start of the research, strategies for gaining attention were expected to be simply a matter of tapping or waving but the data reveal a much more complex set of systems. The

* The research was carried out by the first author while she was at the University of Leeds, working in collaboration with Pam Knight. It was funded in 1995 by the Academic Development Committee of Leeds University. We would like to thank Anne Baker and Bencie Woll for their helpful comments on this paper.

methods used by the children and the adults to gain eye contact prior to communication are determined by a complex set of variables. These include who is trying to attract the attention of whom, for what purpose and in what situation.

Previous research and anecdotal evidence both suggest that hearing adults find it more difficult to get and keep a deaf child's attention than do Deaf adults (e.g. Harris & Mohay 1997, Waxman & Spencer 1997). It has often been claimed that some hearing teachers find it difficult to achieve and maintain eye contact in a group of deaf children, and yet some Deaf teachers are able to do this with apparent ease. This paper describes some of the strategies Deaf adults used with the children.

## 2. Aims of the research

The broad aim of the study was to consider how the provision of a BSL-language nursery could enhance the linguistic experiences of deaf children, and to extend these findings to assist all adults working with deaf children. The specific goal of the work reported here was to find out more about attention-getting strategies such as waving and tapping and how the different adult strategies influenced the children's behavior. Specific questions about attention-getting devices included:

- What strategies are used by adults to attract the children's attention?
- What strategies are used by children to attract the adults' attention?
- Are there rules which govern which strategy is used and when?
- Are attention-getting strategies related to the linguistic development of the individual child?

It is essential in studying the social, behavioral and linguistic development of deaf children to understand the use of attention-getting strategies. It has become very clear from the data to be discussed here that the strategies are not randomly selected, but that Deaf adults select their strategies according to the language skills of the child and the reason for requesting the child's attention. Children need to learn the function of different strategies and when it is appropriate to use them. Where children used incorrect strategies the Deaf adults in the nursery corrected them.

Before we describe the wide range and function of attention-getting devices used in the nursery, we will briefly review literature on attention-getting strategies in sign language conversations.

## 3. Attention-getting strategies

### 3.1 Attention-getting strategies used among Deaf adults

There are a number of studies concerned with attention-getting and turn-taking strategies of both Deaf adults and deaf children. As Baker and Cokely (1980) remark, in describing the more common conversation regulators used in ASL, one of the measurements of signers' communicative competence is how well they can participate in a conversation. Baker and Cokely describe adult conversation in ASL, noting that communication cannot take place unless the addressee is watching.[1] In order to get the addressee's attention a signer may use either visual or tactile initiation regulators. Visual initiation regulators, usually a sharp movement of the hand, can be used where the signer is in the addressee's line of sight. If the signer is not in the addressee's line of sight but is within peripheral vision, the signer can move the hands into the addressee's field of vision. Baker and Cokely also note that when signers move their hands into another signer's signing space, this indicates the wish to take a turn in signing. The most common means of attracting attention when the hands are within the other person's signing space is by waving the hand within the potential addressee's line of vision. Where the signer is completely out of the addressee's line of vision, a tactile initiation regulator is used. Baker and Cokely say that the signer may "lightly touch" the addressee's arm. They give no further description of how an adult may seek attention through touch.

Mather (1996) observed attention-getting strategies that teachers used with children. She focused especially on the role of visual and tactile initiators used by teachers within ASL narratives. Before describing her research findings, she describes some general variations in what she calls, "tap or flap" initiation regulators. She observes that physical contact is not always used as an attention-getting device to allow communication to commence. Referring to Baer (1991), Mather (1996: 115) notes that tapping on top of someone's shoulder is a request for eye contact but tapping the side of the shoulder is a request for someone to move and eye contact is not expected. Among adults, a sharp tap on the shoulder indicates anger and that the initiator demands the addressee's attention immediately. Repeated, quick tapping indicates a sense of urgency or excitement on the part of the initiator. These various tactile initiators, however, are described as only occurring on

1. Nowell (1989) and Coates & Sutton-Spence (2001), however, have observed that signing may still occur in informal groups of conversing friends when the addressees are not looking at the signer. When this happens, it is not for the sake of communication but rather for the benefit of the signer who wishes to participate in the construction of the conversation. Van den Bogaerde (2000) has also observed that a mother will sign to a young child who is not directly looking at her in order to induce the child to look at her while she is signing.

the shoulder. In the narratives that Mather analyzed, waving, sharp tapping and pushing were all found, although the last of these was only used *in extremis* where a character in the story was becoming very angry and pushed the other character in order to get his attention.

Coates and Sutton-Spence (2001) have described a variety of methods of visual and tactile initiation within group conversation among adult friends using BSL. Tapping (both on the arm and the leg) and waving were observed as frequent turn-taking initiators by signers self-selecting for the next turn in the conversation. A much more common self-selection procedure, however, was to begin to sign, in the expectation that the others in the group would see this in peripheral vision or notice the directed attention of other members of the group and so turn their own gaze that way. This happened frequently, both at the end of another signer's turn and during another signer's utterance. There was no other overt signaling for attention before starting to sign.

Having started to sign without getting attention, signers would then repeat what they had just signed after getting the others' attention. In Example 1 the sign MONEY is repeated several times.

(1) A: HORRIBLE-PICTURE. OOH.
B: MONEY MONEY. I HEAR IT'S MONEY
C: NOT-MARRIED

Signers in this setting of a conversation between friends would also frequently begin to articulate a sign and then hold it until everyone attended before continuing. This happened even while someone else was signing, as if "booking a place" for the next turn when a transition relevant point would be available. Alternatively the first sign was articulated for longer and out of the normal signing space in a location that all participants could see. Once the right to the floor had been established, the signing returned to its normal size and space.

Where attention-getting strategies are found in small groups of mature signers, they need to be learned and used skillfully in order to allow smooth-flowing conversation. Where turn-taking is visually regulated, the tightly-governed behavior described by Baker and Cokely (1980) can be relaxed in casual adult conversation. If young children are to become skilled sign language conversationalists they need to learn the rules for attention-getting and initiating signing.

The published research described so far describes only a few tactile and visual initiation regulators and much is related to signers with some degree of linguistic and social maturity. However, there has also been research on the use of attention-getting strategies used by mothers with deaf children who are learning basic linguistic and social codes of behavior.

### 3.2 Attention strategies used with young children

When children are very young, they tend to engage in long periods of mutual eyegaze with their primary caregivers (in the research summarized below, these are always the mothers). However, as children develop, they need to look at other objects in the world, as well as at their caregivers. Waxman and Spencer (1997) point out that children's learning to divide their attention systematically between objects and "social partners" is an important developmental milestone. This is especially important for deaf children, so that they can receive language input about the objects in their world.

Harris and Mohay (1997) analyzed switches in attention by deaf children who were 18 months old. They divided these switches into categories according to whether the child spontaneously looked at the mother ("spontaneous"), the child responded to an action by the mother ("responsive") or the mother attempted to get the child's attention directly ("elicited"). The elicited switches in attention are of particular interest in the research to be presented here.

Within the category of "elicited" events, Harris and Mohay found the following subcategories:

- Making physical contact with the child (e.g. tapping the child on arm or bottom or touching on the shoulder)
- Moving hands or body (e.g. waving the hand)
- Moving an object (e.g. holding a toy close to the child's face)
- Making a sound (e.g. calling the child by name)
- Making a vibration (e.g. banging the hand on paper).

These "elicited" subcategories are similar to the ones found in the BSL nursery, but Harris & Mohay were primarily interested in comparing the use of the three main categories, and not in the details of the subcategories. The research reported here explores these sub-categories in more detail. Waxman and Spencer (1997) also looked at mothers' communicative strategies used to reinforce the visual attention of infants between the ages of 9 months and 18 months. They produced categories for redirecting an infant's attention, which are quite similar to those used by Harris and Mohay (1997).

- Presenting an object (e.g. moving or shaking and object)
- Tapping or pointing to an object
- Tapping on the infant's body
- Waving a hand in the infant's line of vision
- Tapping on the floor

Van den Bogaerde (2000) distinguishes "non-explicit" attentional strategies (where the mother does not manipulate the child's attention) from "explicit" attentional strategies (where the mother does actively seek the child's attention or eyegaze.)

In her description of explicit strategies, she details many of those described by Harris & Mohay (1997) and Waxman & Spencer (1997). However, she also reports that the mother could adjust the position of the child to gain the child's attention.

Baker and Van den Bogaerde (2005) also observed a similar range of attention-getting devices. They studied the turn-taking of a mother–child pair when the child was aged 2;0 to 3;6, finding that visual attention at the start of a turn (which would correspond with instances of successful attention-getting) steadily increased over this period, with the child's skills improving both in directing his attention to his mother for her utterances and seeking the mother's attention before signing. All the research described here identifies the basic attentional strategies used by mothers with their deaf children. In the two 1997 studies, the children were aged up to 18 months; Van den Bogaerde's (2000) study covered a longitudinal range from one to three years. Only in the study by Baker and Van den Bogaerde (2005) was the child as old as 3;6. The research in the study reported here concerns signers from three years of age who are interacting with adults other than their mothers. It also describes the varying strategies in more detail, demonstrating a more complex and subtle set of strategies than has been reported previously.

## 4. Methodology

### 4.1 Subjects and setting

The study was carried out in 1994 in a nursery set up by the University of Leeds especially for the purpose of educational research. This was a "Deaf" nursery, in which staff and children were all deaf, and BSL was the language of communication. Leeds Education services supported a bilingual education policy, where all deaf children aged 3–5 years attended the Deaf nursery once a week. Children could attend morning (10.00 or 10.30 a.m. to 12.00) or afternoon sessions (1.00 to 2.30 p.m.) or they could attend for a whole day. We studied seven children who attended the nursery for the full day sessions and three children who attended half days. The number of children in any observation session varied through the free play activities of the nursery. At lunch time all children were involved, although even there, the number of children observed varied depending on attendance patterns. For example in one session eight children, including one part timer, were filmed, while at the next session there were seven children, of whom six were full time and one was a part timer (a different child from the part-timer in the first session).

The children came from a variety of different family backgrounds, some with home languages other than English. All children had hearing parents, except for one child, who had a hard-of-hearing mother and hearing father. The service for deaf and hard of hearing children provided parents with signing in their homes as soon as their child was diagnosed. The extended family was sometimes involved in learning sign language, although the parents' communication skills varied. The children's language skills also varied but as there was no formal assessment of their language ability at the nursery, it is not possible to comment accurately on their skills. The dialogues filmed for this study show that the language skills in the children ranged from those who had only a small BSL vocabulary to those whose signing was comparable to that of a native signing 5 year old deaf child. The nursery was staffed by two Deaf adults and one hearing adult (this person was not actively involved with the children but was present in case of situations where communication was needed with adults outside the nursery or with parents who had little or no signing skills).

There was no formal teaching in the nursery and children were free to play in various areas, described below. For certain activities such as "cooking" (e.g. making pudding) the children were all invited to come and watch and get involved. Eight children were involved in this session. However, this was not compulsory and if a child chose to continue playing alone, this was allowed. The main aim of the nursery was to provide linguistic and social input for the children and the staff took care to provide language input matched to the children's different abilities.

### **4.2** Data collection

Data were collected over 12 nursery sessions and came from video recordings made with two wall-mounted cameras in the nursery. The researchers were hidden behind a one-way mirror in a control room from which they could switch between the two cameras to record activities in different areas. The children were not aware of the presence of the cameras or the researchers. This avoided any disruption to the dynamics of the group.

Interaction between the children and the adults was recorded in three different activity areas in the BSL nursery. The three activity areas were: -

1. *The home corner* (four extracts)
   This provided settings for different types of role play including a kitchen, an office and on one occasion the setting and props for the dramatization of the story of Little Red Riding Hood.
2. *Lunchtime* (four extracts)
   The focus of lunchtime was on the development of appropriate social and linguistic skills in an everyday social context.

3. *The play area* (four extracts)
   This included activities such as painting with an adult, water play, free play, "cooking" or making cards or hats. We will focus here on "Water play" (one extract and "Cooking" (one extract).

## 4.3 Interaction Styles in the Different Nursery Areas

### 4.3.1 *The home corner*

As described above, four examples of interaction in the home corner were recorded. One of these was based on the story of Little Red Riding Hood. The story was told and acted out beforehand by the adults and then the children were asked to re-tell the story with support. The children were not engaging in free play in this situation but were required to follow the story as far as possible. In another extract the home corner became an office where children could engage in free role-play. The children were able to choose how to interact with the setting. Some children became office workers and started typing, taking telephone calls and writing things down. Others treated the area as a shop, selling office equipment such as paper and pens. Thus, children used the same area to explore and express their imagination through role-play in very individual ways.

The four activities filmed in the role-play area provided very different data. The children's interpretation of the settings, the linguistic opportunities presented by each setting and the individual language abilities of the children were all different. In the home corner setting, the children with less well-developed language skills tended to spend more time pretending to cook and make tea. Those with more developed language skills engaged in more complex and interactive imaginative play such as summoning the fire brigade to put out a fire in the kitchen or dealing with problems such as a crying baby or food spilled on the floor. The role-play setting for Little Red Riding Hood made quite different language demands on the children. They found the required expressive language difficult and also found it hard to remember the story, so they needed the Deaf adult to guide them. This had important implications for the use of attention-getting devices (see 5.2).

Interaction in the home corner was mostly child-oriented in that the role-play generated was essentially created by the children even though the adults gave input of significant new items of vocabulary or language as appropriate. The children who chose to play in the home corner typically had better language skills than other children did and this was reflected in their use of attention-getting strategies.

### 4.3.2 *Lunchtime*

Lunchtime was an important part of the nursery day. Children were involved in reorganizing the nursery for lunchtime, setting the table and clearing away. They

brought their own lunches and ate alongside the adult staff. This provided an opportunity for the children to develop independence skills, observe the social conventions of a mealtime, and interact with the group in a family-like setting.

The two adults took different roles, but the way in which the two adults worked together in the shared supervision of the children was central to the success of the lunchtime session. The adults were aware of the children's language abilities and so were able to modify their language use to match the language abilities of each individual child.

### 4.3.3 *The play area*

Interaction and communication in this area were generally different from those in the other areas because the children's hands were occupied when in the water or when cooking, in contrast to the home corner and lunchtime, where there was more signing in the conversation. In water activities there was much more non-manual description of what was happening in the water, predominantly using facial expression and BSL mouth patterns (also termed "mouth gestures", see Boyes Braem & Sutton-Spence, 2001, and Sutton-Spence and Woll, 1999 for the linguistic function of mouth gestures).[2]

"Cooking" was not a normal weekly event, and it occurred only once during the period of study. The Deaf adult involved the children in clearing up before the start of the "Cooking" session. The session was managed by one adult with a group of eight children (while the other Deaf adult continued playing with the remaining children who did not want to be involved).

## 4.4 Analysis

The first five minutes of each activity recorded were analyzed to identify the ways in which attention was sought by adults (adult to child) and children (child to adult and child to child) through tapping, waving or other means. The term "wave" is defined as the extension and flexion of the wrist, while the hand is in a loosely held **B** handshape, palm down, fingertips towards the addressee. This is found when a person "waves" to another person who is out of reach. The term "tap" is used for a variety of different movements. In a "prod" the fingertips of a **B** hand contact the addressee's body. In a "pat" the flat surface of the fingers contacts the addressee. Both the "prod" and the "pat" are considered to be types of "tap". Taps usually occur when the person is near enough for the child or adult to touch.

2. See Van den Bogaerde and Baker (this volume) and Baker & Van den Bogaerde (2008) for a discussion of code-mixing in deaf adults and children.

A list of waves and taps used by both adult and children was created, defining each one in terms of what happened at the point of gaining attention. Each occurrence of the different strategies was noted for the adults and children. In our analysis of these strategies we attempted to distinguish between attention-getting for the purpose of linguistic interaction and attention-getting for the purpose of behavior modification. In addition, some of the variation in attention-getting strategies is due to accommodation to the physical environment. For example, if a signer has wet hands, tapping is more appropriate than waving. Some variation is caused by the reason for the request for attention. For example, tapping may be sharp to gain attention quickly, or soft to request eye contact because the adult wants the child to stop what he/she is doing (used, for example, with a child with very little language skill).

As well as the two main strategies of waving and tapping, we also noted instances when attention was sought by placing an object within the visual field of the addressee. This strategy is not usually seen as part of conventional sign language discourse, but can work effectively with children who have had less exposure to sign language.

Attention-getting was most often found in one-to-one interactions, but the strategies used by adults to attract and maintain the attention of groups of children were also examined.

For most of the interactions, attention-getting was either already understood by the children or was taught through example. However, in some exchanges the adults were explicitly teaching the children the rules of expected attention-getting behavior. These occurrences were noted separately for further investigation.

## 5. Results

In total, thirty-nine different attention-getting strategies were identified, and the number of uses of each strategy by the adults and children were noted. They are given in Table 1.

The children used seventeen different ways to gain the adults' attention. This finding challenged the initial assumption that gaining attention involved either using one type of tap or one type of wave. Gaining attention is clearly a complex social skill for these children, which involves learning a variety of strategies.

Some attention-getting devices are used appropriately by either a child or adult, such as waving, tapping or waving and tapping. Others are considered within the wider Deaf community to be acceptable only when used by a young child, since adults tolerate immature behavior in children who are developing linguistically or

**Table 1.** Types and frequency of use of attention-getting strategies in the Adults and Children

| **Adults** | | **Child** | |
|---|---|---|---|
| **Type of Strategy** | **No. of tokens** | **Type of Strategy** | **No. of tokens** |
| Wave | 37 | Wave | 18 |
| Wave/tap | 1 | Wave/tap | 1 |
| Wave close to the eyes | 1 | | |
| Wave Hard/Big | 1 | | |
| Tap | 62 | Tap | 70 |
| Tap Continuously | 1 | Tap Continuously | 5 |
| Tap Gently | 2 | | |
| Tap Table | 4 | | |
| Tap on Arm | 1 | | |
| Tap on Head | 1 | | |
| Grab, then tap | 1 | | |
| Leg Tap | 1 | | |
| Bang Table | 2 | | |
| Hold Move | 1 | | |
| Hold Out Hand | 1 | | |
| Wait Touch | 2 | | |
| Hold | 4 | Hold | 1 |
| Freeze Hold | 1 | | |
| Touch Move | 1 | | |
| Eye Gaze | 5 | Eye Gaze | 2 |
| Eye Gaze Continuous | 1 | | |
| Eye Shift | 1 | | |
| Hold Eye contact | 1 | | |
| Make Eye Contact | 6 | Eye Contact | 2 |
| Look | 1 | | |
| Brow raise | 2 | | |
| Chin turn | 1 | Chin Touch | 1 |
| Ignore | 1 | | |
| Point | 10 | Point | 7 |
| Object | 1 | Object | 6 |
| Point to Object | 1 | Point to Object | 1 |
| Nudge | 1 | | |
| Stop Abruptly | 1 | | |
| | | Tap on Knee | 1 |
| | | Touch Tap | 1 |
| | | Touch Hard | 1 |
| | | Touch Arm | 1 |
| | | Touch | 1 |
| | | Touch To Wake Up | 1 |

socially. For example, tapping the chin of the addressee is not acceptable between adults, but was used by these children and accepted by the adult. Adults may also use strategies with these children that they would not use with more mature signers, for example, turning the child's chin to make eye-contact or tapping on the back of the head. Other strategies are unacceptable, even to or from small children, for example, tapping hard or in the middle of the back. When this occurred in our data, the adult did not look at the child straight away but paused and turned round slowly to look at the child. The message that this was unacceptable was further reinforced when another adult removed the child to a quieter part of the nursery.

Thirty-three different attention-getting techniques were used by adults. Again this shows the complex use of attention strategies depending on different situations and different language abilities of the child. In Table 1 it can be seen that, of the 33 types of attention strategies used by the adults, only eleven were also used by the children; the children used six strategies that the adults did not use. Children use different types of touch whereas adults use simple taps more frequently.

Frequency counts of the strategies need to be treated with caution because the strategies were so varied and distributed unevenly across different adults, different children and in different situations. This was only a small study and the data available are necessarily limited. A larger study is needed before the frequency counts can be interpreted with more confidence. However, it is clear that certain strategies are used considerably more than others.

Sometimes the children did not need to be asked for their attention. When re-enacting the story of Little Red Riding Hood in the home corner, for example, they were uncertain as to what they should be doing, and looked repeatedly at the adult in order to be told what to do. This volunteering of eyegaze and attention showed that the children had learned when and why they should look at an adult. This was expected on the basis of Van den Bogaerde's results (2000) which showed that children as young as two years were spontaneously looking at the adult for communication. The adult did not need to seek the children's attention and any attention-getting strategy from the adult at this time would have been intrusive, inappropriate and unnecessary.

During story-time the adult did not need to demand attention on a regular basis. She maintained eye-contact with all the children by a constant sweeping of her eyes around all the children, breaking contact only for reasons of role shift in the story. The adult also managed to maintain the children's gaze at her by creating a signed story that the children wanted to watch.

In the following sections we will examine the main types of strategies individually.

### 5.1 Waving strategies

Although details of the frequency counts of the strategies are not reliable (see above), it is possible to say that waving was the most common strategy of Deaf adults in the nursery (Table 1). Waving was used much more frequently by adults than by children. During the lunchtime session the adult used waving to instruct each child individually to fetch his/her lunch, which may account for the high frequency of this strategy in our data. There are many more waving strategies than the simple "flaps" described by Baker and Cokely (1980). Most importantly, the wave may use just the hand, the whole arm, or the waving hand may hold something. Table 2 gives an overview of the waving types used and in which settings (including whether used adult–child or child–adult)

Only certain situations are appropriate for the use of waving. If the child was within reach, tapping was often used. During water-play, waving was not appropriate because hands were wet. The adult only waved once during water play and that was while her hands were still dry. Once the adult and children were wet, the only attention devices used by adult or child involved tapping.

**Table 2.** Overview of the waving used by adults and children

| **Strategy Type (Adult)** | **Situation where used** |
|---|---|
| A distal wave of the outstretched **B** hand | A general attention-getting device for when a person is out of reach e.g. when the adult was seated at table, this was used for children further away. Also used by children. |
| Wave very close to the face, made by the adult who moves deliberately into the child's line of sight. | Used in close proximity for when the child is engaged in another activity |
| A more proximal wave, larger, from elbow and shoulder joints, and using more body movement | Used when the person is out of reach and engaged in another activity but the initiator does not want to move. |
| Wave followed by tap-"prod" | When the waving has failed to get attention. Also used by children. |
| **Strategy Type (Child)** | **Situation where used** |
| Normal waving motion but made while holding an object | Child to adult |
| Waving object over the head | Child to adult. Occasionally an inappropriate strategy, e.g. when the object is a paintbrush full of paint. |

## 5.2 Tapping and other tactile strategies

As described above, most of the time the adult would try to get a child's attention by waving but, if that failed, they would try tapping. Children usually (although not exclusively) used tapping as their first, and frequently only, strategy.

As described in 4.3, "tapping" does not always take place on the same body location, and there are different sub-types. Table 3 describes some of the different tactile attention getting strategies.

Children frequently used tapping to get the attention of adults and other children. Child-to-child tapping occurred only at the shoulder, but child-to-adult tapping occurred at different body locations, perhaps because of the height difference between the child and the adult. The last two strategies in Table 3 were adopted because of the constraints of the physical environment of the signers.

Some of the strategies were used only by children and never by adults (see Table 4). The children sought the adult's attention because they wanted the adult to do something, rather than because they wanted to tell the adult something. This

**Table 3.** Tapping and other tactile strategies used by adults

| Strategy type | Situation where used |
|---|---|
| Tap-"prod" on the front of the shoulder, 2 or 3 times | Before asking a question or mentioning something, e.g. when the adult was seated at table, this was used for children nearby. |
| Much gentler tap-"prod" on the front of the shoulder, 2 or 3 times | Especially to a child, to point out gently that they are doing something wrong. |
| Continuous tap-"prod" on the front of the shoulder | Especially to a child to show that attention is required immediately. |
| Tap-"pat" on the forearm | Used when the child's hand is already being used, for example playing in water. |
| Gentle rub with fingertips on the forearm | Used by adult with child who has less well-developed conversational skills. |
| Grasp hand or forearm until eye-gaze is achieved | To achieve a quicker response than tapping. |
| Tap back of head | Adult to child — an equivalent of a "smack". Used only as a last resort as a reprimand to a willful child. |
| Hold the chin and turn it | Adult to child when child does not respond to other strategies. Adults preferred not to use this strategy if they could avoid it. |
| Tap-"pat" on the wrist | When the child's hands are wet and the arm is covered in a thick apron — wrist is the only skin exposed. |
| Gentle nudge of elbow with elbow | Rarely used but adult to child or child to child when hands are full or wet. |

**Table 4.** Tactile strategies used only by children

| Strategy type | Situation where used |
|---|---|
| Hard, discomforting tap-"prod" on the shoulder | From a child wanting immediate attention. Adult explains that the child must be more gentle. |
| Tap-"prod" on the knee | Used by children to adults when the adult is sitting down. |
| Tug on the upper leg | To be allowed to look at the book that the adult is using. |
| Tap-"pat" with fingertips of a B hand very gently under the chin | Used by a child wanting to know what is happening when the two other children was talking to adult. |
| Tap then hold flat hand against the arm and then look away | Adult waited until child looked back. |
| Hold the chin and turn it | Child to adult when adult does not respond to repeated tapping. Adult removed child's hand from chin quickly and firmly. |
| Gentle tap-"prod" on the back of the hand, then a small, gentle rubbing motion on the back of the hand. | From child to adult to get the adult's rapid attention. |

use of attention-getting for behavior rather than language may account for some of the differences in the strategies. In some cases the adult corrected the child but in other cases the strategy was accepted. The example in Table 4 of the child holding the adult's chin is also indicative of the child's lack of understanding of when attention can be sought and provided.

### 5.3 Strategies involving use of the visual field

As well as waving or tapping, adults would also get the children's attention by entering into their visual field or by introducing something into the children's visual field that they wanted to children to notice. These strategies were used by adults with children who had limited language experience. These children had less understanding of the abstract linguistic functions of attention-getting strategies, so the adults used strategies outside those normally used in adult BSL. Actions such as moving an object into the line of sight and thereby drawing the child's eyegaze makes fewer communicative demands on the children. The "visual field" strategies observed in the nursery are summarized in Table 5.

The strategy of "squatting down" until the adult was in the child's line of sight was commonly used. In one instance in the home corner a child copied this device and squatted down to get into the adult's line of sight, rather than using the conventional wave or tap. The child had not learned that this is not a conventional strategy, although in this case, the adult accepted the child's call for attention.

**Table 5.** Adults' strategies using visual field

| Strategy types | Situation where used |
|---|---|
| Point at an object | Adult points, child looks at location of point and then back up to the adult. |
| Hold the object in line of gaze | Adult to child: child looks at object and then back up to the adult. Especially for child with less well-developed conversational skills. |
| Hold the object up to the face | Child looks at the object and then at the adult. Especially for child with less well-developed conversational skills. |
| Impose presence by entering line of sight, carrying interesting things | No further attention strategies necessary, e.g. before beginning "cooking", adult stood at the table with the equipment and ingredients. |
| Deliberate maneuver into the child's line of sight and pick up eye-gaze focused elsewhere before standing and drawing eye-gaze | Adult to child (primarily). |
| Deliberate maneuver into the child's line of sight and pick up wandering eye-gaze randomly looking elsewhere before standing and drawing eye-gaze | Adult to child. |

A child with less well-developed conversational interaction skills attracted the adult's attention by pointing to the apron worn by another child, indicating that he wanted it. He then looked up at the adult, waiting for the adult's response. The adult responded in this case with gestures similar to those of the child. Although not restricted to attention-getting, the ability of the Deaf adult to match the communication level of the deaf child is often missing in hearing adults interacting with such deaf children. The skill of adjusting an interaction to suit a child's requirements exactly (sometimes termed "scaffolding") is evident here.

### 5.4 Strategies to gain the attention of more than one person

Strategies for gaining the attention of a group were only used by the adults to the children. These occurred whenever there was group activity, but were especially important at mealtimes when the children were all in one group and the adults needed the attention of some or all of the children. Table 6 gives an overview.

**Table 6.** Adult strategies for gaining the attention of groups

| Strategy type | Situation where used |
|---|---|
| Flash lights | To get everyone's attention; rarely used e.g. before starting "cooking" session. |
| Bang fist on the table | To get attention of people around the table, both within and out of reach — with a sense of urgency |
| Bang flat hand on the table | To get attention of people around the table, both within and out of reach — with less urgency. |

The "cooking" session is an example of how a single adult can gain and hold the attention of several young children without resorting to many and repeated attention-getting strategies. The initial flashing of the lights was sufficiently unusual for the children to attract their attention. They were told that cooking was about to begin and they immediately came over to the table. The adult then stood before the children, clearly holding the equipment and ingredients for the next activity. This served to focus their attention and the adult immediately began her activity before the children lost this initial interest. When the adult needed to fetch her glasses (to read the small print on the packet she was using), she explained carefully and clearly to the children where she was going and why. The children remained seated while she was gone and immediately looked at her when she returned. She continued her task as soon as she returned and did not need to attract their attention again. Throughout the cooking session there was a great deal of interaction between the adult and the children. There were forty adult-to-child initiations (asking questions, making comments and explaining) and twenty child-to-adult initiations. (There was no child-to-child interaction).

### 5.6 Strategies used by adults for behavioral outcome

The strategies described in the previous sections could be used for either linguistic interaction or to modify the behavior of the children. One strategy, however, was exclusively used when the adult needed the child's attention for behavioral reasons (see Table 7). The other was used by children.

**Table 7.** Strategies for behavior control

| Strategy type | Situation where used |
|---|---|
| Tap-"prod" on the shoulder followed by grabbing and holding the wrist. | Adult–child — used when the tapping hasn't worked and restraint is needed to avert an accident e.g. to prevent a paint pot from being knocked over. |
| "Push" shoulder repeatedly, gently with fingertips | Child to adult, in role play meaning "wake up". |

## 5.7 Strategies used by adults to teach children about turn-taking

Children need to not only know how to ask for eye contact but also when to ask for it and when not to ask for it. The adults showed a range of ways to encourage children to wait before signing, so teaching them the turn-taking rules of discourse. Table 8 gives an overview of these.

In some cases the adult wanted to get (or maintain) the child's attention not so that the adult could sign, but so that the child could be encouraged to sign as shown in Table 9.

**Table 8.** Strategies used to teach children about turn-taking strategies

| Strategy type | Situation where used |
|---|---|
| Hold out open **5** hand, palm towards signer, fingertips up. | Adult to child, allowing adult to stop the child's signing that had started before the adult was watching and start again now that the adult is paying attention. |
| Hold hand and sign WAIT with **G** hand. | Adult to child, allowing adult to stop the child's signing started before the adult was watching and start again when adult has finished with another signer and is paying attention. |
| Take hold of the child's hand and then look away | Adult to child, allowing the adult to keep the child from signing until the adult has finished with another signer and is paying attention. |
| Deliberately do not make eye contact despite tapping | Adult to child, ignoring a child's request for attention, expecting the child to know that attention is inappropriate. |
| Shift eye gaze between one child and the one requesting attention | Adult keeps attention and eyegaze of both children, allowing the second child to "wait the turn". |

**Table 9.** Strategies to encourage the child to take a turn

| Strategy type | Situation where used |
|---|---|
| Make eye-contact with eye brows raised | To encourage a child to initiate signing. |
| Open eyes wide and deliberately hold gaze | To encourage a child to continue signing. |
| Tap the shoulder but with the body and head very close to the child | Such closeness at initiation encourages the child to sign more than they would if the tap had been from the normal distance. |

## 6. Concluding remarks

In conclusion, we can now begin to offer answers to the questions asked at the beginning of the paper.

*What strategies are used by adults to attract the children's attention?*
The adults vary their strategies according to the child and the situation — both physical location and the reason for the request for attention. Waving is preferred over tapping in many cases. Adults vary their strategies to control the child's behavior, for example in order to prevent accidents, as well as to develop language and behavior skills. The adults' use of strategies to increase a child's language output should be noted as being just as important as strategies used to encourage children to watch the language of others.

*What strategies are used by children to attract the adult's attention?*
Children prefer tapping to waving. They use some strategies that are inappropriate, such as using too much force or touching inappropriate areas, but it is clear that, when they have adult role models, they are able to determine appropriate rules for both how and when to attract attention. It is clear from the way that they respond to the adults' instructions to wait for attention that they are learning this important conversational rule.

*Are there rules which govern which strategy is used and when?*
Very clear patterns have emerged concerning where and when to use different strategies. Many of these are apparently "common sense" rules — although they are not necessarily obvious to anyone unfamiliar with the rules. Tapping when hands are wet, only tapping the back of the head when a child is willfully ignoring other requests for attention, and switching from waving to tapping to get a quicker response are all examples of rules that are clearly a part of engaging attention with young children.

*Are attention-getting strategies related to the linguistic development of the individual child?*
There are certain strategies that are used with children who have less (or minimal) language. These included grasping the child's hand or wrist, or rubbing the back of their hand gently. These children themselves relied on a limited number of conventional attention-getting devices themselves, including tugging at the adult or waving objects over their head. Differences could be seen between children and adults in that children tend to use touching whereas adults use tapping. More lin-

guistically mature children were able to use tapping and even waving as part of their attention-getting repertoire. They used turn-taking attention-getting devices that are part of the conventional discourse practice of the language, rather than using objects to get attention. The children know that when they tap on an adult and the adult does not respond quickly, they should wait until it is their turn. The younger children do not show this understanding.

A Deaf nursery is an important environment for deaf children's development of social and linguistic skills. At the nursery the deaf children learned appropriate attention-getting strategies from Deaf adults. They learned the rules about how to get attention and when, and also when to give their own attention to other signers. It is clear from the observations made at this nursery that the children were learning from the adult role-models, both as a result of direct instruction and by simply observing and copying adult behavior.

Although this study was only small-scale, it provides strong support for claims that deaf children can benefit from being in an early signing environment with adult signers. By the time they leave the nursery they have learned from Deaf adults what is expected of them in terms of asking for and giving attention. In order to build on this foundation, parents and teachers at primary schools also need to be aware of the rules of behavior. Understanding more about the way that Deaf adults use and teach these strategies to children will help intervention programs for hearing parents and teachers who need to communicate with deaf children.

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# Code mixing in mother–child interaction in deaf families*

Beppie van den Bogaerde[1,2] and Anne Baker[2]
[1]Hogeschool van Utrecht & [2]Universiteit van Amsterdam

In this paper we discuss the mixed language input of four deaf mothers and the mixed output of their three deaf and three hearing children. Taking a strict definition of code-mixing (as defined by Muysken 2000) we find that the deaf mothers mainly use a form of code-mixing, or mixed code-blending, called congruent lexicalization, which results in a mixed form between NGT (Sign Language of the Netherlands) and Dutch in a structure which is compatible with both NGT and Dutch. The deaf children (up to 3 years), who are only just beginning to become bilingual, hardly produce any code-mixed utterances. The hearing children, however, are clearly bilingual in NGT and Dutch, and use code-blending of the mixed type in more or less the same form as their mothers do.

**Keywords:** code-mixing, code-blending, sign language acquisition, bilingual acquisition, NGT, interaction

## 1. Introduction

In language acquisition studies of hearing children with bilingual input it has been found that if the parent(s) mix their languages, children are influenced by this mixed input. Besides acquiring the two (or more) offered languages they also, often from the very beginning, mix these languages (see for instance Quay 1995; Lanza 2001; De Houwer 1990; Bialystok 2001). In deaf families and in families with both hearing and deaf members both the sign language and the spoken language can be used. Moreover more than one sign language or spoken language can be offered (see Pruss-Ramagosa 2001). There can also of course be language mixing between these languages. The children in these deaf families are therefore

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exposed to a variable input, and, as research with hearing children has indicated, input determines the amount and type of code mixing that children produce (Nicoladis & Secco 2000).

In this paper we will look at the language input in deaf families with deaf and hearing children and the language mixing that occurs, both in the input and in the language output of the children. This will be studied in the context of families in which both Nederlandse Gebarentaal (Sign Language of the Netherlands, abbrev. NGT) and Dutch are used.

In language contact situations it has been claimed that a third system can emerge as a language variant (Romaine 1995). She describes this third system as follows:

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

Lucas & Valli (1992) consider the idea of a third system in the context of contact between a sign language and a spoken language, namely American Sign Language (ASL) and English. They studied native signers in different situations of language contact. They concluded on the basis of their findings that a third system was present that they call 'contact signing'.

> We suggest, then, that contact signing is a third system resulting from the contact between ASL and English and consisting of features from both languages. We clearly don't want to call it a variety of English or a variety of ASL. We have been able to isolate and list features of English and ASL that consistently show up in the data, indicating the existence of a predictable and consistent system." (Lucas & Valli 1992:104)

They found this contact signing not only in conversations between a deaf native signer and a hearing participant but also between deaf native signers. They also describe code-switching between ASL and contact signing. It appears to be a system that is in regular use and in constant interaction with ASL.

Throughout their whole book, however, they have problems in defining what should be called code-switching or code-mixing and what should be called the new system 'contact signing' (1992:108). They take a decision as to what can count as a new structure. This can be mixture of syntactic and morphological structures from ASL and English but also combinations of ASL signs and English mouthed or spoken words. The criteria for this decision are unclear.

Emmorey, Borinstein and Thompson (2005) have studied the language production of hearing ASL-English bilinguals, adults who are the children of deaf

parents (CODAs). They designed different types of interaction situations. In retelling a cartoon film where it was expected that speech and sign or gesture would be produced, the participants were explicitly told that it was possible to use both languages with a bilingual partner; in a monolingual situation, where a non-signer was the conversation partner, this was not encouraged. In a third situation the participants were asked to use Sim-Com (a form of sign supported speech) to their bilingual addressee. In the bilingual situation the authors report that nine of the ten participants used mainly English: 95% of ASL signs co-occurred with English words and 23% of the English words with an ASL sign. Emmorey et al. distinguish between code-switching and what they call "code-blending". Code-switching between sign and spoken language is, in their definition, to 'stop talking and switch to signing ASL' (2005:665). This was a relatively low percentage, around 6% in the bilingual situation. Code-blending they define as "ASL signs produced simultaneously with English words" (2005: 666). The notion of blend is useful in that it contains the image of two closely knit elements and we will use this term here where relevant to refer to the simultaneous mixing of signs and words.

For determining code-mixing in spoken languages Muysken (2000) has set out linguistic criteria alongside socio-linguistic factors. Muysken (2000:3) argues that in intra-sentential code-mixing there are in fact three processes to be distinguished:

- **insertion** of material from one language into a structure of the other
- **alternation** between structures from languages
- **congruent lexicalization** of material from different lexical inventories into a shared grammatical structure.

In Example (1) an English word (marked in bold) is inserted into a Dutch sentence that would have a different structure in English; this is therefore lexical insertion. Example (2) shows alternation, first English then Dutch. Example (3) shows congruent lexicalization; the structure of the sentence is identical in both English and Dutch.

Example 1 Ik wil dat je mij een **kiss** geeft
I want that you me a kiss give
'I want you to give me a kiss'

Example 2 I want dat je mij zoent
I want that you me kiss
'I want you to give me a kiss'

Example 3 Geef mij een kiss
'Give me a kiss"

The last type, congruent lexicalization, is most often present in mixing between dialects and between languages, which are close to each other in structure. This type is seen by Muysken as an indication of good command of both languages since code-mixing occurs at those points where the grammatical structures are compatible. Using this division into three types of code-mixing it becomes clearer what the extent of mixing is. Alternation is mixing at a structural level; lexical insertion is mixing at a more restricted lexical level. Congruent lexicalization is an avoidance of structural mixing through the choice of a parallel structure in both languages. It has been difficult in sign languages to determine the nature of code-mixing since signs and words can be produced simultaneously. Muysken's system will be used in this paper to explore the different types of mixed utterances. Code-blending as the simultaneous mixing of words and signs often with the same meaning falls under congruent lexicalization but this has to be explored to see how frequently this occurs..

In every sign language investigated to date mouthings occur to a greater or lesser degree (Boyes-Braem & Sutton-Spence 2001). Lucas & Valli (1992:78) define mouthing to be a central feature of contact signing when it occurs continuously across the whole utterance. They also include as part of contact signing spoken words with phonation when they occur with or without a sign. It remains unclear in their analysis, however, when the presence and form of a spoken element in a signed utterance determines that the utterance belongs to the third system, to ASL or to a category of code-mixing.

Mouthings can be seen as part of the sign language or as part of a mixed system, according to the perspective of the researcher. Words that are produced **with** phonation can also be viewed in the same way (Ebbinghaus & Hessmann 1996). There is no clear consensus in the literature.

If words with or without phonation are considered as belonging to the spoken language, then clearly code-mixing occurs in deaf signers. It is also therefore possible that the three types of mixing mentioned above (Muysken 2000) occur. In **insertion** the lexical item or constituent from the one language takes the place of a comparable item in the other language but it is inserted into the structure of the other language. To identify this type, therefore, the sign or word must add content to the utterance *and* the structure of the sign language or spoken language must be clearly identifiable. Although research on the structure of sign languages has progressed considerably in the last twenty years, it can still be the case that it is not clear whether the spoken language and sign language are distinct in their structure in a specific area. As far as sign order is concerned, it is also known that sign languages are freer than many spoken languages. We can therefore predict that it will be difficult to identify many structures as clearly belonging to the spoken language

or to the signed language. One clear area of difference is the possibility to omit both subjects and objects in a signed language, whereas in many spoken languages this is not possible.

The lack of difference is a restriction too in determining cases of **alternation**, since here structures must alternate. In the case of there being no apparent structural difference, then **congruent lexicalization** is the mixing process. The terms **insertion** and **alternation** suggest sequential mixing. With combinations of signs and words the combination of elements is often simultaneous. However this need not necessarily detract from the possibility of determining one type or the other. This will be discussed further in Section 4.

## 2. Bilingual input in deaf families

Mallory, Zingle & Schein (1993) investigated from a socio-linguistic perspective the language use in several deaf families and found considerable variation and considerable mixing.[1]

In most studies of deaf children's language acquisition little attention has been paid to the linguistic structure of the input and the mixing of languages.

Petitto, Katerelos, Levy, Gauna, Tétreault & Ferraro (2001) are interested in the language mixing in the input to hearing children of deaf parents. The children are learning Langue des Signes Québécoise (LSQ) and French. They choose to make a distinction between LSQ utterances and mixed utterances on the basis of the use of phonation. If a sign in an utterance is produced with phonation or a phonation is produced alone, then they code the utterance as mixed. Mouthed words are not discussed explicitly; implicitly an utterance that contains mouthings, whether continuous or not, belongs to LSQ. This is of course quite different from Lucas & Valli's (1992) definition.

Sutton-Spence and Day (2001) find in BSL that there are more mouthings in child-directed registers than in adult-directed registers.

Petitto et al. (2001) report that the mixed utterances in the input amounted to 91% and 66% from the deaf primary adult caregivers for one child aged around three years. This is a large amount although the deaf primary caregivers are described as being native signers of LSQ and non-speakers of French. At the same age the child produced 33% and 20% mixed utterances with these caregivers. It must be remembered, however, that this was input directed to hearing children and the definition of 'mixed' included any utterance in which phonation together with signs was used.

1. Mallory et al. (1993) do not define in linguistic terms what they count as 'mixing'.

Petitto et al. do not use Muysken's idea that a lexical item or constituent must add to the meaning of the utterance for it to be considered mixed. They do report that a high percentage (89%) of simultaneously produced signs and words were semantically congruent. This would seem to imply that a large number of their mixed utterances would not count as code-mixing if Muysken's definition is followed strictly.

Van den Bogaerde (2000) studied the input to three deaf and three hearing children in deaf families in the Netherlands up to the age of three years.[2] Despite work on the function of spoken words in Sign Language of the Netherlands (NGT) by Schermer (1990) it is still a problem to distinguish between NGT and sign supported Dutch (SSD). SSD is a system made up of simultaneously produced signs and spoken/mouthed words that follows the grammar of Dutch. In its purest form it is re-lexification of Dutch but in the many variants between NGT and SSD it can be the case that mixing takes place. Since at the outset of Van den Bogaerde's research it was unclear how signed utterances containing mouthed or spoken words should be categorized, a strict definition was applied in the first instance. Only utterances with no mouthed or spoken words were included in the category NGT. Utterances including a combination of signs and words were placed in a category Simultaneous Communication. These are now called code-blended using Emmorey et al.'s (2005) terms. Phonation was not a criterion for inclusion here; the words could be mouthed, whispered or spoken with voice.

As can be seen in Table 1, the percentages of code-blending used by the deaf mothers are considerable with both the hearing and deaf children. Petitto et al.

**Table 1.** Percentages of code-blended utterances in the input of the deaf mothers and the output of the deaf and hearing children up to 3 years of age (Van den Bogaerde 2000:260)

| **Deaf mother of deaf children** | **code-blended utt. (%)** | **Deaf mothers of hearing children** | **code-blended utt. (%)** |
|---|---|---|---|
| mother of Carla | 77 | mother of Jonas | 63 |
| mother of Laura | 62 | mother of Alex | 67 |
| mother of Mark | 54 | mother of Sander | 73 |
| **Deaf children** | **code-blended utt. (%)** | **Hearing children** | **code-blended utt. (%)** |
| Carla | 17 | Jonas | 39 |
| Laura | 7 | Alex | 18 |
| Mark | 3 | Sander | 47 |

2. Code-blending in the same children including the age six years has been studied in Baker & Van den Bogaerde (2008).

(2001) also found high percentages in the deaf caregivers of LSQ and French mixed utterances, even though in their definition the use of phonation was essential to identify a code-blend. The children on the other hand produce relatively small percentages of utterances in this category; two of the deaf children have extremely few in number too (n = 16 and = 6). Again these results are not strictly comparable to Petitto et al.'s results because of their different definition of what can be considered code-blending.

If we consider the amount of phonation in the mothers and children in this study, on the basis of an analysis at the level of words, it becomes clear that there are large differences (Van den Bogaerde 2000: 79, 96–98). The deaf mothers of the hearing children had on average nearly 100% phonation in the words they produced. The deaf mothers of deaf children are more variable however. The deaf mother of one deaf child produced 94% of her utterances with phonation in contrast to the deaf mother of the other two deaf children who only used 15% phonation on average. If the definition of Petitto et al. (2001) of mixing is followed, therefore, mixing looks quite different in different individual adults interacting with their children. There is not a clear pattern with hearing children compared to deaf children as one might expect. The children also show a very variable pattern. The deaf children produce between 63–88% of their words with phonation and the hearing children between 39% and 99%. One hearing child shows considerable interlocutor sensitivity by omitting phonation with his deaf mother compared to the other two hearing children.

As already mentioned, Van den Bogaerde (2000) used a working definition of code-blended utterances, then called SC, in which utterances with phonation and mouthed words were pooled. She further analyzed these code-blended utterances in terms of their semantic content, that is on the basis of the proposition. Code-blended utterances were divided into four different combinations. This was done on the basis of the semantics of the utterance as is common in work on code-mixing in spoken languages where the notion of semantic congruence is often used. In this study the proposition is a crucial concept for determining what we want to call the base language. This term originates in the area of creole languages in which a creole is seen as for example English-based when the bulk of the vocabulary is drawn from this language (see Tracy 2000:17–21 for a discussion of the problems of using different definitions in the context of language acquisition studies). Here we use the idea of a semantic base — for example, where the proposition is expressed fully in words with only semantically congruent signs, the code-blended utterance is classified as Dutch Base Language or Dutch BL. Only the proposition is used for this classification; morpho-syntactic criteria are not used since we are dealing in the children with emerging competence. The use of morphological elements to determine the Matrix Language in the terms of Myers-Scotton (1993) could

lead to an incorrect classification, since these elements are in the process of being acquired. In the adult deaf mothers there seems to be also incomplete competence in spoken Dutch. All three mothers could be seen as being in a category between an L1 and L2 learner of Dutch (see Berent 2004), although the mother of Jonas, Laura and Mark has quite a high competence in Dutch. Furthermore the mothers are in interaction with their children and could be using a child-directed register that may involve the omission of certain structural elements. Verb morphology in a sign language, for example, is produced less frequently in child-directed input than in adult–adult interaction (Van den Bogaerde 2000; Baker, Van den Bogaerde & Woll this volume).

The four types are briefly discussed below.

1. Code-blended, Dutch Base Language[3]

A Dutch BL code-blended utterance is an utterance in which the proposition is expressed entirely in the words and where the signs do not contribute additional meaning to the utterance (see for comparison Example 1), in other words each sign occurring is semantically congruent with one word. The utterance is usually structured more or less according to Dutch morpho-syntactic rules but this is not a crucial criterion as discussed above.

2. Code-blended, NGT Base Language[4]

An NGT BL code-blended utterance is an utterance in which the proposition is expressed entirely in the signs and where the words do not contribute additional meaning to the utterance (see for comparison Example 2), in other words each word occurring is semantically congruent with a sign. The utterance is usually structured more or less according to NGT morpho-syntactic rules but this is not a crucial criterion as discussed above.

3. Code-blended, Full[5]

In these utterances the full proposition is expressed in both modalities The utterances do not have to be complete structurally, in either NGT or Dutch.

4. Code-blended, Mixed[6]

A mixed code-blended utterance is an utterance where both the signs and words are necessary to make up the full proposition. There are two possibilities here

3. In Van den Bogaerde (2000) this category was called fully spoken, complementary signed or cf.

4. In Van den Bogaerde (2000) this category was called fully signed, complementary spoken or fc

5. In Van den Bogaerde (2000) this was called Full or ff

6. In Van den Bogaerde (2000) this was called supplementary signed and spoken or ss.

with the simultaneously uttered elements, i.e. the sign and the word can belong to the same word class, but are semantically different or they can belong to different word classes.

In this study we aim to study in more depth the language production in the Code-blended Mixed category in the deaf mothers and their deaf and hearing children. These utterances clearly contain code-mixing according to Muysken's definition since the proposition is spread over the two modalities. They also amount to a considerable proportion of the input from the deaf mothers (see results Table 2). The hearing children also produce these utterances but the deaf children only to a slight degree. Despite these differences we are interested in the linguistic structures in which this code mixing occurs and in the kind of mixing the combinations of signs and words in this Code-Blended Mixed category (see above) represent. We can also see whether they can be termed a 'third system' as defined by Romaine (1995).

## 3. Method

### 3.1 Subjects

In this study we look at the language input and output of four deaf mothers and three deaf children called Carla, Laura and Mark, and three hearing children Jonas, Alex and Sander. These children and their mothers were followed from an early age (all before 1;0) up to age 9;0 in a longitudinal study on input and interaction in deaf families. Van den Bogaerde (2000) studied the children up to the age of 3 years. Below we will give more information on each of the children, and the families they belong to.

*Carla (deaf)*
Carla was diagnosed deaf at the age of 0;9 and at 1;1 showed no reaction to sound. Carla's mother usually wears a hearing aid, with the help of which she can pick up some sounds; her degree of hearing loss is not known. It is also unknown whether her hearing impairment was present from birth, although she suffered from no illness known to cause deafness in her youth. She is born deaf of hearing parents, with no known deaf relatives, and has used Sign Supported Dutch (SSD) and NGT since the age of 3;0 when she came into contact with other deaf children at the school for the deaf. The mother worked at home, and at the time of the study was not very active in the deaf community since in the town where they live there is no club for the deaf. Carla's father is deaf (cause unknown) of hearing parents and he works outside the home. Carla has one deaf brother (hearing loss unknown), who is nearly two years older than Carla.

*Laura (deaf)*
Laura was probably born deaf, and at 0;11 was diagnosed to be profoundly deaf (≥ 80 dB hearing loss in best ear). Over the years however it appeared that she showed only little reaction to the standard hearing tests, so her loss of hearing may be greater.

Laura's mother has a hearing loss of ≥ 70 dB in the best ear, and usually wears a hearing aid, which enables her to pick up some sounds, for instance a passing motorcycle. However, she cannot hear spoken language. She was born deaf, and she has hearing parents and one deaf sister. Before the children were born she worked as a psychological assistant at an institute for the Deaf. She considers herself to be a member of the deaf community and has many contacts with other deaf people.

Laura's hearing father has deaf parents and is a native signer (CODA). He is an active member of the deaf community, and he has been working with deaf and hearing parents of deaf children, but he also develops sign language courses and is an interpreter.

Laura has one deaf twin brother, Mark and a hearing brother Jonas who is 14 months older than the twins.

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

The three deaf children Carla, Laura and Mark started going to kindergarten at an institute for the Deaf when they were approximately 2;6. At the time the teachers in this school were using Sign Supported Dutch (SSD) with the children (see Knoors 1992; 1994). The children were in a class of 5 to 7 children once or twice a week.

*Jonas (hearing)*
Jonas is the hearing older brother of Mark and Laura (see Laura for family details).

*Sander (hearing)*
Sander is the hearing child of two deaf parents. He has two hearing brothers (twins), who are six years older. Sander's mother is born deaf of deaf parents and does not wear a hearing aid. Her hearing loss is unknown. She worked part-time as an assistant at a bookbinder's at the time of the filming. She considers herself an active member of the deaf community.

The father of Sander is deaf of deaf parents, with deaf brothers and sisters. He is an active member of the Dutch Deaf community, and works as a representative of the deaf community.

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

The three hearing children attended pre-school from the age of approximately two and a half.

### 3.2 Data collection

The children were filmed at home monthly by a hearing researcher, who was well acquainted with the families. Since filming started when the children were not yet one year old, the researcher quickly became familiar to them. We feel confident that the language produced by the mothers and children was representative for their usual communication. This was confirmed by the mothers who viewed some of the sessions later. Nevertheless an influence on the interaction from the presence of the hearing researcher cannot be excluded.

Most filming sessions lasted about 20 to 30 minutes. The mothers and children played together in a spontaneous fashion, that is, with toys and books of their own choice. The first author transcribed 10 minutes of these sessions with the help of a native deaf signer. Interrater reliability with a second transcriber was over 88% signs and words for the mothers and over 79% for the children (see Van den Bogaerde 2000:52–55 for details).

For this study we selected the sessions when the children were aged 1;0, 1;6, 2;0, 2;6 and 3;0. The data were pooled across these sessions since the numbers of utterances involved are not large.

## 4. Analysis

All utterances that belonged to the category Code-blended Mixed (or 'ss' in the earlier study of these subjects,Van den Bogaerde 2000:99ff) were further analyzed since these could be strictly considered to contain code-mixing following Muysken (2000). The pointing gesture INDEX was analyzed as part of the grammatical structure in the utterances. When the INDEX occurs with another sign it is quite plausible that it is not a non-linguistic gesture but, for example, a pronoun.

When the INDEX occurs without another sign but together with a word, then its status is more questionable. These were included since they often specified the meaning of the spoken item (see Examples 7 and 8) or functioned as a separate argument of the verb (see Example 9). Phonation was not considered a criterion for determining code-mixing as we discussed above.[7] The utterances were analyzed according to the types of code mixing suggested by Muysken as discussed above: lexical insertion, alternation and congruent lexicalization. Some examples are given here below.

*Lexical insertion*
Lexical material from one language is inserted into the structure of the other.

| | | |
|---|---|---|
| Example 4[8] | Mother of Sander, age 2;7: utt. 121 | |
| signed | $\text{INDEX}_{\text{to-book}}$ | HOUSE |
| spoken | | schuurtje |
| English | | shed |
| translation | 'that's a shed' | |

In Example 4 the structure is NGT and the Dutch word *schuurtje* 'shed' is inserted into that structure.

*Alternation*
No examples of this were identified in the data, neither in the mothers' utterances nor the children's. Example 5 is hypothetical. The signed form HOUSE is marked as a NGT topic followed by a Dutch main clause.

| | | | | |
|---|---|---|---|---|
| Example 5 | *invented* | | | |
| | t | | | |
| signed | HOUSE | | | |
| spoken | | heeft | een | dak |
| English | | has | a | roof |
| translation | 'as for the house, it has a roof' | | | |

7. An analysis of the Code-blended Mixed utterances showed that the amount of phonation in the individual mothers and children was comparable to their phonation in all SC utterances. This category was therefore no different in this respect.

8. Convention for examples: the first line 'signed' describes the manual signs made and these are written in small capitals. If a line appears over the sign glosses, this indicates that a non-manual signal is simultaneously produced, like a head-nod or a head-shake. A dotted line indicates the extent to which a sign and word are produced simultaneously. The next line, 'spoken' depicts all Dutch (parts of) words, with or without phonation. The line called 'English' gives an English translation for the words in line 'spoken'. The line 'translation' gives a free translation of the meaning of the utterance.

*Congruent lexicalization*
Lexical material from both languages has to be mixed in a structure that is shared between the two languages. In Example 6 both the signed part and the spoken part follow the same word order and are possible structures in both NGT and Dutch.

| | | | | | | |
|---|---|---|---|---|---|---|
| Example 6 | Mother of Sander, age 2;6: utt. 110 | | | | | |
| signed | PUSH | | | | | 1-CL-FALL |
| spoken | zo | gaat | de | boom | naar | beneed |
| English | so | goes | the | tree | to | down |
| translation | 'the tree is pushed over' or '[he] pushes the tree over' | | | | | |

The utterances were further analyzed in terms of their linguistic structure to explore whether certain types of construction consistently re-occurred.

## 5. Results and discussion

The total number of utterances in the category Code-blended Mixed varied in absolute figures and percentages of the code-blended utterances as can be seen in Table 2 in both the mothers and children.

**Table 2.** Frequency of Code-blended Mixed (formerly 'ss') utterances expressed in raw figures and as a percentage of all Code-blended utterances

| **Deaf mother of deaf children** | **Mixed code-blended utt. n (%)** | **Deaf mothers of hearing children** | **Mixed code-blended utt. n (%)** |
|---|---|---|---|
| mother of Carla | 57 (13) | mother of Jonas | 117 (21) |
| mother of Laura | 30 (10) | mother of Alex | 132 (23) |
| mother of Mark | 26 (9) | mother of Sander | 155 (31) |
| ***Total code-blended utterances*** | 113 | | 404 |

| **Deaf children** | **Mixed code-blended utt. n (%)** | **Hearing children** | **Mixed code-blended utt. n (%)** |
|---|---|---|---|
| Carla | 10 (22) | Jonas | 41 (33) |
| Laura | 3 | Alex | 21 (25) |
| Mark | 0 | Sander | 49 (38) |
| ***Total code-blended utterances*** | 13 | | 111 |

As we might expect, the deaf mothers have more Code-blended Mixed utterances with their hearing children than with the deaf children. The hearing children have also clearly more of such utterances than the deaf children and proportionally even more than their mothers. Carla is the only deaf child with more than just a few. Her mother also has the highest percentage amongst the deaf mothers with deaf children but it is not higher by a large amount.

The analysis of type of code mixing is presented in Table 3. No examples of alternation were found and so this category is omitted. The cases of lexical insertion are specified according to the matrix language (Myers-Scotton 1993). The percentages are taken from the total number of Code-blended Mixed utterances (see Table 2).

**Table 3.** Types of code mixing expressed as a percentage of utterances in the category Code-blended Mixed (matrix language given for lexical insertion)

| **Deaf mother of deaf children** | **LI** | | **CL** | **Deaf mothers of hearing children** | **LI** | | **CL** |
|---|---|---|---|---|---|---|---|
| | **NGT** | **NL** | | | **NGT** | **NL** | |
| M of Carla | 37% | 0% | 63% | M of Jonas | 14% | 0% | 86% |
| M of Laura | 13% | 0% | 87% | M of Alex | 11% | 0% | 89% |
| M of Mark | 19% | 0% | 81% | M of Sander | 7% | 0% | 93% |
| **Deaf children** | **LI** | | **CL** | **Hearing children** | **LI** | | **CL** |
| | **NGT** | **NL** | | | **NGT** | **NL** | |
| Carla | 0% | 0% | 100% | Jonas | 0% | 0% | 100% |
| Laura | 0% | 0% | 100% | Alex | 0% | 0% | 100% |
| Mark | 0% | 0% | 100% | Sander | 4% | 0% | 96% |

LI means Lexical Insertion
CL means Congruent Lexicalization

From Table 3 it is clear that the deaf mothers show predominantly congruent lexicalization with both the hearing children and with the deaf children. With the deaf children the mothers show, however, slightly more lexical insertion of Dutch into NGT structures. Insertion of NGT into a Dutch structure was not found. The deaf children have very little code mixing but only congruent lexicalization and the same is true for the hearing children. These results suggest strongly that the mothers have a restriction on this type of code-blending or mixing. It is however possible that in these still short utterances as input to the children in this age range the structures of NGT and Dutch are not different enough to show lexical insertion clearly.

Having analyzed the linguistic structure of the Code-blended Mixed utterances we found that the combinations of signs and words fell into the following six categories.

1. A deictic sign (glossed as INDEX) is combined with a word and specifies more precisely the referent. The INDEX does not have the function of an independent argument in the sentence.

| Example 7 | Mother of Sander, age 1;0: utt. 3 | |
|---|---|---|
| signed | $\text{INDEX}_{\text{lap}}$ | |
| spoken | kom | hier |
| English | come | here |
| translation | 'come here' | |

In Example 7 the sign $\text{INDEX}_{\text{lap}}$ specifies the word 'here' but does not add totally new information to the proposition, i.e. it is semantically congruent with the word *hier*.

| Example 8 | Mother of Jonas, age 2;0: utt. 89 | | | |
|---|---|---|---|---|
| signed | $\text{INDEX}_{\text{book}}$ | PLAY | $\text{INDEX}_{\text{book}}$ | |
| spoken | en | Jonas speelt | met de | pop |
| English | and | Jonas plays | with | the doll |
| translation | 'and here Jonas plays with this doll' | | | |

In Example 8 the indices pointing to pictures in a book specify which Jonas is referred to and which doll.

Utterances in this category were almost entirely congruent lexicalization. Both Examples 7 and 8 are examples of congruent lexicalization.

2. A deictic sign (INDEX) functions as an argument in the whole proposition.

| Example 9 | Mother of Alex, age 1;0: utt. 18 |
|---|---|
| signed | $\text{INDEX}_{\text{book}}$ |
| spoken | kijk |
| English | look |
| translation | 'look at the book' or 'look here' |

The sign $\text{INDEX}_{\text{book}}$ is the locative or object argument of the spoken verb *kijken*.

Utterances in this category could have been either lexical insertion or congruent lexicalization, but the latter was predominant. Example 9 is an example of congruent lexicalization.

3. The lexical sign(s) and the lexical word(s) in one utterance are semantically incongruent, that is they differ in their meaning, *and* the word specifies the sign. The word and sign must be of the same word class.

Example 10 Mother of Sander, age 2;7: utt. 121

| | |
|---|---|
| signed | INDEX$_{\text{to-book}}$ HOUSE |
| spoken | schuurtje |
| English | shed |
| translation | 'that's a shed' |

Example 11 Mother of Carla, age 2;0: utt. 29

| | |
|---|---|
| | nod |
| signed | GOOD ---- |
| spoken | jij leuk |
| English | you fun |
| translation | 'you really find that fun' |

The sign HOUSE (see Example 10) is usually accompanied by the spoken word *huis* 'house'. Here the word 'shed' specifies the meaning of HOUSE, that is the type of house. This type of specification through the spoken word occurs frequently in adult NGT (Schermer 1990). It is unclear in this example whether a separate lexical sign exists for 'shed'. There are separate signs for 'good' and *leuk* 'fun' but in Example 11 the sign GOOD is combined with the word *leuk*.

Example 12 Mother of Sander, age 2;6: utt. 110

| | | | | | | |
|---|---|---|---|---|---|---|
| signed | PUSH | | | | 1-CL-FALL | |
| spoken | zo | gaat | de | boom | naar | beneed |
| English | so | goes | the | tree | to | down |
| translation | 'the tree is pushed over' or '[he] pushes the tree over' | | | | | |

In Example 12 (repetition of Example 6) the relations are more complex. The verb sequence PUSH FALL specifies the meaning of the spoken verb *naar beneden gaan* 'to go down'.[9]

Utterances in this category could be either lexical insertion or congruent lexicalization according to the specificity of the structure in which the lexical combinations occur. Example 12 is an example of congruent lexicalization since the structures can occur in both NGT and Dutch. Examples 10 and 11 are examples of lexical insertion; the matrix language is NGT. The verb can be omitted in NGT but not in Dutch.

**9**. This spoken verb is not a correct lexical choice in this sentence. The verb should have been *vallen* 'fall' if it were to match the NGT verb.

4. The lexical sign(s) and the lexical word(s) in one utterance are semantically incongruent that is they differ in their meaning *and* the word adds a quite different semantic aspect. The word can be in the same argument or realize different arguments.

| Example 13 | Sander, age 3;0: utt. 7 |
|---|---|
| signed | DOLL TAKE |
| spoken | paars |
| English | purple |
| translation | '[I'll] take the purple doll' |

| Example 14 | Mother of Alex, age 2;0: utt. 111 |
|---|---|
| signed | TELEPHONE |
| spoken | spelen |
| English | play |
| translation | '[you] are playing with the telephone' |

In Example 13 the signed noun DOLL is specified further with the adjective 'purple'. Together they are the object of the verb TAKE. In Example 14 TELEPHONE is the object of the verb 'play'. The two arguments are realized in the two different modalities, and together they form the proposition.

It is difficult to determine here whether the structure is common since usually the combinations are simultaneous. Examples 13 and 14 are categorized as lexical insertion of Dutch in the matrix NGT since in both utterances the subject argument is dropped. This is grammatical in NGT but usually not allowed in Dutch, except in certain cases.

5. The two modalities express a different pragmatic function in one and the same utterance (Example 15).

| Example 15 | Mother of Sander, age 3;0: utt. 28 | |
|---|---|---|
| signed | MUST | TICKET-PUNCH |
| spoken | moet | wat |
| English | must | what |
| translation | 'what does he have to do? punch the ticket' | |

Here the mother asks a question in words, while at the same time giving the answer in signs. This is not congruent lexicalization since the structure is NGT-like and not Dutch. It is rather lexical insertion creating a structure in which a rhetorical question structure is used as a type of topic marking. All of the utterances falling in this category were of this type and were categorized as lexical insertion.

6. A number of utterances fell into a category Remainder. There were words or signs that were supplementary in these utterances but they were on the level of a discourse marker (Example 16), Minor (Example 17) or Dutch grammatical function word(s) (Example 18). The latter have no equivalent in NGT. These types are all non-referential.

| Example 16 | Mother of Alex, age 2;0: utt. 30 |
|---|---|
| signed | PU[10] |
| spoken | oh kapot |
| English | oh broken |
| translation | 'oh dear, [it's] broken' |

| Example 17 | Mother of Carla, age 1;6: utt. 97 |
|---|---|
| signed | CLEVER GOOD |
| spoken | ja |
| English | yes |
| translation | 'yes, [you're] clever' |

| Example 18 | Mother of Carla, age 2;6: utt. 47 | |
|---|---|---|
| | nod | |
| signed | INDEX$_{Carla}$ | NEW |
| spoken | heb jij | nieuw |
| English | have you | new |
| translation | 'yes, you have new [ones]' | |

The utterances in this category are not so clearly supplementary compared to the other categories since the information added is not strictly necessary for the proposition. If omitted, the proposition does not change fundamentally.

In Table 4 we present the distribution of these Code-Blended Mixed utterances across the categories described above.

As discussed above, the remainder category (6) showed the least addition of information since this was provided by elements such as Minors like 'yes', 'oh', nodding the head etc. The deaf children have almost only this category. This indicates that there **are** combinations of both languages but not frequently. They are also predominantly non-referential.

Across the deaf mothers and the hearing children the remainder category is relatively large too; the percentages are also comparable to each other. These three groups, however, show different patterns of usage in some of the other categories.

10. PU stands for palm-up, which is generally considered to be a gesture-like discourse marker, or can be considered a general question sign (meaning 'what', 'where' etc.)

**Table 4.** Distribution of different categories in the Code-blended Mixed input and output of the deaf mothers and the deaf and hearing children respectively, pooled over time (in raw figures and percentages)

| **Categories:** | **Mothers of deaf children n %** | **Mothers of hearing children n %** |
|---|---|---|
| 1. INDEX as specifier | 7 (6) | 123 (30) |
| 2. INDEX as argument | 26 (23) | 85 (21) |
| 3. Semantically incongruent: lexical specification | 6 (5) | 20 (5) |
| 4. Semantically incongruent: new content | 30 (27) | 27 (7) |
| 5. Different functions | 2 (2) | 4 (1) |
| 6. Remainder | 42 (37) | 145 (36) |
| **Total of utterances** | 113 | 404 |
| **Categories:** | **Deaf children n** | **Hearing children n %** |
| 1. INDEX as specifier | 0 | 7 (6) |
| 2. INDEX as argument | 2 | 48 (43) |
| 3. Semantically incongruent: lexical specification | 0 | 6 (5) |
| 4. Semantically incongruent: new content | 1 | 17 (15) |
| 5. Different functions | 0 | 2 (2) |
| 6. Remainder | 10 | 31 (28) |
| **Total of utterances** | 13 | 111 |

The deaf mothers use far more indices as a specifier (category 1) with the hearing children than with the deaf children. In contrast the proportion of use of indices to provide an argument (category 2) is comparably large in the mothers with both groups of children. The hearing children also make a proportionally large use of this category, even more so than their mothers. In category 1 the argument is lexically specified in Dutch, such as 'doll' in Example 8, and the index specifies which referent is meant, in this case which doll. This is comparable to the way pointing gestures are used by hearing mothers with their hearing children. This would lead us to the conclusion that in fact these examples should not be seen as a form of language combination or code-mixing at all. It is actually impossible to determine this as we discussed earlier in Section 4 (see also Volterra & Erting 1990). Utterances in the category Code-Blended NGT Base Language clearly are examples of language combination. Most cases are cases of congruent lexicalization. There are

very few instances in category Code-Blended, Dutch Base Language and no difference between the mothers with their hearing of deaf children.

The deaf mothers of the deaf children provide proportionally more information by combining lexical content (Code-Blended Mixed) than the deaf mothers of the hearing children. This means that they are heavily relying on the deaf children being able to understand the words used in order to fully understand the whole proposition. In Example 14 the child must be able to understand 'play' in order to know what to do with the telephone. The utterances might be expected with hearing children who have full access to both NGT and Dutch, just as Petitto et al. (2001:487) found instances of this category with the hearing children of deaf parents they studied. This category is quite unexpected with deaf children, however, and it is even more unexpected that the category is larger with the deaf children. The hearing children produce this category proportionally more than their deaf mothers (15% and 7% respectively). Again most cases were of congruent lexicalization in both the mothers and children.

There are relatively few instances of combinations of functions and these are produced predominantly by the mothers. These are all examples of asking a question in one modality and providing the answer in the other **simultaneously** (see Example 15). We suggest that this is a form of topicalization using a rhetorical question construction. It is known from the literature from several sign languages that topics can be established using rhetorical questions (for example in BSL, Sutton-Spence & Woll 1999: 61). This is also true for NGT. The topic in the form of a question is first followed by the rest of the clause or 'the answer'. In these examples this structure seems to be split across the two languages and is articulated simultaneously. In Example 19 even the order of question and answer is not strictly adhered to.

| | |
|---|---|
| Example 19 | Mother of Carla, age 3;0: utt. 5 |
| signed | ANIMAL PU |
| spoken | wat is dat? grgrgr |
| English | what is that? grgrgr |
| translation | 'as far as that is concerned, it's an animal' |

Following this interpretation, all these cases are examples of lexical insertion in the matrix of NGT.

## 6. Conclusion

In our analysis of those utterances in which strict code-mixing (Code-blending Mixed) could be determined it appeared that the deaf children produced very few

such utterances and these were at a most basic level. Up to the age of three years their development in Dutch remains at the one-word stage (Van den Bogaerde 2000). They are just beginning to become bilingual (Van den Bogaerde & Baker 2002). Since this is the case, they cannot be expected to show the ability to code-mix between Dutch and NGT. As discussed above, code-mixing ability is linked to a certain level of fluency in both languages (Appel & Muysken 1987). The deaf mothers use different types of structures in which mixing took place and these were used in different proportions with the deaf and hearing children. This can be explained as a 'hearing' strategy in the case of the greater use of specifying indices with the hearing children alongside the spoken word. However it is unclear why so much use is made of Dutch with the deaf children. The Dutch would seem not to be very accessible to the children, since again they are at very beginning of becoming bilingual at age three. The input is clearly having an effect on the hearing children in that they also produce the different types of mixed utterances.

The type of code-mixing process that primarily occurred is congruent lexicalization with just some lexical insertion. In lexical insertion the matrix language was always NGT. The structures in the utterances are not highly complex, neither in the mothers nor in the children, therefore there are few opportunities for structural differences to be apparent. The finding that congruent lexicalization is dominant could therefore be a result of that fact. There is no evidence that these mixed utterances have a structure that forms a third system, as defined by Romaine (1995).

Muysken (2000:9) identifies congruent lexicalization socio-linguistically as being:

> associated with second generation migrant groups, dialect/standard and post-creole continua and with bilingual speakers of closely related languages with roughly equal prestige and no tradition of overt language separation.

This description does not fit the situation with NGT and Dutch except possibly that in the deaf community there is no long tradition of separation of NGT and Dutch/SSD. Although the emergence of sign languages have been compared to creole languages, it is not clear in our view that the predominance of congruent lexicalization in these data should be ascribed to a post-creole situation.

We have shown that code-blending of the lexical insertion type occurs to a considerable extent in the input to the hearing children but also to a fair amount in the input to the deaf children. The deaf children show little strict code-mixing but this is probably related to their limited competence in Dutch since they are just beginning to become bilingual. The hearing children follow the code-mixing in their input. We need to investigate the code-mixing in greater detail in adults and in older children, amongst other things to see if the type of mixing changes with time in either the input or the children's production.

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