Theoretical Issues in Sign Language Research 9

Sign Languages: spinning and unraveling the past, present and future. TISLR9, forty five papers and three posters from the 9th THEORETICAL ISSUES IN SIGN LANGUAGE RESEARCH CONFERENCE Florianopolis, Brazil, December 2006.

Edited by Ronice Müller de Quadros
Presentation

The TISLR is the world’s most important international conference for sign language studies. The nine edition of the conference attracted researchers who work in various sign languages that have different and similar linguistic typologies. The studies encompass various areas of linguistics from formal to applied studies. The conference have exhibited a significant development of studies of an increasing number of sign languages. This growth in research, shared and published through the editions of TISLR, gives visibility to sign languages from countries such as Brazil and creates opportunities for comparative analysis. It has thus become an event that goes beyond borders. The TISLR 9 was a space for socialization of studies about the world’s different sign languages that seeks explanations for linguistic facts considering the visual-spatial modality that is specific to these languages. For the first time, the event was being held outside North America and Europe and included the participation of researchers from throughout the world, and in particular, Brazilian researchers who have been studying Brazilian sign language to make this a special edition of TISLR. We had researchers represented from 33 different countries in Brazil, from December 6th to 9th, in 2006, at the Universidade Federal de Santa Catarina.

The theme of the 9th edition of TISLR was the development of sign language studies from the 1960’s until today with a look at lines of research for the future. The conference title was: Sign Languages: spinning and unraveling the past, present and future. There were presentations from the scholars who conducted the first sign language studies, as well as researchers who are indicating new directions for study. This volume brings 45 papers e 3 posters presented during the conference available in an electronic version without any cost. This is possible, because we had financial support from Brazilian Federal funding from CNPq, CAPES, MEC/SEESP, FINEP and CORDE. Giving continuity to previous editions, interlinguistic studies were on the agenda, because they contributed to a delineation of the linguistic universals of the visual-spatial modality in relation to the oral-auditory modality.

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Rua das Acáias, 20 – Condomínio Vale União- Araras
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Tel: ( 24) 2225-8397

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1. Introduction

More than two hundred million inhabitants of twenty-two countries across the Middle East and North Africa speak Arabic. However, should a Yemeni and a Tunisian meet, it is unlikely that their Arabic would be intelligible to the other. The Arab world is characterized by pervasive “diglossia,” a language situation in which regional dialects are spoken alongside a highly codified written language. Of the Arabic dialects, the Egyptian dialect is most widely understood by Arabs, since Arab cinema and other entertainment media is largely Egyptian-based and typically uses Egyptian actors. Should a Yemeni and a Tunisian meet, they can resort to the dialect of movie stars to understand each other or they could use the highly codified language of Modern Standard Arabic (MSA) which is used by newscasters and public officials in Arab countries. Although it is the mother tongue of no one, MSA is the official literary standard of Arab countries and is the form of Arabic taught in schools at all stages. Indeed, spoken colloquial Arabic, as the regional varieties are often called, is rarely found in a written form. It is commonly said that the Arabic language is what unites the different members of the Arab community, despite the different geographies and cultural traditions that can be found throughout the Middle East (Suleiman, 2003).

1 The 22 members are Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, and Yemen (League of Arab States, nd).
In writing about sign languages of the Middle East, Abdel-Fattah (2005) suggested that the presence of a standard Arabic spoken language has led to the expectation that there is a shared common sign language in the region. This paper explores to what extent sign languages of this region may be related. It examines relationships between sign languages in the Arab world through lexicostatistics, a method of comparing vocabulary across sign languages to determine type and extent of language relationship, if any.

At least three ongoing circumstances affect the distribution of sign languages in this region. First, as Walsh et al. (2006) describe below, certain marriage traditions are common in the region:

The unique demographic history of the Middle East has led to many [endogamous] communities. For more than 5,000 years and continuing to the present, the eastern shores of the Mediterranean have seen immigration of people from a wide variety of cultures. Villages were often established by a few extended families and, despite their geographic proximity, remained demographically isolated. For centuries, marriages have been arranged within extended families in these villages, leading to high levels of consanguinity and consequently high frequencies of recessive traits. (p. 203)

The common practice of endogamy has resulted in a high incidence of genetic deafness in the Arab world compared to exogamic societies, where deafness is more likely the result of disease than of genetic inheritance. Shahin et al. (2002) document that while approximately one in 1000 infants worldwide are born with hearing loss, communities with high levels of consanguinity have especially high frequencies of inherited childhood deafness. They state: “prelingual hereditary hearing impairment occurs in the Palestinian population at a frequency of approximately 1.7 per 1,000 and is higher in some villages” (Shahin et al., 2002, p. 284). This means that in Palestine, the frequency of deafness is 70% higher than the global average.

From reports of sign languages in such communities, they are not confined in usage to places where deaf people are brought together by social institutions, such as schools for the deaf or local clubs for the deaf, instead they are commonly found in family and community settings. As Groce (1985) illustrates in her history of nineteenth-century Martha’s Vineyard where there was a high incidence of recessive deafness, sign languages are likely to flourish in such communities as deaf people and hearing people use signed communication on a regular basis. Kisch (2004) describes the case of the Al-Sayyid community in the Negev, where consanguineous marriage is common and frequencies of hearing loss is high at 3% of the population due to genetically recessive traits of
profound prelingual neurosensory deafness. Sandler, Meir, Padden, and Aronoff (2005) also write of this community:

Members of the community generally recognize the sign language as a second language of the village. Hearing people there routinely assess their own proficiency, praising those with greater facility in the language… One result of [recessive deafness] is that there is a proportionately large number of deaf individuals distributed throughout the community. This means that hearing members of the community have regular contact with deaf members and that, consequently, signing is not restricted to deaf people. (p. 2662)

Second, cultural and social circumstances in the Arab world provide somewhat more opportunity to learn sign languages from birth. With higher incidence of genetic deafness, sign languages are able to survive across generations within a family, compared to other regions of the world where genetic deafness is less frequent. Where deafness is a result of disease, a deaf person’s chances of learning a sign language are more dependent on having access to organizations or institutions organized for deaf people. In the Middle East, sign language survival is not dependent on formal institutional policies.

Third, cultural, social, political, and economic circumstances lead sign languages in the Arab world to be more likely to be isolated from one another. Marriage customs in the Arab world give preferential treatment for partners from the same region as they are more likely to share a common dialect and customs. Moreover, political factors of immigration regulations within Arab countries make it difficult for nationals of one region to travel to another. For these reasons, a Jordanian woman is more likely to marry a man from the Levant region (northern countries of the Middle East) as opposed to one from a Gulf state. This is because she would need a visa to travel to Dubai, for example, but not one to travel to Damascus or Beirut. Moreover, proximity of Damascus and Beirut to Jordan makes it more economically feasible for a Jordanian woman to meet a man from these cities as opposed to meeting a Qatari man. Inasmuch as cultural, social, political, and economic factors restrict such contact, sign languages in the Arab world would arise within boundaries that possibly isolate them and allow them to develop independently from each other. Research on sign languages in the Arab world may reveal interesting findings on the geographic distribution of sign languages that are used on a daily familial and tribal social basis as opposed to those found in a more state formalized, institutional basis.
2. Review of Literature

The methodology of comparative lexicostatistics is used to develop hypotheses on possible historical relationships between spoken languages (Crowley, 1992). This is done through a quantitative study of cognates among the vocabularies of the languages under study. Cognates are defined as vocabulary from two different languages that are homogeneous enough to be considered as having similar linguistic derivation or roots. A comparison among spoken languages involves identifying similarities in syllable and segmental structure; in sign languages, cognate similarity is based on comparing handshapes, movements, locations, and orientations of the hand in vocabulary of two different sign languages. Many spoken language linguists use basic 200-word lists as the basis of their lexicostatistical research as opposed to longer lists, as a convenient and representative way of sub-grouping languages. The higher the lexicostatistical percentage between spoken languages’ cognates, the closer the historical relationship between the languages as it points to a more recent split from a common parent language (Black & Kruskal, 1997). Within the lexicostatistical methodology, Crowley (1992) defines languages to be dialects if they share 81-100% of cognates in core vocabularies. They are considered as from the same language family if they share 36-81% of cognates, and families of a “stock” if they share 12-36% of cognates. By “stock,” lexicostatisticians do not need to identify the languages as descending from one common ancestor language, instead, the term recognizes that languages within a region can have opportunity for contact with one another. Greenberg (1957) provides four causes of lexical resemblances across languages, only two of which are historically related: those are genetic relationship and borrowing. The other two are shared symbolism, where vocabularies share similar motivations either iconic or indexic, and finally, by chance.

Woodward (1978) is one of the first sign linguists to conduct lexicostatistical research on sign languages. He compared the lexicon of French Sign Language (LSF) from a sign language dictionary with ASL, where one set of signs were elicited from an older deaf man and another set from younger ASL signers. He began with a list of 200 core words from the Swadesh list, a common tool among anthropologists for eliciting a basic vocabulary, but excluded numerals, pronouns and body parts because they are indexical and highly iconic. With 77 words remaining on his list that had counterparts in the LSF dictionary, he found 61% cognates for both sets of comparisons of LSF with the older deaf man and with the younger signers. Substituting the modified core vocabulary list for all 872 available signs in the LSF dictionary, he found that cognates dropped slightly to between 57.3-58% for both sets of ASL signs. Woodward concludes
that contrary to previous sign language studies’ assertion that ASL has roots in LSF, it is more likely that some sign language varieties existed in the United States before contact with LSF was made, after which a creolization process took place.

Woodward (1991) also compared several sign language varieties found in Costa Rica. With results ranging from between 7-42% cognates, he concludes that there are at least four distinct languages in Costa Rica. In a third study, he compared sign language varieties in India, Pakistan, and Nepal with results ranging from 62-71% cognates (Woodward, 1993). He concludes that these varieties are separate languages but belong to the same language family. Likewise, Modern Standard Thai Sign Language and ASL share 57% cognates, making them distinct languages that are related historically because of contact between American deaf educators and deaf Thai Sign Language users (Woodward, 1996). Unfortunately, in these studies Woodward does not identify how many or which parameters are taken into account when determining cognates.

McKee et al. (2000) use Woodward’s modified core vocabulary list of 100 concepts to establish the relationship between New Zealand Sign Language (NZSL), ASL, Australian Sign Language (Auslan), and British Sign Language (BSL). The vocabularies were drawn from dictionaries and CD-ROMs of their respective sign languages. They identify signs as cognates if all phonemic parameters (handshape, location, movement, and orientation of the palm) are identical or if only one parameter is different. Vocabulary that falls in the latter category is designated related-but-different, or vocabulary that is similar enough to have a common origin. They found that between 79-87% of the vocabularies of Auslan, BSL, and NZSL are cognates, which would designate them as dialects of a parent language. The researchers expected this high degree of similarity, as both Auslan and NZSL have colonial origins, when BSL was brought to Australia and New Zealand by deaf educators and other immigrants from the United Kingdom. Moreover, there has been frequent contact between deaf people from Australia and New Zealand. This is in contrast to ASL which has no historical linkage with the other three sign languages. As expected, the researchers found that only 26-32% of ASL vocabulary was identical or similar to Auslan, BSL, and NZSL, confirming that ASL is a separate language from the other three.

McKee et al. acknowledge that some language scholars criticize the method of employing selective or core vocabularies. Because they are high frequency concepts, such vocabularies may overestimate the similarities between the sign languages. Instead these researchers prefer random vocabularies on which to base their lexicostatistical study. Slightly altering Woodward’s methodology to double the vocabulary being compared and to include more random vocabulary as
opposed to core vocabulary from the Swadesh list, McKee et al. found that the number of cognates between NZSL and each of Auslan and BSL dropped dramatically to 65.5% and 62.5% respectively. As expected, cognates between NZSL and ASL remained low at 33.5%. The researchers reason that the slightly higher rate of commonality between NZSL and Auslan than that between NZSL and BSL is related to geographical proximity and to historical educational policies in which the New Zealand Department of Education introduced the Australian Total Communication System in 1979 that continued to be used until the early 1990s. However, they find it difficult to make a claim as to whether NZSL is a separate language or if it is, like Auslan, a dialect of BSL. While the first analysis they used found that NZSL was a dialect of Auslan and BSL because it fell within the lexicostatistical range of 81-100%, the second analysis suggests that NZSL belongs only to the same language family as Auslan and BSL with significant divergence having occurred between them.

Currie, Meier, and Walters (2002) counted cognates in their lexicostatistical comparison of LSM with French Sign Language (LSF), Spanish Sign Language (LSE), and Japanese Sign Language (NS). LSM is compared with LSF as there is reason to believe they are historically related. A deaf French educator came to Mexico in 1866 when he first learned of a deaf school being established there. For this reason, some believe LSF may be a source of borrowing for sign language(s) in Mexico. With Spanish being a shared spoken language in both Mexico and Spain, LSM and LSE may have a basis for similarity. Finally, because they have no known historical relationship, the comparison of LSM and NS is used as a control to approximate the possible degree of similarity between two unrelated sign languages.

Data for the analysis was retrieved from videotaped elicitations. Word lists ranged from 89 vocabularies for the LSM-LSE comparison to 112 vocabularies for the LSM-LSF comparison and 166 concepts for LSM-NS. Concepts were designated as cognates if they shared two out of three parameters. Unlike McKee et al. (2002), Currie et al. (2002) exclude the fourth parameter of orientation. Results found 38% cognates for LSM-LSF, 33% cognates for LSM-LSE, and 23% for LSM-NS. While there is history of contact between LSM and LSF, it is clear that their historical development is non-genetic. They attribute the similarity to borrowing. Their findings also do not support similarity between LSM and LSE even though they exist in communities that share a spoken language, Spanish. Finally, the LSM-NS comparison provides a base level of the degree of similarity between any two sign languages that may have shared iconicity. They argue that the visual-gestural modality of sign languages and their capacity for iconic representations support at the very least, a minimal level of similarity between unrelated sign languages.
Genetic relationships between sign languages in the United States, Western Europe, and the British colonies are mapped onto the history of deaf education in these regions, but relationships between sign languages of the Arab world may follow an entirely different pattern given that schooling for deaf children was introduced much later in the Middle East. Brother Andrew, a pioneering educator of deaf people in the Middle East, credits Father Andeweg, a fellow Dutch Anglican missionary, with the establishment of the first school for deaf people in the region in Lebanon in the late 1950s. Brother Andrew came first to Lebanon in the capacity of a teacher and later moved to Jordan in 1964 to resuscitate a deaf school that had been also established by Father Andeweg (Holy Land Institute for the Deaf, 2004).

The Holy Land Institute of the Deaf (HLID) in Salt, Jordan is now considered a model school for deaf people in the Middle East. Schools for deaf people in other Arab countries did not open until several years, and decades later. These schools were established by their respective governments and largely without influence from Europeans. HLID being a rare exception, most schools for the deaf in the Middle East emphasize oral methods of communication, preferring it to sign language. Given the youth of such institutions for deaf people and their continued advocacy of oral methods for communication, we would expect sign language development in the region to exhibit a different geography than in Europe and the US.

This paper will explore similarities and differences among sign languages of the Arab world through the method of lexicostatistics. The sign languages that will be examined in comparison to Jordanian Sign Language (LIU)\(^2\) are Al-Sayyid Bedouin Sign Language (ABSL)\(^3\), Kuwaiti Sign Language (KSL), Libyan Sign Language (LSL), and Palestinian Sign Language (PSL). LIU will also be compared with ASL as a baseline, with the expectation that percentage of cognates will be low due to no known historic relationship between the two. However, as there are Jordanian professionals working with deaf people who have studied in the US as well as a few deaf Jordanians who have studied at Gallaudet University, there may be lexical borrowings from ASL to LIU.

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\(^2\) LIU is the abbreviated form of the Arabic-English phonetic translation, *Lughet il-Ishara il-Urdaniyyeh*.

\(^3\) ABSL is used in the Al-Sayyid community in the Negev Desert in Israel.
3. Methodology

Vocabulary used for comparison was drawn from published dictionaries of the respective sign languages, with the exception of ABSL where the vocabulary was elicited through an interview with a deaf member of the Abu Shara community on video. All vocabulary in the LIU dictionary and each of the other four dictionaries were used for the comparisons. The reason for such an extensive comparison was that using a modified core list or randomly selected vocabularies would have resulted in a smaller set of comparison vocabulary from the Kuwaiti and Libyan dictionaries, or a lack of comparison vocabulary as was the case with the Palestinian dictionary which was targeted towards high school and university students in the math and sciences, or too focused on local references such as names of organizations and royalty as is the case with the Jordanian dictionary.

Individual signs of different languages were compared based on four phonemic parameters (handshape, movement, location, and orientation of the palm), following McKee et al.’s (2000) more stringent guidelines. For McKee et al., cognates are signs that share at least three out of four parameters. Non-manual differences such as facial markers were not included in the comparison.

4. Results

As illustrated in Table 1, between 165-410 vocabulary were examined for the different comparisons. The number of vocabulary is similar to past comparative research on sign languages. As predicted, LIU-PSL had the highest number of cognates at 58%, followed by LIU-KSL with 40%, LIU-LSL with 34% cognates, and LIU-ABSL the lowest with 24% cognates.

Two signs from different sign languages were termed identical if they shared all four parameters, as in Figure 2. They were termed related if they differed on only one of four parameters, as in Figure 3 where handshape is the differing element. They were termed different if they differed on two or more parameters.

Table 1 demonstrates that LIU-PSL and LIU-KSL are related but probably not dialects of the same language, as their cognates lie within the 36-81% range. As for LIU-LSL, LIU-ABSL, and LIU-ASL, they are likely not related since they share only 12-36% of cognates. These results
demonstrate first and foremost that the geography of sign languages in this region does not map onto that of spoken languages. Although ABSL, KSL, LIU, LSL, and PSL are languages existing in Arabic-speaking communities, they are distinct sign languages. These results contradict anecdotes that sign languages of the Arab world are mostly similar or are dialects of a single sign language. Instead, the results suggest that at least those sign languages in the Arab world do not have common origins, or they have diverged greatly over time.

As expected, LIU and PSL share the most cognates of any two languages examined in this study. This is not unexpected as the Palestinian and Jordanian communities are tightly knit in terms of custom and marriage traditions. Also as expected, KSL and LSL have a lower number of cognates with LIU. This is attributed to the cultural, social, political, and economic circumstances that limit contact between the three nations. Finally, LIU and ABSL share the fewest cognates of all the sign languages studied. This confirms ethnographic reports that the Al-Sayyid Bedouin community is a closed community that has little contact with other Arab communities. Only 24% of their signs were cognates with LIU of total vocabularies compared, similar to that of LSM-NS which shared 23% and was considered by Currie et al. (2002) as a base level of similarity that can be expected between any two unrelated sign languages. This degree of difference falls just below the baseline of 26-32% that McKee at al. (2000) give for ASL-NZSL. In fact, LIU-KSL and LIU-LSL at 40% and 34% cognates are not significantly higher than that base level. This suggest two things: 1) LIU, KSL, and LSL are probably unrelated historically. But the higher level of similarity may be due to the fact that these sign languages exist within the Arab world where there are many common emblematic gestures. It is indeed said that speech, gesture, and culture are so intimately related to Arabs that to tie an Arab’s back while they are speaking is tantamount to tying their tongue (Barakat, 1973). It is not unlikely then for deaf Arab communities with little or no contact with each other to have similar signs due to a shared gestural repertoire.

Finally, LIU-ABSL cognates are at 24%, which is a higher rate than 17% shared by LIU and ASL. While these results fall within the unrelated category, the slightly higher base level for ABSL than for ASL may due to the fact that LIU and ABSL share the same culture. It should also be noted that the difference might be due to the discrepancy in vocabularies compared. In the LIU-ASL comparison, more than twice the vocabulary was available than with LIU-ABSL. Possibly if a larger vocabulary were compared, the degree of similarity would drop.
6. Conclusion

Given the tradition of endogamy in the Arab world which leads to high rates of genetic deafness, most likely there has been a long history of sign languages in the region. As the results of this study show, many of these sign languages are distinct languages, not dialects, and are unrelated historically. Similarities in their vocabularies may be attributed to sharing similar cultural values and gestural repertoires. These results follow from the historical pattern of sign languages in the Arab world which develop largely in familial institutions as opposed to educational ones as is the Western pattern. Indeed, organized educational systems in the Arab world are relatively young. This presents a unique geography of sign languages unlike the situation in the West. It can, however, be paralleled to Woodward’s (1991) findings on sign languages used in Costa Rica, where he found several distinct ones among the numerous indigenous pueblos.

Finally, a key question in lexicostatistics of sign languages is whether two unrelated sign languages have more vocabulary in common than any two unrelated spoken languages. We find in our comparison of sign languages of the Middle East region that two geographically distant sign languages can have a somewhat higher base level of similarity when compared to two unrelated spoken languages, suggesting that there is something inherent in the visual-gestural modality of sign languages that predispose their vocabulary to similarity. This may be why sign languages of a region can seem to be similar when upon closer analysis, they fall below a threshold of measurable similarity.

References


Abstract

Space is one of the basic domains of human cognition. Every language has its own forms of representing spatial relations of entities. Spatial representations in sign languages are worth studying because in sign languages spatial relations are construed by using 3-D space (signing space). This paper aims to investigate perspective taking strategies and reference frames that are used in the static-spatial descriptions of Turkish Sign Language (TID). We find that TID signers take narrator and neutral perspectives even in situations where they know that addressees are expected to retell the descriptions. Also, TID uses intrinsic and intrinsic+relative reference frames in talking about spatial relations.

0. Introduction

We talk about situations and locate them in space in our everyday interactions. Our description of situations relies on the spatial relationships of the entities involved. We also need a reference point to describe the spatial arrangement of the entities. Choosing a reference point is, however, subject to our own experience with the environment surrounding us, our perception, and the language we use. The environment may give us a canonical representation of the situation; for instance, because of gravity an apple falls down from a branch of a tree to the ground. Our perceptual capacity may limit a representation of the situation such that we cannot talk about the situation unseen. In addition, every language has its own lexicalized and/or grammaticalized forms in representing a situation. Some languages use adpositions; others use case-markers or positionals in referring to spatial relations (Grinevald, 2006). This paper aims to investigate the linguistic representations that are used in the spatial-locative descriptions of Turkish Sign Language (TID)¹ Deaf native signers.

The outline of the paper is as follows: Section 1 is devoted to the theoretical background. In 1.1 the frames of reference are defined. Then in 1.2, the research on spatial descriptions within sign linguistics is discussed. Section 2 summarizes the present study. In 2.1, the research questions and hypotheses are given. Section 3 of this work is devoted to the method used: the information about participants (3.1), the material used in the study (3.2), and the procedure followed (3.3). The results of the analysis and the discussion of the results are in section 4. Section 5 concludes this paper.

1. Theoretical Background

In this section I will present up-to-date theoretical and empirical research on spatial language. First, I will review theoretical approaches to spatial conceptualization. Second, I will present empirical investigations on this issue from the studies on spoken and signed languages.

According to Jackendoff (1990), we conceptualize the spatial relations of objects in a conceptual structure (CS) by combining all aspects of spatial structure. This is, arguably, represented in the brain. This conceptualization process is subject to our perceptual capacity (spatial representations, SR) and all aspects of language structure, i.e. lexicon and grammar (language representations, LR). Although CS is universal, languages differ from one another in semantics because of the interface between syntax, CS, and the lexical concepts (Jackendoff, 1996, p.7). Our conceptualization results in a message (or a string of messages). However, the message has to be tuned to the language one uses and depends on one’s own communicative intention (Levelt, 1996, pp. 77-81).

A conceptualization of a spatial arrangement resulting in a message takes into account that there is usually an asymmetrical relation between entities with respect to each other (Talmy, 1983, 2000). Relations can be asymmetrical with regard to size, containment, support, orientation, order, direction, distance, motion, or a combination of these in the entities located in a space (Svorou, 1994, p. 8). In an asymmetrical relation, we identify one entity as Figure (F) with respect to a referent object, a Ground (G) (Talmy, 1983, p. 232). There is a tendency to identify larger, immobile, culturally significant, and familiar objects as G (Svorou, ibid., p.9-12).

In addition, in describing a spatial arrangement a speaker should choose a perspective for their message. There are three perspectives defined to date. One of them is narrator perspective in which the speaker takes his/her own perspective and describes the spatial relations accordingly. Another one is addressee perspective in which the speaker describes the spatial relations according to the addressee’s viewpoint. In English descriptions, for example, there are cases in which the addressee

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2 For the evidence from the studies on perceptual spatial representation see Peterson, et al. (1996, pp. 556-562).
perspective is highly likely taken in interaction between interlocutors regardless of relative positioning of the interlocutors (see Schober, 1993). The third choice of perspective is neutral perspective, defined as the perspective which is a combination of the other two. Moreover, in neutral perspective, there can be no reference to narrator or addressee.

Asymmetrical relations, \( R(F,G) \), need a coordinate system to describe the spatial arrangements of the entities in space. In a coordinate system, one strategy is to locate an entity (F) in relation to another entity (G) on the basis of a search domain of G. After establishing the asymmetrical relations between the entities, the lexical items giving information about \( R(F,G) \) are always used in the context of an assumed coordinate system (Jackendoff, 1996, p. 15). There are three coordinate systems, or frames of reference, defined and widely accepted: intrinsic, relative, and absolute (Levinson, 1996a; Levinson and Wilkins, 2006). These coordinate systems are discussed in the next section.

### 1.1. Three Frames of Reference

Three frames of reference are distinguished on the basis of the following criteria: origin of the description (object vs. environment vs. viewpoint), type of relation (binary vs. ternary), and egocentric vs. allocentric, among others (Levinson, 1996a, pp. 148-152; 2003, pp. 24-34). Table 1 shows how these reference frames are distinct according to those criteria.

<table>
<thead>
<tr>
<th>Reference Frames</th>
<th>Origin</th>
<th>Relation Type</th>
<th>Egocentric vs. Allocentric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic</td>
<td>Object</td>
<td>Binary</td>
<td>Allocentric</td>
</tr>
<tr>
<td>Relative</td>
<td>Viewpoint</td>
<td>Ternary</td>
<td>Egocentric</td>
</tr>
<tr>
<td>Absolute</td>
<td>Environment</td>
<td>Binary</td>
<td>Allocentric</td>
</tr>
</tbody>
</table>

Table 1. The three reference frames.

On the basis of these criteria three reference frames are defined. Intrinsic frame of reference is a coordinate system of a binary spatial relation between F and G, almost always object-centered, and allocentric. To give an example from English: “The car is in front of the house” where G is the

---

2 In the literature, there are many other reference frames defined. For instance, Jackendoff (1996, pp. 15-9) proposed eight frames (four are intrinsic; the others are environmental). Nonetheless, I will follow Levinson’s definitions here.

3 Note that the expression ‘The ball is in front of me’ employs intrinsic reference frame. It is because there are only two arguments (ball and me: binary relation) within which ball is F and me is G.
house and $F$ is the car. In this expression the car is located according to an intrinsic feature, ‘the front’ of the house, which is, supposedly, the entrance of the house. It is object-centered because there is no reference to the environment or to the viewpoint of the interlocutors. Thus, it is allocentric, too (Levinson, ibid., 140-2).

Relative frame of reference is a coordinate system of a ternary relation between $F-G$, and the viewpoint of the interlocutors, almost always viewer-centered, and therefore, egocentric\(^4\). To give an example from English: “The car is to the left of the house” where $G$ is the house and $F$ is the car. In this expression the car is located according to the viewpoint of the speaker; thus, viewer-centered and egocentric (Levinson, ibid., 142-5).

Absolute frame of reference is a binary relation between $F$ and $G$, almost always environment-centered, and thus allocentric. In this reference frame, the spatial arrangement of $F-G$ is given based on fixed geocardinal directions (north/south) and landmarks (uphill/downhill). To give an example from English: “The car is to the north of the house” where $G$ is the house and $F$ is the car. In this expression, the car is located according to the cardinal directions referring to the house; hence, it is environment-centered and allocentric.

The three reference frames are used across all languages studied to date. However, every language gives more importance to, or uses more extensively, one of the reference frames over the others. In Table 2 possible combinations of reference frames are given with some language examples (Levinson, 1996b, p. 8; Pederson et al. 1998; see also Majid et al. 2004 for discussion).

<table>
<thead>
<tr>
<th>Intrinsic</th>
<th>Intrinsic &amp; Relative</th>
<th>Intrinsic &amp; Relative &amp; Absolute</th>
<th>Absolute &amp; Intrinsic</th>
<th>Absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mopan</td>
<td>Japanese</td>
<td>Kgalagadi</td>
<td>Guugu Yimithir</td>
<td>Tzeltal(^5)</td>
</tr>
<tr>
<td></td>
<td>Dutch</td>
<td>Yucatec</td>
<td></td>
<td>Hai//om</td>
</tr>
<tr>
<td></td>
<td>Turkish (Arik, 2003)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Possible combinations of the reference frames with language examples.

\(^4\) Note that the expressions ‘The ball is to the left of the house, from your point of view’ and ‘Bill noticed that the ball is to the right of the house’ are based on relative reference frames. In the first one, it is a ternary relation within which the reference is given to the addressee; in the latter, it is a ternary relation, too, within which the reference is given to the third person.

\(^5\) See Pederson (1994) for an extensive discussion of the Tzeltal absolute system.
In the next section, I illustrate the sign language systems recruited in describing spatial relations that refer to the referents.

1.2. **Sign Language Research on Spatial Descriptions**

In recent studies on spatial descriptions there has been growing interest in sign languages since using signing space carries linguistic information about these descriptions. In signing there may be no need for the linguistic forms other than the classifier constructions since these constructions, by definition, express the motion and the direction of entities; the relational items are realized in the classifier forms (see Emmorey, 2002, pp. 76-82 for ASL; Arik and Nadolske, 2006 for TID). It is claimed that the classifier forms may not convey information about the location of the entities (Emmorey and Herzig, 2003). The locative relations between entities can be realized by means of the use of signing space (Liddell, 2000).

In order to talk about spatial contrastive relations between referents, an ASL signer chooses either viewer space in which the signer uses his or her own viewpoint in description or diagrammatic space in which the signer uses bird’s-eye perspective. Studies have shown that signers represent spatial relations among entities taking, first, a perspective in space (viewer vs. diagrammatic), and then using the frames of reference mentioned above (see Emmorey, 2002, pp. 91-9; 1996, pp. 179-184). This perspective can be either deictic (narrator or addressee) or non-deictic (neutral). While ASL signers use both deictic and nondeictic perspectives, Croatian Sign Language (HZJ) signers use narrator perspective extensively (Arik and Milković, 2007). After the signer chooses a perspective in describing locative relations between the referents, he or she demonstrates the contrastive relations between the objects by taking into account either intrinsic features of them (intrinsic frame of reference) or his or her own viewpoint (relative frame of reference) or the geographical landmarks (absolute frame of reference) (Emmorey, 2002). It also seems that, similar to what is found in spoken languages, the choice of reference frames differs from one sign language to another.

2. **Present Study**

From the little we know, spatial representations have interesting features in TID. Preliminary research has indicated that the signers of TID are inclined to use both the intrinsic features of the spatial referents and their own viewpoint. However, there is a strong need to investigate other factors such as shared space, shared perspective, and role shifting which affect the linguistic representations of the spatial events (Arik, 2003).
In the present study, TID signers are asked to give spatial descriptions of two pairs of entities in different situations. The pairs of entities are made of small toys. The two objects are presented in a static situation in which the objects have no motion. In each situation, the objects are located on different axes. In one of the two configurations, the objects are located on a lateral axis (left-right); in the other one, the objects are positioned on a sagittal axis (front-back).

2.1. Research Questions and Hypotheses

In light of the previous work on this issue, this paper takes into account linguistic expressions in describing locative contrastive relations among objects in TID. Following Arik (2003), I investigate TID static events descriptions extensively in this study. I aim to understand conceptualization of space in TID in general and properties of locational events, frames of reference, and perspective taking strategies in particular. My goals include a contribution to semantic typology of reference frames (cf. Pederson et al., 1998) on the basis of TID findings and a deeper examination of the use of signing space in sign languages. In the following parts of this section I address the research questions concerning the three aspects of spatial representation and I also formulate my respective hypotheses.

I focus on the following questions:

1- Which reference frame(s) (intrinsic, relative, absolute) is used in TID spatial descriptions?
2- Which perspective (narrator, addressee, neutral) is preferred in TID?
3- How do perspective taking strategies interact with the relative positioning of interlocutors?

The operational definitions of the terms used in these questions will be given in section 3.3.2.

On the basis of my own previous work and observation I have developed several hypotheses and respective expectations. First, I expect TID signers to employ the linguistic forms, i.e. ‘classifiers’, that encode not only location of the referent but also orientation of the referent in the signing space. This observation is fundamentally different from spoken language spatial coding strategies. The use of certain linguistic forms gives rise to my second hypothesis. That is, I do not expect to find any use of relative frame of reference (narrator perspective + no reference to orientation of the objects in scene) in TID. Instead, intrinsic and relative reference frames are conflated.
3. Methodology

3.1. Participants

The Deaf participants (n=12; 3 females, 9 males; age range: 18-50) are second, third, or fourth generation deaf (above 90 dB hearing loss) and exposed to sign language from birth. They reported that they learned TID from their parents. Since there is no sign language education in Turkey and there is no tool to assess the proficiency level in language, native knowledge in TID is considered only. Their educational level varies. Data were collected in Izmir, Turkey in May-June, 2006.

3.2. Material

Sixty pictures consisting of several spatial arrangements of objects were shown to the signers who were expected to describe the object relations to a native signer addressee. The descriptions of twelve of the pictures were analyzed extensively. These pictures were prepared by using small toys, i.e. dolls, planes, cars, animals, etc. The background color was white-gray. Background and shadows of the objects were kept to give a 3-D impression. Among the testing items, there were control items, which were excluded from the analysis. All descriptions were videorecorded for analysis. In the following, I give testing item examples.

![Testing Item Samples](image)

The testing items consisted of several spatial arrangements of the toys. There were object arrangements on the left-right axis such as (a) and (b); on the front-back axis such as (c) and (d). In addition, there were several arrangements of object orientations. Thus, for example in (b) and (c), objects faced toward the same direction; in (a) objects are facing each other; and in (d) objects are facing different directions.

3.3. Procedure

3.3.1. Data collection

A digital camera, a laptop, a small table for the laptop, two chairs for the participant and the addressee were prepared beforehand. The laptop on the small table was put in front of the
participant who had a clear view of the laptop. The participant, the laptop, the addressee, and the camera were on a straight line. The Deaf participants were recorded either at the Izmir Deaf Association Computer Room or at their home. Each participant was requested to look at the pictures very carefully and to describe the event in as detailed way as possible to the addressee. S/he was also told that there is no right or wrong description for the event in the picture. While looking at the addressee, s/he described the event. There was no trial session since the very first items were control items. The entire data collection session lasted 3 to 5 minutes per participant. When s/he demanded more information about the events, this was provided by the experimenter. In the end, permission for using the recorded data in academic settings was obtained from the participant. All participants were also given a small gift for their participation.

3.3.2. Operational Definitions and Coding
In this section I will summarize operational definitions, measures, and the coding system that are used in this study. Signing space is the space between the signer and the addressee which includes signers’ front and body. Signing space is divided into two axes for research purposes. Both axes are in the neutral space, which is in the front of the signer. The lateral axis is the axis that lies from left to right of the signer whereas the sagittal axis lies from proximal to distal.

On the basis of matching criteria perspective taking strategies are coded. There are three: Narrator, Addressee, and Neutral. The description is understood as narrator perspective when the narrator describes the picture from his/her viewpoint. The description is understood as addressee perspective when the narrator describes the picture according to addressee’s point of view. The description is coded as neutral perspective when neither the narrator nor addressee perspective is taken in the description.

Reference frames are coded according to perspective taking strategies. The description is coded as intrinsic frame of reference when perspective is neutral. It is coded as relative frame of reference when perspective is either narrator or addressee but no “classifier forms” are used since these forms encode inherent features of the referents in addition to relative locations. The spatial description is coded intrinsic+relative frame of reference when perspective is either narrator or addressee used with “classifier forms”. Absolute reference frame can be taken only when the narrator refers to an external constant landmark or geographical north, south, west, east, etc. I give examples from the data in the following.
Figure 2. Testing item (a) and its (partial) description.

(1) TID: TWO CAR CAR-SHAPE:3-D:RECTANGULAR TWO CAR$_1$-LOC:BACK-ORI:AWAY CAR$_2$-LOC:FRONT-ORI:AWAY

“Two 3-D rectangular shaped cars [=trucks] are located on the sagittal axis and oriented away from me”

Since the trucks in testing item (Figure 2a) are located on the lateral axis in the actual scene, I expect a representation of these trucks on the lateral axis of signing space when a narrator perspective is used. However, the signer uses the sagittal axis. Orientations of the trucks (facing the same direction) match with Figure 2a. But locations of the trucks (Figure 2a) are represented in different locations in her signing space. Therefore, perspective is neutral. If perspective is neutral and there is no reference to an external landmark, then the reference frame employed in the description is intrinsic, which is the case in this description.

Figure 3. Testing item (Figure 2a) and its (partial) description.

(2) TID: CAR CAR$_1$-LOC:LEFT-ORI:RIGHT CAR$_2$-LOC:RIGHT-ORI:RIGHT

“Two cars [=trucks] are located on lateral axis and oriented toward right.”
This signer describes the same testing item in Figure 2a. His description differs from (1) in the following ways. Locational and orientational information is kept in his signing space. He takes narrator perspective. Orientational information, by definition, specifies inherent features of the objects in the scene. Therefore, his description is coded as intrinsic+relative frame of reference.

In order to understand whether perspective taking strategies interact with relative positions of the interlocutors I created three situations. In one of the situations the narrator and addressee were seated side-by-side; in another the pair were seated face-to-face. In the third situation they were seated diagonally or at “90-degrees”. The narrator first described the picture to the addressee who was expected to retell the same description to the narrator. The interaction between the interlocutors is coded according to the perspective strategy of both narrator and addressee.

Here I give two examples from the data collected. In Figure 4a,b the narrator and the addressee are seated face-to-face. In (4a) the narrator on the right first describes the testing item to the addressee. In (4b) the addressee on the left describes what he understands.

In (4a) the narrator takes narrator perspective since the objects in the testing item are located on a sagittal axis and oriented proximal to distal. In (4b) the addressee describes it from the narrator’s point of view (his own; he mentally rotates the scene). Glosses and translation are given in (2) for Figure 4a, (3) for Figure 4b.

(2) TID: HORSE PIG HORSE-LOC:FRONT-ORI:AWAY PIG-LOC:BACK-ORI:AWAY
“A horse and a pig are located on sagittal axis and oriented away from me.”

(3) TID: HORSE PIG HORSE-LOC:FRONT-ORI:AWAY PIG-LOC:BACK-ORI:AWAY
“A horse and a pig are located on sagittal axis and oriented away from me.”
Figure 5a,b illustrate another example of interaction. In this example, the narrator and the addressee are seated diagonally. In (5a) the narrator on the left first describes the testing item to the addressee. In (5b) the addressee retells it. In (5a) the narrator takes neutral perspective since the objects are located on a lateral axis in the picture. In (5b) the addressee describes it from the narrator’s point of view (mentally rotate the scene). Glosses and translation are given in (4) for Figure 5a, (5) for Figure 5b.

(a)      (b)

Figure 5. Perspective taking in interaction.

(4) TID: PIG PIG₁-LOC:LEFT-ORI:LEFT PIG₂-LOC:RIGHT-ORI:RIGHT
   “Two pigs are located on lateral axis and facing different directions.”

(5) TID: PIG PIG₁-LOC:LEFT-ORI:LEFT PIG₂-LOC:RIGHT-ORI:RIGHT
   “Two pigs are located on lateral axis and facing different directions.”

4. Results and Discussion
In this section I will present the results from my analysis. First, I will discuss perspective taking strategies without any interaction between interlocutors. Second, I will present the results from TID reference frames. Finally, the results from TID perspective taking strategies during interaction will be given.

4.1. Perspective
I expected that TID signers would use both narrator and neutral perspectives. I found that TID signers employ narrator (68% of the descriptions) and neutral (32% of the descriptions) perspectives. Importantly, there is no use of addressee perspective. This finding suggests that TID signers take either narrator or neutral perspective in their spatial descriptions. Addressee perspective
is never taken; therefore, I do not expect a signer to describe a spatial arrangements of objects according to his/her interlocutors’ viewpoint.

My finding is contra to what Schober (1993) reported. That is, according to Schober the (English) narrators take the addressee perspective in face-to-face situations in front of the (real or imagined) addressees. However, the TID strategies are in line with what Emmorey (2002) and Emmorey et al. (1998) report for ASL. According to their works ASL signers describe the scenes from narrator perspective such that addressees must perform a 180-degree mental rotation to comprehend the description. TID signers do so, too. However, this strategy cannot be generalized such that sign languages differ from spoken languages in preferring narrator or neutral perspective over addressee perspective.

4.2. Frames of Reference

I found that TID signers employ intrinsic+relative (68% of the descriptions) and intrinsic (32% of the descriptions) reference frames. There was no description with either relative or absolute frame of reference taken.

As I expected, TID signers did not employ relative frame of reference. It might be because of the linguistic forms, i.e. ‘classifiers’, and their functions. ‘Classifier forms’ encode locative-relational and inherent features of the objects with respect to each other. Thus, it is not possible to analyze their use in spatial descriptions without capturing intrinsic reference frame. Nonetheless, when an F-G relationship is conveyed with respect to narrator’s perspective, reference frame is coded as relative by definition. What I suggest is that intrinsic and relative frames of reference are conflated in TID. Then the question is whether there is any possibility of using relative reference frame only without referring to intrinsic properties of the objects.

The use of relative frame of reference is possible in a (hypothetical) signed description. When the referents are introduced by indexical signs such as pointing toward the location of the object in signing space along with taking either narrator or addressee perspective, this strategy can be coded as relative reference frame. However, this kind of encoding spatial relations is never detected in the present TID data.

This finding has repercussions in the typology of frames of reference (cf. Pederson et al., 1998). As given in Table 2 languages can be typologically grouped according to their preference in choosing reference frames. In this table, there is no place for the languages in which intrinsic and relative reference frames are conflated. On the basis of the findings in this study I claim that there are languages such as TID which prefer intrinsic & intrinsic+relative frames of references.
TID frames of references differ from American Sign Language (ASL) frames of references in the following respects. In ASL, according to Emmorey 2002, signers choose a perspective in describing locative relations between the referents, then they demonstrate the contrastive relations between the objects by taking into account either intrinsic features of them (intrinsic frame of reference) or his or her own viewpoint (relative frame of reference) or the geographical landmarks (absolute frame of reference). What I found is that in TID there is no use of relative or absolute frames of reference. It is still possible that ASL relative reference frame is similar to what I called intrinsic+relative reference frame in TID. Typologically, then, ASL belongs to the languages that prefer all three reference frames, i.e. intrinsic, relative and absolute, whereas TID belongs to the group of languages that prefer intrinsic and relative reference frames.

4.3. Perspective in interaction

I found that TID narrators use narrator and neutral perspectives only even when addressees are expected to describe the scene respectively. In all three situations, i.e. face-to-face, side-by-side, and 90-degrees, narrators never describe the object relations from their addressees’ viewpoint. Table 3 gives approximate percentages of narrators’ perspective taking strategies during interaction.

<table>
<thead>
<tr>
<th></th>
<th>Face-to-face</th>
<th>Side-by-side</th>
<th>90-degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrator Perspective</td>
<td>52%</td>
<td>57%</td>
<td>57%</td>
</tr>
<tr>
<td>Neutral Perspective</td>
<td>48%</td>
<td>43%</td>
<td>43%</td>
</tr>
</tbody>
</table>

Table 3. TID Narrators’ descriptions: Approximate percentages of perspective types.

An analysis of addressee descriptions showed that TID addressees retell the descriptions on the basis of narrator’s point of view or a neutral perspective. Table 4 summarizes approximate percentages of perspective types. What is remarkable is that during side-by-side interaction, perspective taking strategies of addressees are very similar to the findings from the earlier no interaction condition. In face-to-face and 90-degrees interactions, however, TID addressees mostly take narrators’ perspective. In doing so, the evidence suggests that addressees must (mentally) rotate the object relations made in the narrators’ signing space. This finding suggests that the TID signers in the sample have no difficulty taking narrator perspective and retelling the same description.
Table 4. TID Addressee retellings: Approximate percentages of perspective types.

<table>
<thead>
<tr>
<th>Perspective</th>
<th>Face-to-face</th>
<th>Side-by-side</th>
<th>90-degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrator Perspective</td>
<td>94%</td>
<td>68%</td>
<td>91%</td>
</tr>
<tr>
<td>Neutral Perspective</td>
<td>6%</td>
<td>32%</td>
<td>9%</td>
</tr>
</tbody>
</table>

However, TID strategy is different from that of spoken languages. According to Schober (1993), for example, (English) speakers take often their addressees’ point of view in face-to-face interaction. He also found that this strategy does not change during side-by-side interaction. Nonetheless, there is no addressee perspective taken in the TID data. This observation gives rise to several questions. For example, how, then, do TID signers establish referring expressions such as pronominals in the signing space? I leave this question open for future investigation.

5. Conclusion

In this paper I analyzed spatial-locative representations in TID. I focused on three research questions: 1) Which reference frame(s) (intrinsic, relative, absolute) is used in TID spatial descriptions? 2) Which perspective (narrator, addressee, neutral) is preferred in TID? 3) How do perspective taking strategies interact with the relative positioning of interlocutors? If my analysis is correct, then TID signers prefer intrinsic and intrinsic+relative reference frames, and narrator and neutral perspectives. This is contra to ASL findings which suggest that ASL employs all three of the reference frames (Emmorey, 2002). This report also contributes to the typology of reference frames (cf. Pederson et. al., 1998) in which there is no place for intrinsic+relative languages (other than mixed languages such as intrinsic and relative). My final remark is that I believe that even though space is represented by using signing space in the sign languages studied so far, there is no reason to assume that the use of signing space is “identical” across sign languages.

There is a need for investigations on other languages to understand how static-locative relations are made in particular and how spatial information is conveyed in general before making claims on the basis of findings from a single language. This is exactly what I am planning for my future study on ASL (American Sign Language), HZJ (Croatian Sign Language), and ÖGS (Austrian Sign Language) to replicate this study and compare the results. I believe that studying
these languages may provide a better understanding of spatial language. In a similar vein, a planned future study will examine topological relations and motion events in these languages. I hope that a deeper examination of spatial descriptions from a crosslinguistic perspective will contribute to the understanding of ‘spatial grammar’, e.g. pronominalization, indexation, temporal relations, because all appear to be coded in signing space.

Acknowledgements

This study is supported by NSF grant (BCS-0345314) awarded to Ronnie Wilbur, which is extended to TID research (Engin Arik). I thank Beril Tezeller Arik for her assistance to prepare testing items. Aysel Basar assisted data collection and transcription of the data and Sabiha Orer also helped data collection. I thank both. Finally, I am grateful to the Deaf TID signers who participated in this study and willingly shared their insights with me.

References


The research presented in this paper attempts to deepen understanding of MOUTH MORPHEMES, by which we mean ‘morphemes which involve the mouth as their primary articulator’. Such morphemes have been mentioned in the literature for decades, but often with only a superficial treatment. We attempt a more thorough coverage than has appeared previously, both of their general role within the grammar of ASL (sections 2 and 3) and of descriptive details of specific morphemes (section 4). We focus especially on combinatorial restrictions of mouth morphemes with manual signs and aspectual modulations.

There are two primary sources of our data, in addition to previous scholarly literature:

- Intuitions of Kathy Fraychineaud (5th generation Deaf from New Orleans, ASL instructor) and recorded videos of her signing
- Videotaped examples by Kevin Struxness (1996; Deaf, ASL instructor, southern California)

1. Distinguishing Function from Etymology

Different uses of the mouth in signed languages are often categorized diachronically, in terms of their etymological origin: whether or not they are borrowed from a spoken language. For example, the papers in Boyes Braeme and Sutton-Spence 2001 distinguish between MOUTHINGS and MOUTH GESTURES.2

- Mouthings: Borrowed from a spoken language, including both full and partial mouthing.
- Mouth gestures: Not borrowed from a spoken language; may be derived from gestures used in the surrounding community or iconic representations, or they may have no obvious origin.

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1 That is, mouth morphemes do not have a primary manual component, although as we discuss later, they do sometimes involve modified motion on manual signs.

2 The term MOUTH GESTURE is unfortunate in light of Sandler’s (2003) distinction between mouth morphemes and true instances of gesturing with the mouth, in that many “mouth gestures” are part of the grammar, not gestures in Sandler’s sense.
For our purposes, however, we prefer to classify them according to their status in the synchronic grammar.

- Use of the mouth which is an inherent part of specific manual signs.
- Use of the mouth as an independent morpheme which combines with a variety of manual signs (MOUTH MORPHEME).

These two ways of classifying them are logically and empirically independent. Most mouthings fall in the first category, and most mouth gestures fall in the second, but the correlation is not 100%.

<table>
<thead>
<tr>
<th>Mouth shapes inherently associated with particular manual signs</th>
<th>Borrowed from English (mouthings)</th>
<th>Not borrowed from English (mouth gestures)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[ʃ] with FINISH</td>
<td>[p] (“pah”) with SUCCESS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>squared lips with TORMENT,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Liddell 2003:13-14)</td>
</tr>
<tr>
<td>Mouth shapes independent of particular manual signs (“mouth morphemes”)</td>
<td>oo ‘to an amazing degree’</td>
<td>cs ‘near’</td>
</tr>
<tr>
<td></td>
<td>(from interjection “ooh”)</td>
<td>th ‘sloppily’</td>
</tr>
</tbody>
</table>

We concentrate on the second row.³

2. The nature of mouth morphemes

In this section, we describe key properties of this group of morphemes. This is important, since they are often described in the literature in a superficial and thus somewhat inaccurate way.

2.1. Are dynamic and require coordinated timing with manual signs

Some mouth morphemes involve a sequence of mouth shapes. Timing of the transition from one mouth shape to the next is carefully coordinated with motions in associated manual signs.⁴

- In cha (section 4.2), the mouth reaches its final open position at the same time as the hands reach their final location.
- In po (section 4.11), the gap between manual articulators (hands or fingers) narrows at the same time as the mouth opens.
- sta-sta (section 4.16) cooccurs with signs that have cyclic motion. The mouth opens rapidly at the same time as the primary pulse of the manual cycle (i.e. the point at which a moving hand

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³ Two other uses of the mouth should also be recognized, and are also not the concern of this paper: full mouthing in contact signing (Lucas and Valli 1990) and gesturing with the mouth (Sandler 2003, cf. McNeil 1992).

⁴ This suggests, of course, that mouth morphemes are associated with the same timing slots as manual components, that is, they share a single timing skeleton.
passes a point of articulation, or the fastest segment of a cycle which varies in speed), then closes more slowly during the rest of the cycle.

2.2. **Involve more than just the mouth**

Some mouth morphemes involve other nonmanual articulators, particularly the head and shoulders.⁵

| cs ‘close’: raised shoulder, head turn/tilt | sta-sta ‘with effort’: head tilt | clenchTopic: head/shoulders drawn back from referent, shoulder tilt |
| NEAR/cs | STUDY/sta-sta | THAT-ONE/clench-topic |

Some mouth morphemes induce changes in manual motion. For example, *th ‘sloppily’*, introduces erratic irregularity in path and pacing. Unlike aspectual modulations (Klima and Bellugi 1979:243-271), this change in motion does not have any morphemic status; it only occurs with *th*, and is therefore part of that morpheme. (Cf. unrealized inceptive aspect, Liddell 2003:37-40, which likewise has both nonmanual components and modification of manual motion, and our comments about *mm/mm* in sections 4.7 and 4.8)

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⁵ The term *MOUTH MORPHEMES* may turn out to be just a convenient phonological classification (“those morphemes that use the mouth but not the hands”) rather than a principled category relevant to the grammatical structure of the language. That is, the picture that seems to be emerging is that ASL morphemes vary in what combinations of articulators they use. Many morphemes specify the use of one or both hands, but some do not. Some happen to specify mouth shapes; others do not. Some involve other non-manual articulators; others do not. These different classes of phonological features combine with each other in many different ways and a full description of each morpheme needs to note all articulators that are consistently involved in its production. There is not a clean distinction between mouth morphemes and others, or for that matter, between manual signs and non-manual signals; such distinctions refer only to phonological components, not whole morphemes.
2.3. **Are not just adverbial**

Often mouth morphemes are characterized as “adverbial” or even as “adverbs”. That is, many express degree, manner, and affective evaluation, the prototypical meanings associated with adverbs, and are used to modify verbs, adjectives or other adverbs.

- CLEAN/clench ‘extremely clean’
- WRITE/th ‘write sloppily’
- STUDY/puffedBlow ‘study a lot’
- FAR/ahh ‘very far’
- DIRTY/oo ‘amazingly dirty’
- WORK/halflip ‘work with complaint’

However, some mouth morphemes have uses that are not normally considered “adverbial”, such as size, quantity, distance, relativization, and conversation regulators.

- LARGE/cha ‘large’
- SMALL/po ‘tiny’
- CL-bentB/CL-B/cha ‘a lot (of homework)’
- CL-1:“here”/cs ‘right next to’
- CL-Y:“fat legs walking”/puffed ‘(fat person) waddling along’


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6 The brow raise is likely the separate morpheme for topicalization, since relative clauses generally occur only in topics; the relative clause signal itself must consist of the raised upper lip and backward head tilt, and thus is appropriately called a “mouth morpheme”.

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35
In some cases, e.g. with LARGE/cha above, the mouth morpheme appears not to add very much to the meaning of the manual sign. However, it is still analyzable as a distinct morpheme because it involves a consistent form-meaning association that can occur with several different manual signs.

2.4. **Have cooccurrence restrictions with signs and aspectual modulations**

Mouth morphemes are almost always used in combination with individual manual signs. However, there are severe restrictions on which mouth morphemes can be used with which signs.

- *BECOME-SICK/cs ‘(become recently sick)’
- *DIRTY/ahh ‘(very dirty)’
- *EMBARRASSED/mm ‘(normally embarrassed)’

There are also restrictions on combinations of mouth morphemes and aspectual modulations.

- *clench* occurs only with a limited set of aspectual modulations (see section 4.3).

The exact nature of these restrictions (the rules that account for them) remains unclear and is one subject of our ongoing research. We document some of them in section 4.

2.5. **May combine with each other and with mouthings**

One of the more interesting facets of the use of the mouth as an articulator is that mouth morphemes and mouthings can combine with each other, either simultaneously or sequentially.

- *sow* may be a compound of *clench+oo* (see section 4.15)
- *mm ‘as expected’ + puffed ‘large’ = ‘large but as expected’ (Baker-Shenk and Cokely 1980:20)
- *th ‘sloppy’ + puffedBlow ‘very’ = ‘very sloppy’ (Struxness 1996 04:24)
- *clench* ‘very’ can combine with mouthings and with intensive aspectual modulation to express intense or dark shades of color (Struxness 1996 07:54)
  - RED/[ɹɛ] (with the spread lips of *clench* on the vowel and greater tension throughout) ‘very red’
• TAN/[tæn] (with the spread lips and greater tension of clench throughout) ‘dark tan’

• For Struxness (1999 22:50, 50:10), at least, a tongue wag (protruded and trilled vertically), meaning ‘extremely’, can be infixed in mouthings associated with certain aspectual signs.7

• FINISH/[f]tongueWag[f] ‘finally after a long time’

• MUST/[m]tongueWag[s] ‘mandatory’

3. The role of mouth morphemes in ASL grammar

Where, exactly, do mouth morphemes fit in the grammar of ASL and of signed languages generally? Although they may involve a completely different type of grammatical construction than is found in spoken languages, it seems reasonable to attempt to characterize them first using the same general theoretical constructs that are well-documented in languages generally. There are, then, three hypotheses that should be considered about their role in the grammar:

• derivational (lexical) morphology: Mouth morphemes are not listed by themselves in the lexicon, but are specified as derivational affixes included in complex lexical items built on manual signs as roots.8 Word formation rules exist to create novel combinations of some morphemes with lexical signs and classifier constructions, but these rules vary in productivity.

• inflectional (syntactic) morphology: Mouth morphemes are not listed in the lexicon, but combine with manual signs as inflectional affixes according to general morphosyntactic rules.

• “simultaneous syntax”: Mouth morphemes are separate “words” that have the special property of being articulated simultaneously with other words (i.e., with manual signs). The rules that control these combinations are essentially syntactic.

Baker-Shenk and Cokely’s (1980:17) and Liddell (1980:42ff) seem to adopt the third hypothesis, since they describe mouth morphemes as “nonmanual adverbs”, and Liddell presents them under ADV nodes in syntactic trees (e.g. 1980:45, 50). Neidle et al. 2000:43ff, however, distinguish mouth morphemes from prosodic nonmanual signals such as the negative head shake or raised eyebrows for topicalization. For prosodic nonmanuals, they give a clearly syntactic account in terms of functional projections and c-command, which suggests that they feel mouth morphemes are not to be characterized in the same syntactic terms. They stop short, however, of actually claiming that mouth morphemes are morphology, describing them simply as “adverbial markings” and “modifiers” (p. 42) without offering any analysis.

7 Fraychineaud does not use tongueWag, and has never seen anything like the combinations Struxness reports. We have only limited data about tongueWag, and so we do not attempt to include it in section 4.

8 Liddell 1980:47 acknowledges this possibility for SLEEP+SUNRISE/mmm ‘sleep-in’.
We believe that the available current evidence, though not conclusive, points toward the first hypothesis, that most mouth morphemes combine with manual signs as derivational morphology.\(^9\)

We offer the following considerations in preliminary support of this position:

- **Most mouth morphemes are bound, not free; they must cooccur with a manual sign.**\(^10\)
- **Mouth morphemes normally occur only on single signs; they do not spread over syntactic constituents.** Though they may occur on several signs in sequence, they don’t show the variable spreading behavior characteristic of prosodic nonmanuals (Neidle et al. 2000:43-48). When the same mouth morpheme does occur on more than one sign in sequence, there can often be prosodic breaks between signs (e.g. brief relaxations of the nonmanual signal).\(^11\) In addition, Liddell 1980:48 notes that when *cs* ‘near’ occurs with expressions like YESTERDAY NIGHT, they are signed as compounds, hence consistent with the idea that *cs* is a derivational affix added to single word, rather than superimposed on a whole phrase.
- **The meanings of most mouth morphemes are not typical of inflectional morphology.** They often have multiple senses, and each sense is semantically complex rather than easily characterized using grammatical categories (see section 4).
- **Mouth morphemes do not organize into paradigms like inflectional morphology.**
- **There are apparently arbitrary gaps in what combinations are possible, of the type that is typical of derivational morphology:**
  - *clench* ‘extremely’ cannot be used with the standard form of SLOW used in most dialects (strong hand drawn along back of base hand), but can be used with a synonymous sign local to Arizona (Y hand with thumb at corner of mouth, wrist flexes down)
  - *clench* may be used with a classifier upright index finger to mean ‘walk along/past very fast’ if a rapid, tense, up-and-down motion or side-to-side wagging is superimposed on the motion path, but not with a smooth, fast sweep (which is surprising, because this is the most iconic possibility of the three). Instead, the latter motion uses *oo*.
  - Since there are cooccurrence restrictions (section 2.4) of mouth morphemes with aspectual modulations, and since Liddell 2003:49-52 argues that aspectual modulations are derivational affixes, it is likely that mouth morphemes are also derivational.

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\(^9\) Of course, they might conceivably be bound roots that participate in compounds with manual signs; tentatively we assume they are affixes since they do not occur alone and generally modify the meaning of the sign they attach to.

\(^10\) The conversational regulator *m-m-m* (section 4.9) can occur by itself, without a manual sign, and therefore cannot be considered to be an affix. However, *m-m-m* does not seem to combine with other material at all to form sentences, only with other conversation regulators such as OH-I-SEE. It thus appears to be in a class by itself, unlike the main body of mouth morphemes discussed in the argument in the text.

\(^11\) There are occasional exceptions, such as the use of *mm* (our *mmmm*) across an entire clause noted by Liddell 1980:66, note 19. It is not yet clear how to account for such usages.
• The meanings of mouth morphemes in combination with manual signs are not totally predictable, a characteristic typical of derivational morphology:
  
  • *th* with an upright CL-1 traversing a horizontal but erratic path typically means ‘walking clumsily due to drunkenness’, not due to some other reason such as cerebral palsy. The same mouth morpheme with WRITE typically means ‘writing sloppily due to inattention’. See Liddell 1980:50–52 for other specific meanings with particular signs.
  
  • *clench* ‘extremely’ often has negative connotations of pain, discomfort, danger, or excess. However, when used with an aspectual modulation that involves tense, short, rapid (trilled) movement of the hand(s), it means simply ‘fast’ with no negative connotations.
  
  • Most mouth morphemes are not relevant to the syntax in the sense of Anderson 1982:587; their distribution is not conditioned by the syntactic context in the same way that e.g. agreement and tense are. This, argues for them being derivational rather than inflectional.

If, in fact, most mouth morphemes are derivational affixes, then this has consequences for the conception of the ASL lexicon. Under standard assumptions about derivational morphology, each conventional combination of manual sign plus mouth morpheme needs to be listed in the lexicon. Indeed, in light of Liddell’s (2003:49-52) arguments about aspectual modulation being derivational, one must list each valid combination of manual sign plus mouth morpheme plus aspectual modulation.

Learners of ASL need therefore to acquire each combination on its own, in addition to whatever they eventually determine about the abstract characteristics of each mouth morpheme. This means, for example, in ASL language instruction, it is not sufficient to simply teach mouth morphemes or aspectual modulations in the abstract and give a couple examples of each. It is important to teach each combination as a separate vocabulary item in order for students to learn which combinations actually occur and what they mean.

4. **Specific mouth morphemes**

Our ongoing research includes a strong descriptive component, documenting the mouth morphemes that occur in ASL in greater detail than has appeared previously (extending the work in Struxness 1996 and Bridges and Metzger 1996). We aim to provide the following information, as precisely and completely as possible, about each mouth morpheme in ASL that we can find:

| citations | sample references, along with any informal names used in the literature other than the ones we use |
| phonology | prototypical phonological form: descriptions (with photos) of the mouth and any other articulators, modifications of manual motion, and coordinated timing with other articulators—any aspect of form that is associated with this morpheme and not (yet) attributable to other morphemes or general rules |
We include here results so far. Some of these morphemes are mentioned in the literature but not necessarily described well; others are (as far as we know) newly-reported here. Each section head indicates the informal name we use.

### 4.1. ahh

| citations | Struxness 1996 46:00 |
| phonology | Mouth open, more so than with *halflip*. Often cheeks raised, eyelids narrowed, and head tilted back. |
| semantics | 1) (with signs indicating extent of space or time) ‘long’, e.g. with FAR, ALL-DAY, and certain verbs  
2) ‘astounded’, e.g. with SHOCKED |
| notes | The two meanings are possibly better analyzed as two distinct morphemes. |

### 4.2. cha

| citations | Baker-Shenk and Cokely 1980:24, Bridges and Metzger 1996:38, Struxness 1996 03:00 |
| phonology | Phase 1) Jaw closed, upper teeth visible. Some signers start with lips thrust forward (squared or with large rounded opening). Phase 2) Mouth opens quickly at same time as manual sign reaches its final hold. |
| semantics | ‘large’ |
| grammar | Only used with adjectives expressing size or quantity, such as size-and-shape specifiers. Used redundantly with lexical adjectives such as LARGE, TALL. |
| notes | Often produces an audible [tʃḁ] or dental/alveolar click, which indicates contact of the tongue with the alveolar ridge during phase 1. |
4.3. clench

| phonology | Jaw fully closed, lips drawn back to reveal teeth. Eyebrows down and drawn together. Mouth corners may be either raised slightly or neutral. Inhale through teeth. Sometimes in an "intense" version: greater muscular tension overall in face, body and hands, exposing more of the teeth, adding squint, raising shoulders. |
| semantics | 1a) (with state verbs + intensive aspect) 'very, extremely', to a greater degree than with \textit{puffedBlow} (cf. Baker-Shenk and Cokely 1980:20) but a lesser degree than with \textit{sow}, e.g. with ANGRY, BEAUTIFUL, BIG-HEADED, BORED, CLEAN, DANGEROUS, DEPRESSED, DIRTY. Often has negative connotations of excess; used more often with roots with negative meanings.  
1b) (with state verbs + intensive/inchoative aspect) 'become extremely or rapidly ___', e.g. with BECOME-SICK  
2) (with distance or duration) 'very (and undesirably) long', e.g. with FAR, ALL-DAY  
3) (with quantities) 'very many', e.g. with HORDES  
4) (with colors) 'dark, intense, not pale, fully saturated'  
5) (with actions, using a rapid, tense, trilled motion) 'fast', e.g. with COOK, FLASH-LIGHT, RUN, SCRATCH, WALK, WALK-ALONG, WASH  
6) (with actions + other modulations) 'with pain, danger, effort, or discomfort'  
| grammar | Generally used only with certain aspectual modulations.  
- On states, often cooccurs with intensive aspect (Klima and Bellugi 1979:259): slow beginning, accelerate to abrupt stop and hold. In this case the intensified variant (with tension and squint) usually is used.  
- On actions, often cooccurs with a rapid, tense, trilled motion.  
- On a variety of word types, may occur with slow, tense motion, e.g. with ANGRY, DISGUSTED, HORDES  
| notes | The variant with raised mouth corners (first photo above) may be a distinct morpheme without any negative connotations, or may represent the addition of a smile as an emotive signal. |

4.4. clench\textit{Topic}

| phonology | Jaw fully closed, lips drawn back to reveal teeth. Eyebrows raised (due to standard marking for topic). Eyes wide open (no squint). Head drawn back away from referent of pronominal sign. Pronominal sign is articulated higher and closer to the body than normal. |
| semantics | 'topic' |

\textsuperscript{12} We prefer the label \textit{clench} for this morpheme, reserving the term \textit{intense} to describe a gradient modification of this and other mouth morphemes.
4.5. Cs

**citations**

**phonology**
Jaw closed, lips spread (more so on strong side), head tilt toward strong side, chin and strong shoulder pulled together. Articulation of manual sign is closer to strong shoulder than normal. Eyegaze at hands. Overall: all articulators are drawn towards the space between strong cheek and shoulder, hence the abbreviation cs. (In casual signing, may appear identical to clench, but in careful signing it is distinct: cs is asymmetric, with greater tension and prominence of signals on strong side.)

**semantics**
‘close in space or time’ (i.e. to some reference point, usually the place and time of locution). Greater tension and distinctness of the phonetic cues provides a gradient symbolization of greater closeness. (Baker-Shenk and Cokely 1980:177)

**grammar**
Either with adverbial expressions representing extent in space or time, or an apparently small number of active verbs such as APPROACH and ARRIVE.

**notes**
Baker-Shenk and Cokely (1980:18, 177-78) limit the reference point of the temporal sense to the present moment, but Fraychineaud can use it with a reference point displaced into the past.

4.6. halflip

**phonology**
Mouth partly open, upper lip raised exposing teeth. Head tilt back, eyes half closed. Brows not raised (unlike the nonmanual signal for relativization).

**semantics**
Indicates attitude of signer or agent: putting up with a situation but complaining internally about it, e.g. with DIRTY, DON'T-LIKE, EMBARRASSED, FLASH-LIGHT, READ, SICK, WALK

**grammar**
Occurs with an apparent wide variety of verbs, both states and actions.

**notes**
Perhaps derived from a sneer.

4.7. мм

**citations**

**phonology**
Mouth closed, lower lip pushed slightly upward. Face relaxed.
4.8. *mmm*

**citations**

**phonology**
Lips thrust prominently forward and upward, more so than with *mm*. Chin thrust forward (i.e., head tilt back). Often head tilt to one side. Manual motion relaxed and slower than normal, with no sudden changes in speed or direction.

**semantics**
‘with pleasure, enjoyable’

**grammar**
Seems limited to dynamic verbs.

**notes**
The morpheme *mmm* is not distinguished from *mm* in the literature, and not all signers make the distinction (e.g. Struxness 1996 14:00 does not). But, for some signers (e.g. Fraychineaud), the *mm* and *mmm* are phonetically distinct, at least in careful signing. For example, *mm* can be used with COOK when the strong hand is held above the base hand, palm contra, with trilled forearm rotation (unlike the normal gentle motion used with *mmm*); this combination means ‘cook routinely’. In contrast, *mmm* used on COOK, meaning ‘cook with pleasure’, requires 180° rotation of forearm and contact with the base hand on each turn. Similarly, Baker-Shenk and Cokely 1980:410 report CONTINUALLY-SICK/mm ‘be continually sick as a regular matter of course’, a meaning that is inconsistent with *mmm* ‘with pleasure’ but expected for *mm*. Liddell 1980:45 notes both meanings but stops short of positing two distinct morphemes, attempting rather to give a single abstract meaning that encompasses both usages.

4.9. *m-m-m*

**citations**
Struxness 1996 40:40

**phonology**
Mouth closed, corners down, lower lip thrust upward/outward trills open-and-shut repeatedly. Eyes wide open, eyebrows raised. Often accompanied with repeated head nodding at a slower rate than the lip trill. (See photo sequence in section 2.3.)

**semantics**
‘Oh really!, You don’t say!’ (i.e. backchannel response to moderately surprising new information)

**grammar**
Usually occurs alone, without any manual sign, but can also be simultaneous with manual backchannel signals like OH-I-SEE (Y hand, palm down, moving up and down in neutral space).

**notes**
With the lips closed (no trill), seems to be usable with manual signs as a possibly distinct mouth morpheme with closely-related meaning.
4.10. oo

| phonology | Mouth open slightly in center, corners narrowed. Some signers: lips rounded. Often with head turn to one side, eyes wide, eyebrows up. |
| semantics | 1) ‘to an amazing degree’, but a lesser degree than with clench, e.g. with BEAUTIFUL, DIRTY, WOW, HORDES, OVERWHELMING, WALK-PAST/fast, WORK/continuous 
2) ‘to a small degree’, e.g. on SHORT, SMALL, THIN (Baker-Shenk and Cokely 1980:376–7) 
3) (with colors) ‘light, pastel’ (in this usage, manual motion is slow and relaxed) |
| grammar | Generally does not combine with what Klima and Bellugi 1979:259 call intensive aspect. |
| notes | The distinct senses suggest that there may be distinct morphemes (cf. Baker-Shenk and Cokely 1980:21), but we haven’t been able to find any consistent difference in form. |

4.11. po

| citations | Bridges and Metzger 1996:44. |
| phonology | Mouth closed, opens to small slit in center. At the same time, eyebrows are pressed together, and the distance represented in the manual sign (between hands or fingers) becomes slightly smaller. (Illustrated with one of several possible manual signs.) |
| semantics | ‘very small’ |
| grammar | Only with adjectives or classifier constructions denoting small size. |

4.12. pressed

| phonology | Lips pressed together and forward, eyebrows together and/or down, overall tense face. Head pulled down and/or shoulders up. |

---

13 The term “pursed lips” is used for different mouth shapes by different people, so we suggest avoiding it. Struxness 1996, for example, uses it to describe a morpheme that appears to be same as our pressed.
### 4.13. puffed

| citations | Bridges and Metzger 1996:37, Struxness 1996 06:15 |
| phonology | Mouth closed, cheeks and often lips inflated, no leakage of air. |
| semantics | ‘fat, large and round’ |
| grammar | With certain adjectives of size, e.g. FAT, and certain classifier constructions, e.g. WADDLE-ALONG (using the inverted Y classifier ‘fat person walking’, see photo in section 2.3). |
| notes | See note on puffedBlow below. |

### 4.14. puffedBlow

| phonology | Mouth closed, cheeks inflated (but not as much as with puffed), air leaks out through small opening. |
| semantics/grammar | ‘to a medium high degree’ (more than mm but less than clenched). Appropriate translations vary depending on type of predicate: (with extent of distance or time) ‘far, long’ e.g. with BACK-THEN (with states) ‘very’ e.g. with BECOME-SICK, AWKWARD/th (with quantities) ‘many’ e.g. with HORDES, CL-4:“many people enter” (with some verbs) ‘exhausted’ e.g. WALK |
| notes | For some signers, puffedBlow seems to be distinct in meaning and form from puffed, even if in casual signing (or in published sources) they are difficult to distinguish. Struxness does not describe them as different morphemes though his actual productions are visually distinct. |
### 4.15. sow

<table>
<thead>
<tr>
<th><strong>citations</strong></th>
<th>Bridges and Metzger 1996:40, Struxness 1996 20:30</th>
</tr>
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</table>
| **phonology** | Phase 1) Jaw closed, lips spread wide exposing teeth.  
Phase 2) Lips open only a slit, corners of lips tight, sometimes rounded.  
Overall: squint, tense. |
| **semantics** | 'to an extremely high degree' (greater than clench) |
| **grammar**   | Only with states (or inchoative states). Not with reduplicated signs. |
| **notes**     | Perhaps analyzable as a compound of clench + oo. |

### 4.16. sta-sta

|---------------|-----------------------------------------------|
| **phonology** | Phase 1) Jaw closed, upper lip raised and lax, showing upper teeth.  
Phase 2) Jaw opens slightly, revealing lower teeth. Opening coincides with the pulse of the (cyclic) manual sign (i.e. at the most prominent part of the cycle: the fastest motion or place where the hand passes closest to a location)  
Throughout: head tilt to one side. |
| **semantics** | 'with effort' |
| **grammar**   | Only seems to occur with signs that have cyclic (reduplicated) movement. |
| **notes**     | Produces an audible dental click, indicating contact of the tongue with the gum line during phase 1.  
A single sta is occasionally possible, though we don't have enough examples to describe it;  
sta-sta may therefore simply be an aspectual reduplication of sta. |

### 4.17. th

<table>
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<tbody>
<tr>
<td><strong>phonology</strong></td>
<td>Mouth slightly open, tongue tip or blade visible between upper and lower teeth. Liddell (1980:50) claims the lips must be pushed forward and the upper lip slightly curled, but this does not seem to be true for Franchineaud, who also just barely shows the tongue. Often with puffed cheeks (Neidle et al. 2000:42) and airflow through teeth. In action verbs, motion in the manual sign is more erratic than normal, and there is erratic swaying of head and torso. Relaxed muscles in all articulators.</td>
</tr>
<tr>
<td><strong>semantics</strong></td>
<td>'with effort'</td>
</tr>
<tr>
<td><strong>grammar</strong></td>
<td></td>
</tr>
<tr>
<td><strong>notes</strong></td>
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</table>
### semantics

1) sloppily due to inattention (antonym of *pressed*), e.g. with CARELESS, SLOPPY, WRITE, classifier constructions employing BE-LOCATED[redup]

2) clumsily due to temporarily impaired ability (esp. drunkenness), e.g. with DRUNK, STEP, WALK-ALONG

Liddell 1980:50 characterizes the range of meaning as centering “around lack of control, inattention, unintention, and unawareness”.

### grammar

Adjectives of manner, verbs.

### References


Boyes Braem, Penny, and Rachel Sutton-Spence, eds. 2001. The hands are the head of the mouth: The mouth as articulator in sign languages. Hamburg: Signum-Verlag.


A cross-linguistic study of word segmentation in three sign languages

Diane Brentari
Ronnie Wilbur
Purdue University

Abstract

This study analyzes (speakers of English, Croatian, Austrian). Hypothesis 1 is that signers will show sensitivity to more simultaneous information and sign language (SL) specific phonological the word-segmentation strategies used in 3 groups of Deaf signers (ASL, HZJ, ÖGS) and 3 groups of hearing nonsigners constraints than nonsigners, such as distribution of handshapes (HS), places of articulation (POA), and movements (M). Hypothesis 2 is that the visual nature of the signal will cause both speakers and signers to use word-level information for their judgments in a SL, despite the fact that work on spoken language shows that speakers are predisposed to use syllable sequences (i.e. the foot) to make word segmentation judgments in spoken languages. We expect that speakers will adapt to the new language modality by shifting to a word-level segmentation approach.

Hypothesis 1 was partially confirmed: signers are more sensitive to simultaneous information in the signal than nonsigners. Hypothesis 2 was also confirmed: nonsigners adapted to the strategies of SLs when making word segmentation judgments in a visual modality.

Keywords – phonology, units, modality independent/specific, crosslinguistic similarities, constraints on possible signs, sign components, handshape, place of articulation, movement

1. Introduction

The determination of word boundaries provides important information about the phonological structure of words. Every language has a set of constraints on what may be a possible word. Frequently these constraints are stated in prosodic terms, such as allowable number of feet or sequences of types of feet. Speculation that sign languages look more similar to each other than spoken languages do (Newport and Supalla 2000) raises the question of whether sign languages share some of the same constraints on what may be a possible sign. While it is known that
handshape inventories differ among SLs (Eccarius 2002), the inventories of locations and movements are not as well studied. Our study compares the word-segmentation strategies used in three groups of Deaf signers (ASL, HZJ, ÖGS) and three groups of sign-naïve hearing speakers (English, Croatian, Austrian). In doing so, we can address a number of interesting research questions:

1) Do Deaf, native signers and hearing nonsigners use the same principles to identify word boundaries in a string of signing (in a sign language neither group understands)?

2) Does the sign language or dominant language/culture make a difference in the answer to the first question?

In order to address these questions, we need to consider where signers and speakers prefer to divide a sign sequence and why they choose to do so. In this study, sign parameters Handshape (HS), Place of Articulation (POA), and Movement (M) are systematically varied to permit us to test the cues that are used for making such decisions. The information gained allows us to understand more about sign structure, and in particular, what combinations of the phonological parameters are permitted in a single well-formed sign, and how that might differ by sign language. The comparison of signers and nonsigners also allows us to determine the effect of experience on sign sequence parsing. We assess the impact of two between-subject factors, Language Modality (Spoken, Signed) and Specific Language, and one within-subject factor Phonological Parameter (HS, POA, M).

The information gained from a study such as this can be applied to a practical situation – the automatic parsing of signing streams by computational sign recognition algorithms. The computer needs to know what clues to use to decide if a sign has begun or ended.

In Section 2, we discuss the importance of word segmentation for understanding sign structure, perception, and application to automatic sign recognition, and provide important details of sign language phonology for understanding the nature of the task and its implications. In Section 3, the experiment is presented; in Section 4, the results are presented; and in Section 5 we discuss the findings and future directions.

2. Background

2.1. Word Segmentation

Word segmentation is the competency needed to break up a string of uninterrupted language signals into shorter, manageable chunks for further processing. However, word segmentation is not itself word identification, that is, knowing where a word may end and the next one start is not the same thing as identifying what word is involved. Word segmentation is also not necessarily based on
segmental units. For example, monosyllabic words could be separated based on sonority sequences rather than on the sequence of individual segments of which they are composed.

To investigate word segmentation, the cues that can be used as the basis for making decisions are put into conflict with each other to determine the relative strength of each cue. Possible cues can be rhythm and properties of the sounds or signs themselves. Children acquire the language-particular word segmentation constraints/strategies through statistical learning of some kind. The signal itself (visual or auditory) has some effect on how a person decides where word boundaries are; this is a “modality effect.” Because of this modality effect, our first hypothesis is that signers will have sharper judgments than nonsigners about where to break between 2 signs. Signers will show sensitivity to more simultaneous information and SL-specific phonological constraints than nonsigners, such as distribution of handshapes (HS), places of articulation (POA), and movements (M). Furthermore, signers will use the rules of their own SL for segmentation, even for an unfamiliar SL.

Our second hypothesis is that segmentation in signed and spoken languages require different strategies. The visual nature of the signal will cause both speakers and signers to use word-level information for their judgments in a SL, despite the fact that work on spoken language shows that speakers are predisposed to use syllable sequences (i.e. the foot) to make word segmentation judgments in spoken languages. We expect that speakers will adapt to the new language modality by shifting to a word-level segmentation approach.

2.2. SL Phonological Parameters

2.2.1. Useful facts: HS

In the experiment we keep track of unmarked and marked HSs. We consider the Unmarked HSs to be the index finger “one” or whole hand “all”. These are first HSs acquired and the last lost in cases of brain damage. We consider all other combinations of selected fingers to be Marked HSs. Within a word, when there are 2 HSs, they are usually open and closed versions of the same HS, or one or both HSs are unmarked.

2.2.2. Useful facts: M

Two movements can occur in the same sign under certain conditions. If one M is a path (Brentari’s [direction] or [tracing], with shapes ‘arc’, ‘straight’, ‘circle’, or ‘7’) and the other is local (changes of aperture, orientation or setting), they can occur simultaneously in a single sign. There are also
ASL signs that allow the sequence of a circle M followed by a straight M. Repetition of M is also treated as a single sign.

Other combinations of movements are not allowed within a single sign. One prohibited combination is any sequence of path M followed by local M or vice versa (Perlmutter 1992). Another impossible combination for a single sign is the sequence of two circles each in a different direction (Uyechi 1996). Finally, although the sequence ‘circle M followed by straight path M’ is allowed, the reverse, ‘straight path M followed by circle M’ is not (Uyechi 1996).

In spite of these general constraints, some lexical signs, such as DESTROY (Figure 1), have 2 HS and 2 M and are nonetheless fine.

![Figure 1: The disyllabic ASL sign DESTROY](image)

2.2.3. Useful facts: POA

There are 4 major body regions: head, arm, torso, and the non-dominant hand. A monomorphemic sign may have one or two POAs within each region, but not across regions (e.g. not head and arm). In addition, there are three planes (vertical, horizontal, midsagittal), within which a monomorphemic sign may be made, but changes across planes are not permitted.

3. Method

3.1. Subjects

Six groups of subjects participated in this study: three Deaf signing groups and three hearing sign-naïve groups from USA, Croatia and Austria (Table 1). The signers were all culturally Deaf (they were well-integrated into the Deaf Community) and had all been signing for at least 20 years. The nonsigners were from the same urban areas as the signers in each country and in the same age group (between 20-55 years of age).

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### Table 1: Participating Groups

<table>
<thead>
<tr>
<th>Groups &amp; Language</th>
<th>USA   (N)</th>
<th>Croatia (N)</th>
<th>Austria (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaf signers ASL</td>
<td>13</td>
<td>HZJ 10</td>
<td>ÖGS 10</td>
</tr>
<tr>
<td>Sign-naive hearing speakers English</td>
<td>13</td>
<td>Croatian 10</td>
<td>Austrian German 10</td>
</tr>
</tbody>
</table>

### 3.2. Task

Participants were asked to watch video clips of signs and to click one of two boxes to answer the question: “1 sign or 2 signs?” (Figure 2 shows the buttons labeled in German).

![Figure 2: Example of the display of task items on the computer screen](image)

### 3.3. Stimuli

All 168 stimuli were ‘pseudo-signs’ (i.e. nonsense signs) composed of counterbalanced combinations of movement (M), handshape (HS), and place of articulation (POA) in order to create cue conflict. There are 6 M conditions x 5 HS conditions x 2 POA conditions. This resulted in 28 cells (two are impossible to construct), in which M, HS, and POA cues are placed in conflict with each other to test the most resilient word segmentation strategies in each group of participants. Our design seeks to determine the relative strength of each of these cues with respect to each other as well as the relative effects of different forms within each of these cue types.

Handshapes are separated into unmarked (HSu) and marked (HSm) groups: (1) HSu includes B, 5, A, S, and 1; and (2) HSm includes all other HSs. There are five HS conditions in the stimuli, two of which are permissible in ASL monomorphemic signs and three of which are not permissible.

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2 Details of the videorecording, the signer, and the timing of the stimuli are provided in Brentari (2006).
The phonotactically permissible types are (1) just one HS or (2) a sequence of two HS which share the same set of selected fingers and are related by an aperture change.

The impermissible types are (3) two HSu (i.e. the index or all fingers), (4) one HSu and one HSm, and (5) two HSm. It is predicted that permissible combinations will elicit responses of 1 (meaning, one acceptable sign) and those with impermissible combinations will elicit responses of 2 (meaning, the stimulus cannot be one acceptable sign). The conditions, the markedness of their HSs, the combinations in the stimulus sign, and the predicted response (number of signs) are given in Table 2.

### Table 2: Handshape Conditions

<table>
<thead>
<tr>
<th>Condition No.</th>
<th>HS Markedness</th>
<th>HS in stimulus</th>
<th>Predicted response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>U</td>
<td>1 HS (no aperture change)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>U</td>
<td>1 HS (+ aperture change)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>U + U</td>
<td>2 HSu</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>U + M</td>
<td>1 HSu+1 HSm</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>M + M</td>
<td>2 HSm</td>
<td>2</td>
</tr>
</tbody>
</table>

There are two POA conditions: one POA or two POAs (Table 3). Again, the forms with two POAs do not occur in monomorphemic ASL signs but may occur in compounds. The choices of POA came from the set of major body regions (head, torso, H2, arm), and the three-dimensional planes.

### Table 3: Place of Articulation conditions

<table>
<thead>
<tr>
<th>Condition No.</th>
<th>POA in stimulus</th>
<th>Predicted Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 POA</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2 POAs</td>
<td>2</td>
</tr>
</tbody>
</table>

There are six M conditions, divided into those that are permissible in monomorphemic signs and those that are not (and which are also not permissible in ASL compounds) (Table 4). Two of the conditions are permissible in monomorphemic signs: (1) one group of 30 items has one movement and (2) another other group of 30 items with two movements, which is a repeated movement. The remaining four M conditions contain 108 items that are not permitted in either

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3 Types (3) and (4) are possible compounds, but not monomorphemic signs, and type (e) combinations do not occur in single signs of any type.
monomorphemic signs or compounds. These conditions include: (3) 24 combinations of non-permissible local movements (e.g., combinations of HS changes and orientation changes); (4) 30 illicit combinations of two path movements (e.g. straight+arc or circle+circle with the second circle going in the opposing direction); (5) 24 combinations of a path movement and a handshape change; and (6) 30 combinations of a path movement and an orientation change.

**Table 4: Movement Conditions**

<table>
<thead>
<tr>
<th>Condition No.</th>
<th>M Permissibility</th>
<th>M in stimulus</th>
<th>Predicted Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 grammatical M</td>
<td>M</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2 grammatical Ms</td>
<td>M + M</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Ungrammatical local Ms</td>
<td>Local M1 + local M2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Ungrammatical path Ms</td>
<td>Path M1 + path M2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Ungrammatical path+HS change</td>
<td>Path + HS change</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Ungrammatical path+orientation change</td>
<td>Path + Orientation change</td>
<td>2</td>
</tr>
</tbody>
</table>

The overall organization of the stimuli is depicted in Table 5. By putting cues in conflict in this way, we can directly evaluate the following word segmentation factors.

**Table 5: Distribution of items in stimulus set. Grey cells indicate physically impossible forms. (‘∆’ = ‘change’)***

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>M (repetition)</th>
<th>M 1 or+1hs∆</th>
<th>M 2 path</th>
<th>M 1 path+1hs∆</th>
<th>M 1 path+1or∆</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 1</td>
<td>POA(1) 3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POA(2) 3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HS 2-apert∆</td>
<td>POA(1) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POA(2) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>HS 1u+1u</td>
<td>POA(1) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POA(2) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>HS 1u+1m</td>
<td>POA(1) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POA(2) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>HS 1m+1m</td>
<td>POA(1) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>POA(2) 3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
The stimuli were presented to the participants on a computer screen in four blocks with rest breaks in between. Presentation blocks were rotated such that the first subject started with block 1, the second started with block 2, and so on, returning to block 1 for the fifth subject and repeating the rotation as needed until all subjects were run.

3.4. Analysis
Because our data are binary (viewers respond ‘1’ or ‘2’), we used binary logistic regression instead of traditional ANOVA. Regression tells us which factors are important and gives us chi-square results, for which we report the Wald statistic and its significance level.

4. Results
We will report first the results for the Phonological Parameters, then for the Groups (first using Language Modality (signer, nonsigner), and then using individual Languages (six possibilities), and then the interactions. We will follow up by concentrating on the details of one condition, HS Condition 1 (HSu), which provides further insight into the strategies used to decide word segmentation.

4.1. Phonological Parameters
We find that HS, POA, and M are all significant main effects (HS: df=4, Wald = 280.0213, p<.0001; POA: df=1, Wald=755.8732, p<.0001; M: df=5, Wald=904.7584, p<.0001) across Groups (Table 6). In addition, there are significant interactions among the three of them (HS*POA: df=4, Wald=112.1380, p<.0001; HS*M: df=18, Wald =238.0592, p<.0001; POA*M: df=5, Wald = 42.9386, p<.0001). That is, whether a viewer will use HS, POA, or M to decide about word boundaries depends on what other HS, POA or M might be in the sign with it.

Table 6: Effects of HS, M, and POA and 2-parameter combinations

<table>
<thead>
<tr>
<th></th>
<th>DF</th>
<th>Wald Chi Square</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS</td>
<td>4</td>
<td>280.0213</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>POA</td>
<td>1</td>
<td>755.8732</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>M</td>
<td>5</td>
<td>904.7584</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>HS*POA</td>
<td>4</td>
<td>112.1380</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>HS*M</td>
<td>18</td>
<td>238.0592</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>POA*M</td>
<td>5</td>
<td>42.9386</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>
4.2 Groups

We turn now to the analysis of differences among the groups. Brentari (2006) reported no difference between signers (ASL) and nonsigners (English speakers). In this study, we extend those results to two additional groups of signers (HZJ and ÖGS) and two additional groups of nonsigners (Croatian and Austrian German speakers). For Language Modality, we still have two groups, signers and nonsigners. For Language, we have six groups.

4.2.1 Language Modality

There was no significant main effect of Language Modality (df=1, Wald =.0738, p=.7859). Both groups, Signers and Nonsigners, used the same overall strategies: 1 value = 1 word. This is especially true for the M phonological parameter, which was unaffected by Language Modality.

But Signers were more sensitive to a greater amount of simultaneous information in that they made significantly greater use of HS information than did the Nonsigners (df =4, Wald =13.4804, p=.0092). We will return to the HS differences below.

4.2.2 Language

Comparing all Signers against all Nonsigners masks variation within each group. To explore this further, we analyzed the results by Language (ASL, English, HZJ, Croatian, ÖGS, Austrian German), and found a significant effect (df=5, Wald = 76.1424, p<.0001). Post-hoc analysis revealed that (1) ASL differed more from the European spoken languages (Croatian, Austrian German) than it did from English, and did not differ from HZJ or ÖGS; (2) English speakers diverged from all the European languages (HZJ, ÖGS, Croatian, Austrian German); and (3) there were no differences among the European languages.

Using Language instead of Language Modality, we continue to find no interaction with M (df=25, Wald=22.8873, p=0.5841), and we do continue to find an interaction with HS – that is, sensitivity to HS, but not M, is dependent on the Language a subject uses (df=20, Wald =42.6356, p=.0023); that is, sensitivity to HS varies significantly among all languages (among sign languages too, not just between signers and nonsigners).

To confirm this sensitivity, we employed the measure of d-prime (d’), which is a statistical test for sensitivity, to allow us to recognize and control for irrelevant response patterns, such as always saying ‘1 sign’ regardless of stimuli (Keating 2005). It is calculated from the mean difference of the Z-scores of the Hits (e.g. the predicted value of the response was ‘1 sign’, and the actual response was ‘1 sign’) minus the False Alarms (the predicted value of the response was ‘2
signs’ and the response was ‘1 sign’) (Table 7). A value of 1.0 for d’ includes about 69% of all cases.

Table 7: Sensitivity to each parameter after applying d’

<table>
<thead>
<tr>
<th>Language Modality</th>
<th>Language</th>
<th>d’-HS</th>
<th>d’-POA</th>
<th>d’-M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign</td>
<td>1 ASL</td>
<td>1.65</td>
<td>.78</td>
<td>.79</td>
</tr>
<tr>
<td>Spoken</td>
<td>2 English</td>
<td>.21</td>
<td>.04</td>
<td>.86</td>
</tr>
<tr>
<td>Sign</td>
<td>3 HZJ</td>
<td>.33</td>
<td>.38</td>
<td>.23</td>
</tr>
<tr>
<td>Spoken</td>
<td>4 Croatian</td>
<td>.01</td>
<td>.56</td>
<td>.04</td>
</tr>
<tr>
<td>Sign</td>
<td>5 ÖGS</td>
<td>.86</td>
<td>.54</td>
<td>.60</td>
</tr>
<tr>
<td>Spoken</td>
<td>6 Austrian German</td>
<td>.25</td>
<td>.02</td>
<td>.25</td>
</tr>
</tbody>
</table>

Looking first at the sensitivity differences between the Signing and Spoken Modality group, we can see that (1) overall sensitivity for the nonsigners was substantially below that of signers, and (2) HS was most important for the signers and least important for the nonsigners (Figure 3).

Figure 3: d’ for HS, POA, and M by Language
Comparing the three signing groups (Languages 1, 3, and 5), what we see in Figure 3 is that the HSs used in the stimuli, which were taken from ASL, were most relevant to the ASL signers and less relevant to the other two signing groups, although more relevant to the ÖGS signers than to the HZJ signers. This suggests that the HS inventories and constraints in these two sign languages vary to differing extents from that of ASL. In those cases where HS might be the only available cue on which to base a decision, the HSs were not as useful to non-ASL signers as they were to ASL signers. The POA and M sensitivities indicate that the word level constraints of HZJ and ÖGS also differ from those of ASL.

Looking at the nonsigning groups (Languages 2, 4, 6), we see that the English speakers relied heavily on M, the Croatian speakers relied heavily on POA, and the Austrian speakers relied equally on M and HS. In short, they adopted different strategies for weighting the available cues which has the overall effect of yielding 2 values = 2 words, 1 value = 1 word.

4.3. HS condition 1

As seen in Figure 4, which shows the mean correct response for ‘sign = 2’ conditions, the largest difference between Signers and Nonsigners is in HS condition 1. For these items, on the basis of HS alone, subjects should respond ‘one’ to the question of whether the stimulus is one sign or two; however, each stimulus also contains at least one POA and at least one M. This difference between this condition and all others is significant (df=1, Wald= 9.3123, p=0.0023) in greater detail than the others.

Figure 4: Subject responses for HS conditions 1-5 for Signers (1) and Nonsigners (2), (courtesy of J. Bourneman)

Exploring this condition further reveals interesting patterns of interaction between phonological parameters and subject groups. In HS condition 1, the stimuli contain a single
unmarked HS from the inventory of ASL. The degree to which subjects use this additional information will affect whether they will say ‘one’ or ‘two’ despite there being only one HS. The first observation is that for signers and nonsigners alike, they were all sensitive to M in HS condition 1, as elsewhere.

The second observation is that decisions in HS Condition 1 are affected differently by POA for signers and nonsigners, and interestingly, also within the signer group. ASL signers were sensitive to HS regardless of whether the stimuli contained one POA or two. HZJ signers were not sensitive to HS when the stimuli had only one POA, but were sensitive when the POA had two POAs. In contrast, ÖGS signers were sensitive to HS when the stimuli had only one POA, but not when it had two POAs. For nonsigners, if the stimuli contained only one POA, their responses were sensitive to HS; that is, they paid attention to whether there was more than one HS. However, when the stimuli contained two POA, nonsigners were not sensitive to HS.

<table>
<thead>
<tr>
<th>Language</th>
<th>POA = 1</th>
<th>POA = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASL</td>
<td>Wald = 16.6679, p&lt;.0022</td>
<td>Wald = 35.7146, p&lt;.0001</td>
</tr>
<tr>
<td>HZJ</td>
<td>Wald = 3.8585, NS</td>
<td>Wald = 11.5864, p=.0207</td>
</tr>
<tr>
<td>ÖGS</td>
<td>Wald = 24.7699, p&lt;.0001</td>
<td>Wald = 3.5, NS</td>
</tr>
<tr>
<td>English</td>
<td>Wald = 29.1783, p&lt;.0001</td>
<td>Wald = 5.3665, NS</td>
</tr>
<tr>
<td>Croatian</td>
<td>Wald = 48.3648, p&lt;.0001</td>
<td>Wald = 6.9677, NS</td>
</tr>
<tr>
<td>Austrian German</td>
<td>Wald = 13.4635, p=.0092</td>
<td>Wald = 7.3515, NS</td>
</tr>
</tbody>
</table>

### 5. Conclusions and future work

#### 5.1. Hypothesis 1: Signers will show a sensitivity to more simultaneous information and SL specific phonological constraints than nonsigners, such as distribution of handshapes (HS), places of articulation (POA), and movements (M).

Hypothesis 1 was partially confirmed: signers are more sensitive to simultaneous information in the signal than nonsigners. The results reported here show two apparently contradicting trends: no difference between signers and nonsigners overall, and a clear difference between signers and nonsigners with respect to specific phonological parameters. The similarity of signers and nonsigners overall is the result of the same treatment of Movement, that is, for both groups, Movement was a significant factor in making their word segmentation decisions. The differences
between the two groups are the result of the role, or lack thereof, of POA and HS. The use of POA varied for the nonsigners, with nearly none for English and Austrian German speakers and much more for Croatian speakers, as well as for the signers, as seen with the contrast between HZJ and ÖGS with respect to how POA values affected their decisions in the HS conditions.

Our results indicate that HS is special in sign language phonology. Signers pay more attention to it than nonsigners in word segmentation. It is also clearly more categorical than POA, which can be treated differently even within different sign languages, or Movement, which is treated similarly by both signers and nonsigners. There is also a big difference in the HS inventory between SLs and gesture systems.

The results presented here also support the hypothesis that signers will use the rules of their sign language for the segmentation task, even in an unknown sign language. The ASL signers were essentially dealing with the phonemic inventory of their own language while making decisions about word level constraints on combinations. In contrast, the HZJ and ÖGS signers were dealing with unfamiliar phonemic inventories and word level constraints. The stimuli may have contained HS, POA and M that are not phonemic in either HZJ or ÖGS. In addition, the word level constraints for these two sign languages may be different. So for example, some of the stimuli that would clearly be two separate signs in HZJ or ÖGS might be allowable single signs in ASL, or vice versa. The example of ASL DESTROY, discussed earlier, illustrates the complexity of such constraints in that some combinations of two movements can still be considered a single sign in ASL. Faced with unfamiliar phonemic inventories and combinations, signers must use the rules of their own sign language to make segmentation decisions. This fact is underscored by the different decision patterns for HZJ and ÖGS, that is, their differential sensitivity to HS in the two POA conditions. HZJ signers were not sensitive to HS when the stimuli had only one POA, but were sensitive when the POA had two POA. In contrast, ÖGS signers were sensitive to HS when the stimuli had only one POA, but not when it had two POA. If it were merely a matter of modality, we would expect the HZJ signers and the ÖGS signers to behave in a similar pattern rather than the contrasting pattern that was observed here.
5.2. **Hypothesis 2:** The visual nature of the signal will cause both speakers and signers to use word-level information for their judgments in a SL, despite the fact that work on spoken language shows that speakers are predisposed to use syllable sequences (i.e. the foot) to make word segmentation judgments in spoken languages.

Segmentation in signed and spoken languages requires different strategies. Spoken language word segmentation relies heavily on rhythmic cues—trochaic feet (e.g., *children, breakfast*). This is more “syllable-based.” Sign languages use domain-based cues, which are more word-based (1 value=1 word). Signers approach the task differently from nonsigners. Signers paid attention first to M, then HS, then POA. Nonsigners paid attention first to M most, then POA, and generally ignored HS.

A key question for the task presented here is whether the reliance on M cues is a word effect or a syllable effect. We would argue that it is a word effect, because the general strategy used by participants is ‘1 value=1 word’. In order for the syllable to be the relevant unit, evidence of a syllable sequence of a particular sort would be needed, such as the foot, with a trochaic (strong-weak) or iambic (weak-strong) pattern. Instead, like word segmentation based on vowel harmony, every change in value triggered the perception that it signaled the beginning of a new word.

We therefore conclude that viewers of SLs use the word to segment signed strings, which is argued to be due in large part to the visual/gestural nature of sign languages, while listeners of spoken Ls depend most heavily on the syllable for word segmentation, which is argued to be due the auditory/vocal nature of spoken languages (cf. discussions of differences in Allen, Wilbur & Schick 1991; Brentari 1998; Wilbur & Allen 1991; Wilbur & Petersen 1997).

5.3. **Future directions**

There are several factors that deserve further exploration. One of them is the way we word the question for our subjects. We anticipate different results if we were to reword the instructions to ask signers “Could this form be a compound?” There are compound signs in ASL that permit 2 contrastive POA, for example FEMALE(head)^MARRY(hand) = ‘wife’ There are also compounds that contain 2 contrastive POA and 2 HS, such as SLEEP^SUNRISE= ‘oversleep’. Given the interaction between ASL and the one-handed fingerspelling alphabet, there are a substantial number of signs containing 2 contrastive HS. These include loan signs such as #JOB (reduced from fingerspelled letter sequence to just the first letter and last with a wrist twist for movement) and initialized signs such as #BACKGROUND and #PROJECT. The responses from ASL signers to the novel stimuli we present might be affected if they consider the possibility of the form being a compound.
On the other hand, compounds are not well-studied in HZJ and ÖGS, and a preliminary impression of HZJ is that there are many fewer. In HZJ there are (virtually) no initialized signs or loan signs from fingerspelling. The situation for ÖGS is generally unstudied. So it is difficult to predict what effect changing the instructions might have on these two groups.

At the same time, it is clear that many questions about our results will not be answered until we have much better descriptions of the phonologies of both HZJ and ÖGS. An inventory of the distinctive POA in HZJ reveals that in the head area, HZJ has a distinctive location at the front of the neck that ASL does not use; that ASL uses the front of the wrist and the finger fronts of the nondominant hand distinctively, but HZJ does not; and that HZJ uses the radial side of the wrist, which ASL does not use distinctively (Šarac Kuhn, Alibašić Ciciliani & Wilbur 2006). The HS inventory of HZJ also differs from ASL – not all ASL HS are used in HZJ, and HZJ has HS that are not used in ASL, for example index and middle finger extended and adjacent to each other with the thumb spread (‘U-th’) (Šarac Kuhn, Alibašić Ciciliani & Wilbur 2006). We do not yet have equivalent information for ÖGS, nor is there any indication of word level constraints for either ÖGS or HZJ.

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**References**


The Effects of ASL on Co-speech Gesture in Hearing Native Signers
Shannon Casey and Karen Emmorey
Laboratory for Language and Cognitive Neuroscience
San Diego State University

Introduction
We investigated whether native acquisition of ASL affects co-speech gesture. The gestures of hearing native signers (Cudas) were compared with those of non-signers with respect to the following questions:

• Do Cudas produce more iconic and deictic gestures than non-signers?

• Are gesture handshapes more marked (e.g., F, X, R, as defined by Battison, 1978) or varied for Cudas?

• Do Cudas produce more gestures using a character viewpoint?

Method
13 Cudas and 12 non-signing English speakers viewed a 7-minute Tweety and Sylvester cartoon and then described it to a non-signer.

Results
1) Gesture types
• Cudas produced more iconic gestures with a mean of 74.07% vs. 67.15% by non-signers: \( t(23) = 1.73, p < .05 \) (one-tailed).

• There was no difference in the production of deictic gestures, with Cudas producing a mean of 12.86% vs. 11.73% by non-signers: \( t(23) = .36, p = .36 \) (one-tailed).

• Cudas produced fewer beat gestures with a mean of 13.06% vs. 20.75% by non-signers: \( z = 2.15, p = .03 \) (see Fig. 1).

2) Handshapes
• Cudas produced more marked and unmarked handshape types than non-signers: \( t(23) = 2.66, p = .01; z = 1.95, p = .05 \); respectively (see Fig. 2).

• Cudas produced more unmarked and fewer marked handshape tokens than non-signers: \( t(14) = 2.15, p = .05 \) (see Fig. 3).

3) Character viewpoint
• When adopting a character viewpoint, the gesture's body is used as if it were a character in the cartoon, e.g., using the hands to show Tweety throwing a bowling ball (McNeill, 1992).

• Cudas produced a higher percentage of gestures using a character viewpoint than non-signers: \( t(23) = 1.96, p = .03 \) (one-tailed) (see Fig. 4).

Discussion
Native acquisition of ASL enhances the use of iconic, representational co-speech gestures and decreases the use of rhythmic gestures that index the pragmatic function of speech (beat gestures).

Cudas may produce a greater variety (types) of handshapes due to their exposure to the large variety of handshapes in ASL. The greater production of unmarked tokens by Cudas suggests an influence of ASL phonology on co-speech gesture, because these are the most frequently occurring handshapes in ASL.

Cudas also incorporated the use of referential shift found in signed languages by producing more gestures from the perspective of a character.

These results indicate that native acquisition of a signed language changes co-speech gesture so that it resembles signed languages by increasing the use of iconic gestures, handshape variety, unmarked handshapes, and character viewpoints.

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Contact Information
Shannon Casey: scasey@projects.sdsu.edu
Karen Emmorey: kemmorey@mail.sdsu.edu
PORTUGUÊS (L2) E LIBRAS (L1): DESENVOLVIMENTO DE ESTRUTURAS DE POSSE NA INTERLÍNGUA

Adriana Cristina CHAN-VIANNA (PG-UnB)

1. INTRODUÇÃO
O quadro dos estudos gerativos em segunda língua permite equiparar as gramáticas de primeira língua (L1) e de segunda língua (L2) e investigar aspectos divergentes. Como indica a literatura recente há limites para a variação em gramáticas não nativas, assim como em gramáticas nativas. Por meio de experimento controlado de produção escrita, elaborado com o intuito de examinar as construções de posse não pronominais do português, buscou-se a identificação e a descrição de construções de posse na interlíngua dos aprendizes surdos que não são facilmente observadas na produção espontânea. Em vista da hipótese de que, a partir de conhecimento inato e do conhecimento da LIBRAS, desenvolve-se o processo de aquisição do português, a investigação das estratégias dos aprendizes surdos leva ao questionamento de propriedades de traços da gramática e de efeitos de transferência da L1.

Neste trabalho são apresentados os resultados que mostram que as gramáticas da interlíngua de aprendizes surdos, falantes/sinalizadores de LIBRAS, apresentam construções convergentes com a gramática alvo (português), incluindo a possibilidade de reestruturação de aspectos morfológicos (marcação de Caso genitivo) e não apresentam violação dos princípios que restringem as línguas naturais. Além desses, os padrões não convergentes revelam aspectos envolvidos no desenvolvimento do sintagma nominal do português (L2) pelos aprendizes surdos e remetem a propriedades da LIBRAS (L1).

Apresentam-se a seguir (seção 2) os pressupostos teóricos para a descrição do experimento, a partir do qual foram identificadas variantes encontradas na interlíngua na realização da relação de posse em português (seção 3). Na seção 4, são considerados os aspectos envolvidos na aquisição das estruturas de posse pelos aprendizes surdos e sua relação com a L1, seguindo-se as considerações finais (seção 5).
2. PRESSUPOSTOS

No âmbito da pesquisa lingüística de enfoque gerativista, a segunda língua de um indivíduo - falante não nativo - é um sistema lingüístico complexo e abstrato e, nesse sentido, semelhante ao sistema lingüístico de um falante nativo. Aprendizes de uma segunda língua, assim como os falantes nativos, possuem representações mentais desse conhecimento adquirido. O sistema lingüístico que resulta da aquisição de uma segunda língua, desde seu início até a estabilização do processo, é denominado interlíngua. A interlíngua pode constituir-se de aspectos da língua nativa do aprendiz, da língua alvo ou de outras línguas naturais.

As observações sobre a inevitabilidade, a uniformidade e a completude da aquisição da L1, que são a base para se postular a faculdade de linguagem inata e de domínio específico, não podem ser observadas no processo de aquisição de L2 (White, 1998, 2003; Sorace, 2003). Os aprendizes de L2, entretanto, atingem estados mentais que vão além dos dados disponíveis, e além do ensino explícito, sendo capazes de entender e produzir enunciados que não viram ou ouviram antes. Os padrões encontrados na aquisição da L2 não resultam de analogia com formas do input de L2 nem são derivados apenas do conhecimento da L1.


Reconhece-se, naturalmente, que as gramáticas da interlíngua diferem de várias maneiras da gramática dos falantes nativos. A interlíngua se caracteriza pela variabilidade no uso de flexão verbal e nominal e em itens lexicais relacionados. Morfologia relacionada a concordância, número, gênero, caso, tempo, entre outras categorias, estão às vezes presentes, às vezes ausentes da produção dos aprendizes de L2, quando seriam obrigatórios para os falantes nativos. Quando estão presentes, podem não ser convergentes com a gramática alvo do falante nativo. A variabilidade não é atribuída a uma deficiência na representação gramatical, em uma abordagem como a adotada por Epstein et al. (op.cit.), Schwartz (op.cit.) e White (op.cit.), entre outros, ao contrário, todas as categorias funcionais e lexicais estão disponíveis e presentes no léxico desde os primeiros estágios da aquisição de L2, embora possam ainda não ter sido mapeadas na matriz morfológica/fonológica convergente.

A hipótese de que problemas na interface morfologia/sintaxe podem ser atribuídos a problemas de mapeamento não prevê que esses problemas são inevitáveis, nem permanentes (cf. White, 2003). Certamente, há resistência de determinados aspectos gramaticais ao desenvolvimento,

A opcionalidade é inerente ao desenvolvimento da L2 e, entre outros fatores, decorre da L1: propriedades da L1 podem se manifestar na interlíngua antes que os aprendizes tenham se apropriado de novos valores paramétricos ou antes que todos os traços formais de um novo item da L2 tenham sido identificados, incluindo-se a possibilidade de reestruturação no nível paramétrico/morfológico, como consequência de a GU estar disponível para o aprendiz de L2 (cf. Craats et al., 2000). Conforme a Hipótese da Conservação, nos estágios iniciais, o aprendiz de L2 segue pela gramática de L1 no desenvolvimento da gramática de L2, e, em seguida, a Gramática Universal (GU) permite que o aprendiz compare seu output e o input da L2, reestruturando sua gramática inicial, se necessário (cf. Schwartz, 1998; Craats et al., 2000).

O output dos aprendizes surdos apresenta similaridades importantes com o de aprendizes de L2 ouvintes (Berent, 1996; Lillo-Martin, 1998; Fernandes, 2003; Salles et al., 2003, Chan-Vianna, 2003). Embora a situação em que os surdos aprendem uma língua oral seja diferente da situação das crianças ouvintes que a aprendem como uma primeira língua ou a de estudantes ouvintes que aprendem uma língua como segunda língua, Lillo-Martin (1998) ressalta que há padrões comuns nos dados obtidos em tarefas de produção e compreensão escrita de crianças, em fase escolar, surdas e ouvintes. Os estudantes surdos cometem mais equívocos do que os estudantes ouvintes, porém estes desvios não violam os princípios da GU, conforme a autora, o comportamento dos aprendizes surdos difere do comportamento dos ouvintes na marcação não-convergente de parâmetros e alguns padrões não-convergentes refletem a fixação de parâmetros da língua de sinais.

Desde trabalhos pioneiros sobre a aquisição de língua oral por surdos (Thompson, 1936; Heider e Heider, 1940; Myklebust, 1964 apud Berent, 1996) atesta-se que as categorias gramaticais estão praticamente ausentes nos primeiros anos e seu uso tende a aumentar em função da idade, ainda que muitos estudantes surdos, até muito tarde, não utilizem elementos dessas categorias. Sobre a aquisição de português por surdos, Fernandes (2003) demonstra que o uso das categorias gramaticais e sua convergência são influenciados pelo grau de escolaridade e que alguns indivíduos atingem alto grau de sucesso. Berent (1996) e Lillo-Martin (1998), conforme o modelo de aquisição de linguagem baseado na GU, afirmam que, de modo geral, os estudantes surdos progridem em julgamentos de gramaticalidade conforme avançam no sistema escolar. Como indica Lillo-Martin (1998), se um conjunto de princípios universais se aplica a todas as línguas e as línguas diferem em
algumas áreas da gramática, a previsão é a de que os aprendizes mostrem evidências dos universais da linguagem desde cedo, embora algum tempo seja necessário para o desenvolvimento das áreas nas quais as línguas diferem.

3. CONSTRUÇÕES DE POSSE NA INTERLÍNGUA

Construções de posse não pronominal presentes na interlíngua de aprendizes surdos e que não são facilmente observados na produção espontânea foram identificadas e descritas a partir de experimento realizado com oito informantes falantes/sinalizadores de LIBRAS, com surdez profunda e congênita – quatro estudantes da 8ª série do ensino fundamental e quatro estudantes do 2º ano do ensino médio. O experimento constituiu-se de 21 tarefas de produção escrita a partir de ilustrações correspondentes elaboradas com o intuito de favorecer a manifestação de expressões de posse não pronominais pelos informantes.

Como no exemplo em (1), as expressões (aqui destacadas em itálico) foram fornecidas no experimento, cabendo ao informante, mediante observação da ilustração associada, preencher uma lacuna (cuja expressão será apresentada sem o destaque).

(1) --------*estão fechados*. --------*estão abertos*.

O par de sentenças em (1) é ilustrado pelos personagens Magali e Cebolinha, cujos olhos estão fechados e abertos, respectivamente. As lacunas supõem o uso de ‘olhos’ e, a fim de distinguir a que olhos se referem a primeira e a segunda expressão a menção ao possuidor de ‘olhos’ é esperada.

Em um segundo tipo de tarefa, as sentenças fornecidas estão associadas a uma ilustração em que vários personagens desempenham, cada qual, uma atividade diferente. Nesse caso, o preenchimento da lacuna, em (2), implica a escolha de um dos personagens; por exemplo, ‘o pai do Cebolinha’, mas não ‘o pai do Cascão’.

(2) --------*lê o jornal*.


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Na grande maioria das respostas às tarefas propostas, a relação de posse é identificada e diferentes estratégias sintáticas ocorrem na expressão dessa relação semântica. No conjunto de dados se destacam as seguintes estratégias:

(i) presença e ausência de um dos termos (possuidor ou possuído),
(ii) diferente ordenação dos termos possuidor e possuído,
(iii) ausência e presença de preposição.


3.1. VARIANTES NA REALIZAÇÃO DE ESTRUTURAS DE POSSE

As duas variantes da expressão de posse na interlíngua dos aprendizes surdos foram classificadas com relação à presença/ausência dos termos possuidor e possuído. Em (3), exemplifica-se a variante denominada ‘possuído-possuidor’ e em (4) e (5) a variante denominada ‘possuído exclusivo’.

(3) [O vestido de Magali] é amarelo.
(4) O Cebolinha [olhos] estão fechados.
(5) O passarinho azul está [cabeça].

3.1.1. A VARIANTE ‘POSSUIDO-POSSUIDOR’

A variante predominante nos dados, cuja ordem é possuído-possuidor, apresenta construções sem marcação morfológica do genitivo, como em (6) e construções em que a marcação do genitivo ocorre na forma da preposição ‘de’, em (7), mas também com outros itens, como ilustrado em (8).

(6) [pai Cascão] vê um rato.
(7) [O pai de Cascão] vê um rato.
(8) [O pai e Cascão] vê um rato.

Nota-se que a interlíngua dos aprendizes surdos, falantes/sinalizadores de LIBRAS, apresenta construções convergentes quanto à ordem dos termos das construções de posse não pronominal com a gramática do português, incluindo o uso da preposição. A ocorrência de estruturas de posse
convergentes é consistente no que diz respeito à ordem dos termos. Todos os informantes, neste experimento, realizam a ordem possuído-possuidor.

Quanto à marcação morfológica do possuidor, manifesta-se ampla variação individual. As preposições são itens considerados resistentes à aquisição na segunda língua, especialmente a preposição ‘de’ que marca morfologicamente o possuidor no português, por seu caráter mais gramatical/funcional e menos temático/lexical. Além do uso da preposição ‘de’ e do marcador nulo, como em (4), outros elementos, como ‘que’ e ‘e’, marcam a estrutura de posse na interlíngua dos aprendizes surdos. Esses elementos têm propriedades que os identificam como conectivos e como categorias funcionais. A ocorrência de tais elementos, em lugar da preposição ‘de’, indica o preenchimento da posição ocupada pelo marcador de posse com itens cujos traços foram parcialmente identificados. Na aquisição da estrutura de posse, os aprendizes preenchem a posição ocupada pelo marcador de posse com itens da L2 que compartilham propriedades com a preposição convergente.

Destaca-se que a marcação morfológica do possuidor ocorre somente com a ordem possuído-possuidor, que é convergente com o português. Embora todos os informantes realizem a ordem possuído-possuidor, a ocorrência desse padrão não implica a ocorrência de marcador de posse. A presença do marcador de posse, mesmo com ocorrência em pequena escala no conjunto dos dados, representa a possibilidade de reestruturação morfológica. Nas construções de posse na LIBRAS, o possuidor (realizado como DP pleno) não é marcado morfologicamente2. Nesse sentido, a marcação do genitivo no português exige desses aprendizes a aquisição de um item lexical novo.

3.1.2. A VARIANTE ‘POSSUÍDO EXCLUSIVO’

A variante ‘possuído exclusivo’ inclui, por hipótese, uma categoria vazio referente ao possuidor e ocorre com o possuidor mencionado anteriormente, fora do domínio sintático do possuidor (9-11).

(9) A Mônica tem cachorro [cor _______i] é marrom.

(10) O passarinho azul está [cabeça _______i].

(11) [Magali] [vestido _______i] é amarelo.

Em situação exemplificada em (9), o possuído se refere ao termo anteriormente mencionado. Em ‘a Mônica tem cachorro cor é marrom’, o possuído (‘cachorro’), da primeira predicação, torna-se o possuidor, da segunda predicação. Na estrutura que relaciona ‘cor’ e ‘cachorro’, o predicado é

2 A possibilidade de a LIBRAS apresentar um morfema/sinal marcador de posse, como a ASL (Língua Americana de Sinais) não está descartada; os dados disponíveis, no entanto, não atestam esse morfema.
'cor' e seu argumento ocorre como uma categoria nula, co-referente com o termo 'cachorro' da predicação anterior. Assim estrutura nominal com a categoria nula é considerada uma variante.

A presença de apenas um único termo, nesses contextos, levanta a hipótese de relação anafórica e/ou uma oposição alienável/inalienável na construção das estruturas de posse. A correferência é utilizada como estratégia na representação do possuidor em construções com possuído exclusivo. O exemplo (10) (repetido abaixo) mostra exemplo de posse inalienável.

(10’) O passarinho amarelo está [pé] (= pé da Mônica)

O padrão que se configura na superfície com a ordem possuidor-possuído, exemplificada em (11) (repetido abaixo), mostra também a manifestação da variante denominada ‘possuído exclusivo’.

(11’) Magali vestido é amarelo.

A expressão que se configura na superfície com a ordem possuidor-possuído não é a ordem de maior freqüência no output dos informantes, porém é a mais difundida entre eles (apenas para um informante não há nenhuma ocorrência dessa construção). A ordenação possuidor-possuído predomina amplamente em início de oração e sua ocorrência é maior em sentenças construídas com os verbos ‘ser’ e ‘estar’.

Considerou-se que a ocorrência do padrão possuidor-possuído está associada à transferência da L1 e, desse modo, a ordenação possuidor-possuído não se configura em um sintagma nominal, pois o possuidor ocuparia a posição topicalizada como em (12).

(12) [Magali] [DP vestido] é amarelo.

Uma estrutura de tópico leva a analisar os elementos ‘o’, em (13), não como marcador de posse, mas como determinante.

(13) [Magali] [DP o perna] estão fechados.

Em face das construções em que o possuidor é analisado como um tópico, entende-se que as construções em que o possuidor precede o possuído são estruturas do tipo ‘possuído exclusivo’ no que se refere à estrutura do sintagma nominal.
4. CONSIDERAÇÕES SOBRE ESTRUTURAS DE POSSE NA INTERLÍNGUA E L1

A reestruturação relacionada à ordem parece ser menos resistente do que a reestruturação morfológica com relação à aquisição de estruturas de posse, como sugere Craats et al. (2000), entretanto deve-se considerar que a ordem não-convergente (possuidor-possuído) apresentada pelos aprendizes surdos não se relaciona à ordenação núcleo-complemento, já que o português e a LIBRAS são línguas de núcleo-inicial (cf. Quadros, 2000, 1999).

Nota-se que nos dados da interlíngua dos informantes surdos não ocorrem construções do tipo exemplificado em (14).

(14) *Magali de vestido é amarelo.

Tal construção representaria violação dos princípios que restringem as línguas naturais pelo fato de apresentar o possuído marcado morfologicamente pela preposição ou implicaria a presença da preposição posposta ao nome.

Construções com possuidor anteposto ao possuído são encontradas entre aprendizes de português como L2. É o caso de falantes de japonês L1, como mostra Gonçalves (1997) 3. Os padrões encontrados entre eles, porém, não são encontradas nos dados dos aprendizes surdos. Segundo o autor, essas construções não-convergentes ocorrem sob a influência do parâmetro núcleo-final da L1 (japonês), conforme os exemplos abaixo:

(15) [Meali] mãe (=mãe da Meali)

(16) [Raru de] papai (=papai de Raru)

(17) [de (a) Cássio] irmã (=irmã de Cássio)

Em todos os casos a preposição ocorre no DP-possuidor, entretanto as construções refletem a ordem núcleo-complemento do japonês (L1) que é inversa à do português (L2). Os exemplos, em (15), mostram a ausência de preposição e o complemento anteposto ao núcleo do sintagma, conforme a ordenação núcleo-final do japonês; em (16), a preposição é utilizada, porém a ordenação do sintagma preposicionado é núcleo-final (‘Raru de’), assim como, no sintagma de

---

3 Os informantes no estudo de Gonçalves (1997) são crianças de 6 a 8 anos.
posse, o possuidor precede o possuído; em (17), o sintagma preposicionado é convergente com a ordenação do português (a preposição antecede o nome), porém o complemento (‘de Cásio’) precede o núcleo (‘irmã’).

Esses dados revelam a influência da L1 na construção da gramática de L2. Como mencionado, o tipo de estruturas encontrado nos falantes nativos de japonês não se manifesta na interlíngua dos aprendizes surdos. As estruturas realizadas pelos falantes de japonês refletem o parâmetro do núcleo, cujos valores são diferentes na L1 e na língua alvo. No caso dos aprendizes surdos de português, L1 e L2 são línguas de núcleo-inicial.

De acordo com a hipótese de que o aprendiz constrói a gramática de L2 a partir da gramática da L1, propriedades que são semelhantes nas duas línguas deveriam se manifestar desde os estágios iniciais na interlíngua. A preferência pela ordem possuído-possuidor pleno pode refletir o fato de que tanto o português quanto a LIBRAS são línguas de núcleo-inicial e que ordenação possuído-possuidor pleno é gramatical em LIBRAS.

Se a ordem não-convergente ‘possuidor-possuído’ apresentada pelos aprendizes surdos não se relaciona à ordenação núcleo-complemento, a possibilidade é a de estar associada a outras propriedades. Considerando-se a estratégia de se evitar estruturas encaixadas, comuns aos aprendizes, e a interferência de propriedades da primeira língua, essas construções não convergentes sugerem a ocorrência de construções topicalizadas.

A topicalização é uma propriedade reconhecidamente produtiva na LIBRAS. Conforme Quadros (1999; 2000), na LIBRAS, apesar da flexibilidade na ordem das palavras, todas as sentenças SVO são gramaticais. As ordens OSV e SOV são marcadas por expressões não-manuais e envolvem topicalização ou focalização; outras ordens não ocorrem na LIBRAS. Segundo Ferreira-Brito (1995), as sentenças da LIBRAS são mais flexíveis no que diz respeito à ordem das palavras ou constituintes do que as sentenças do português, de modo que a topicalização, muito mais freqüente do que no português, pode ser considerada regra geral na LIBRAS, isto é, caso não haja restrições para o deslocamento de constituintes, a ordem tópico-comentário é a preferida.

As propriedades que determinam a topicalização na LIBRAS podem ser transferidas para a interlíngua dos aprendizes. Nesse caso, os falantes de LIBRAS transferem a propriedade [+ tópico] associada à construção de posse para sua gramática de L2 até que o input desencadeie a reestruturação da gramática.

Em busca de evidência para a observação de que as construções topicalizadas tendem a ser um comportamento associado a estágios iniciais, examinou-se o comportamento de aprendizes com menos tempo de exposição ao português. Foram apresentadas a três informantes -
falantes/sinalizadores de LIBRAS, com surdez profunda e congênita, estudantes da 4ª série do ensino fundamental – oito sentenças com lacunas posicionadas em início da oração⁴.

O conjunto de dados fornecido por esse grupo de informantes caracteriza-se pelas mesmas estratégias na expressão de posse relacionadas anteriormente. Entretanto, nesse grupo,

(i) a ordem possuidor-possuído é predominante e representa cerca de 70% das ocorrências
(ii) a ordem possuído-possuidor, por sua vez, é mínima (apenas uma ocorrência)
(iii) não há ocorrência de preposição ou de quaisquer elementos conectivos

No grupo de estudantes mais avançados (mencionado na seção 3), a ordem possuidor-possuído representa apenas 22% no total de dados, em resposta ao mesmo conjunto de sentenças. O fato de os alunos de menor escolaridade apresentarem um uso categórico da construção possuidor-possuído sugere que esta construção precede as demais estratégias de construção do sintagma nominal de posse. A preferência por essa construção reforça a hipótese de que a construção topicalizada é reflexo de propriedades da L1 conservadas na interlíngua.

5. Considerações finais

Buscando ressaltar a sistemática das construções não convergentes com o português, propôs-se que as variantes da interlíngua, quanto à ordem/presença dos termos plenos, restringem-se a duas, como apresentado no quadro 1 (abaixo). Ao lado da variante convergente, ‘possuído-possuidor’, classifica-se a variante não convergente ‘possuído exclusivo’. Esta última inclui uma categoria vazia referente ao possuidor. Os padrões observados sugerem que a categoria vazia ocorre com a presença do possuidor topicalizado, com o possuidor mencionado na oração imediatamente anterior e, ainda, em situações em que o possuidor está implícito.

quadro 1 - classificação das variantes do sintagma nominal de posse na interlíngua.

| ‘possuído-Possuidor’ | [O vestido de Magali] é amarelo. |
| ‘possuído exclusivo’ | por topicalização O Cebolinha [olhos] estão fechados. |
|                      | por apagamento do possuidor O passarinho azul está [cabeça]. |

Os resultados obtidos até aqui permitem, ainda, propor que o desenvolvimento do sintagma nominal com possuído e possuidor plenos, na interlíngua, articula-se com o uso de construções

⁴ Nesse estádio, em andamento, somente os resultados relativos a sentenças constituídas com os verbos ‘ser’ e ‘estar’.
topicalizadas. Por sua vez, a estrutura com os dois termos plenos e marcador de posse nulo precede a estrutura convergente com o português, em que há marcador de posse expresso (cf. quadro 2).

**Quadro 2 – Desenvolvimento lingüístico relativo à construção da expressão de posse em português.**

<table>
<thead>
<tr>
<th>estrutura topicalizada</th>
<th>ordem convergente e marcador de posse nulo</th>
<th>estrutura convergente com o português</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mônica cachorro</td>
<td>pai Cascão</td>
<td>a boneca de Mônica</td>
</tr>
<tr>
<td></td>
<td></td>
<td>boca com Cascão</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pé para Mônica</td>
</tr>
</tbody>
</table>

O reconhecimento das gramáticas em desenvolvimento de aprendizes surdos de português, falantes/sinalizadores de Língua de Sinais Brasileira (LIBRAS), em particular na constituição do sintagma nominal, requer, por um lado, a análise de mais dados e o confronto com outros aspectos da interlíngua no que se refere ao sintagma nominal. Por outro lado, os resultados sugerem que as seguintes (supostas) propriedades da LIBRAS influenciam a aquisição das estruturas do português pelos aprendizes surdos: (i) na estrutura de posse não pronominal o possuído precede o possuidor (i) há condições para a realização do possuidor em posição inicial da oração, (i) há distinção entre estruturas de posse alienável e inalienável.

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The non- (existent) native signer: sign language research in a small deaf population

Brendan Costello, Javier Fernández & Alazne Landa
KHIT (Sign language research group of the Basque Country)
EHU – University of the Basque Country

Abstract

This paper examines the concept of a native language user and looks at the different definitions of native signer within the field of sign language research. A description of the deaf signing population in the Basque Country shows that the figure of 5-10% typically cited for deaf individuals born into deaf families does not hold true, and consequently there are very few signers who could be considered native users of the language. As a result, a research methodology has been developed which involves registering sociolinguistic metadata for each informant in order to gauge the extent to which an individual is or is not a native signer. An analysis of the expression of role shift reveals correlations between nativeness and specific aspects of language use, and suggests that the examination of non-native language production may provide important insights into grammaticalization processes and language structure in general.

0. Introduction

The notion of native-speaker is central to linguistic research; the object of study, language, is manifest in its most natural state in the language production of a native speaker. This is reflected by the importance given to grammaticality judgements or intuitions of native speakers for deciding what is or is not possible in a given language system. The Chomskian revolution has made claims about the biological foundations of language which endorse the supremacy of native language use, understood as the brain doing what most naturally comes to it (Chomsky 1959). Non-native speakers are problematic as they may present any of a number of complicating factors, hence they do not reveal the language faculty in its natural, or native, state.

In the case of monolingual spoken language contexts, the notion of a native speaker is fairly straightforward, but for situations which diverge from this standard, the concept of native speaker becomes less obvious and requires careful definition. A clear example of a non-standard linguistic
context is the case of sign languages, which have a complex sociolinguistic profile and a thoroughly atypical and heterogeneous population of users. As is well known, sign languages are minority languages which exist in close contact with the majority spoken language(s) and display a great deal of variation. The most decisive factor for development of sign language is the fact that 90-95% of deaf children are born to hearing parents. This figure has become almost mythical in the literature and is constantly cited to explain the anomalous situation of sign language. However, this statistic is based on the population of the United States and may not be directly applicable to other populations. As we shall see, this figure does not hold for the deaf population in the Basque Country, in the north of Spain.

In this paper we examine the notion of native speaker/signer in the context of the sign language community of the Basque Country. In section 1 we review the types of definition that have been used to characterize native signers in different studies of sign language. Section 2 describes the specific sociolinguistic situation in the Basque Country. Although no reliable statistical data are available, it is clear that the number of deaf-of-deaf individuals (that is, deaf people born into deaf families) is extremely low and comes nowhere near to the levels of 5-10% normally cited in the literature, and we posit various explanations for this apparent anomaly. The lack of deaf-of-deaf signers makes the participation of native signers as informants in linguistic research virtually impossible, and this has led us to question whether we can arrive at a native model of the language and to take into account the variety of use and competency among the signing population in our methodology. In order to control for sociolinguistic factors we generate a profile for each informant based on IMDI metadata defined by the ECHO project, and this methodology is described in detail in section 3. In section 4 we describe a specific grammatical element of sign language which may be affected by the signer’s degree of nativeness: role shift. We present data on role shift by Basque signers which reveal two correlations between the degree of nativeness and the expression of the grammatical elements that mark role shift. Section 5 presents a summary and offers further discussion of the issues that arise in this paper, specifically the relevance of studying non-native language production for the linguistic enterprise.

1. The notion of native signer

The importance of native data has been upheld in sign language research, and many research groups carefully select deaf-of-deaf informants who have acquired sign language in the most “natural” or native-like context. However, there is no single agreed-upon definition of native signer, and frequently no explanation at all is given when the term is used. For example, in their thorough and insightful methodological considerations for data collection in ASL, Neidle et al. emphasize the
importance of having native signers as informants, yet give a fairly loose definition of what they mean by this: ‘Deaf people who grew up with Deaf signing parents and who identify with the Deaf community’ (2000: 13). The notion of identification with a community brings in all sorts of social factors which may be difficult to measure objectively.

When faced with such vagueness and with the sociolinguistic complexities and heterogeneity of the signing deaf community, many research groups tend to go for the safest option, selecting subjects who are (at least) second generation deaf-of-deaf signers. This guarantees that the person grew up acquiring sign language from their signing parents. This ‘safest option’ model of native informants is particularly favoured in neurolinguistic research, as the millisecond findings are often sensitive to such details, and there is a need to factor out as much noise as possible (cf. Neville et al. 1997; Petitto et al. 2000; MacSweeney et al. 2002).

However, access to signers from multigenerational deaf families is not always possible; when the ‘safest option’ of second- or higher-generation signers is not viable, an alternative strategy is to specify various criteria which informants must meet. To give a recent example, in their study of verbal agreement forms in different sign languages, Mathur and Rathmann (2006) stipulate that their informants must fulfil three conditions: (i) exposure to sign language by the age of three; (ii) ability to judge with ease whether a sentence is grammatical; (iii) daily contact with a signed language in the Deaf community for more than 10 years. The idea here is that early acquisition combined with continuous contact with the language is ‘as near as dammit’ as far as being native is concerned.

As we shall see in the next section, the demographics of the signing population we are studying make it difficult to find even such a second best. What option remains when there are not even enough individuals with an early acquisition of the language to work as informants? In section 3, we set about answering this question by returning to the notion of native signer and explaining the definition we have adopted within our methodology, which attempts to accommodate the participation of non-native signers as informants. Before looking at our response to the specific situation of the deaf signing population of the Basque Country, we describe that situation in section 2.

2. The deaf population of the Basque Country

The Basque Country is a region in the north of Spain and south-west of France. Our research group works in the administratively Spanish part of the Basque Country, which is divided into three main provinces: Araba, Biscay and Gipuzkoa. (Henceforth, when we refer to the Basque Country, we are referring to these three provinces; we shall not consider the French part of the Basque country since the deaf community there uses a different sign language – LSF or Langue de Signes Française –
and is regarded as a separate linguistic community.) According to Eustat, the Basque Statistics Office, the population of the Basque Country stands at just over 2,100,000 (latest figures from the 2004 census). The main spoken languages in this part of the Basque Country are Spanish and Basque; although almost 60% of the population are monolingual Spanish speakers, nearly 70% of children are currently going through either bilingual Basque-Spanish or monolingual Basque schooling (source Eustat), which means that the tendency is towards a higher degree of bilingualism in the population.

The sign language used in our area of study is a variant of LSE (Lengua de Signos Española), the sign language used in most of the rest of Spain. Dialectal work on LSE based on lexical comparison and mutual intelligibility judgements has shown that the sign language of the Basque Country is a variant of LSE and forms the core lect of the main northern dialect, with certain differences which set it apart from other dialects (Parkhurst & Parkhurst 2001). It is very difficult to find statistical information relating to the number of sign language users in the Basque Country or in Spain, and no clear figures are available. We will give a brief overview of those figures which may shed some light on the number of sign language users, but clearly more accurate data are required and there is a need for official censuses to include questions on sign language use.

The Spanish National Association of the Deaf, CNSE, claimed in 2002 that there were 150,000 deaf sign language users in Spain (CNSE 2002 website, retrieved via the Internet Archive). They did not give a source for this statistic, nor did they state how they arrived at this figure. If we scale this down for the population of the Basque Country, the number of deaf sign language users should be in the region of 7,200.

The Spanish Statistical Institute, INE, conducted a survey on disability in 1999 but made no specific mention of sign language use in the questionnaire. The categories which were used, such as “Communication by means of alternative languages” or “Communication by means of non-signed gestures”, are too vague for our purposes as they may include many communication systems other than sign language. However, the figures on hearing loss may give an idea of the number of sign language users. Following Johnston (2006), we can assume that the number of sign language users may be estimated as the sum of all of the profoundly deaf individuals and half of the severely deaf individuals. This gives us a number of around 5,100 deaf sign language users in the Basque Country. This estimate is based on figures for population in the age range of 6-64, which helps to exclude the large number individuals in the 65+ group who lose their hearing through old age and

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1 Currently, the CNSE website only gives a figure for the number of sign language users, which includes both deaf and hearing signers (hearing family members, interpreters, etc.).

2 It should be noted that Johnston’s figures were based on audiological criteria (hearing threshold in decibels), but the INE statistics are based on functional criteria (“Cannot hear at all”; “Hears only with extreme difficulty”)
are extremely unlikely to be sign language users; there are no regional figures available for the population group under 6 years old, but a rough estimate by scaling down the national figure suggests that there are less than 50 profoundly deaf children in the Basque Country, which would have little effect on the total.

The regional councils of the three Basque provinces (Araba, Biscay and Gipuzkoa) publish figures on the number of individuals who have been certified as disabled. In 2003, there were 2,950 individuals certified as having “hearing disability” (Pisonero Riesgo 2004). This disability certification is an administrative measure to assess whether or not an individual qualifies for certain types of social support; it is rated on a linear scale and does not give much indication of the individual’s situation since many different factors are conflated. In this case, the figure may include individuals who have some hearing loss combined with other disabilities, or individuals who have profound hearing loss but do not use sign language; conversely, there may be deaf sign language users who have not managed to be certified as disabled, and thus are not included in this statistic.

Finally, an indicator of the number of sign language users in the Basque Country may be gleaned from the membership figures of the local deaf associations, the social hubs of the signing community. There are six different associations (one in Araba: Vitoria-Gasteiz; three in Biscay: Bilbao, Basauri and Durango; two in Gipuzkoa: San Sebastian and Tolosa) and they have a total of 750 members. While it is possible that some individuals may belong to more than one association, there will be many more deaf signers who are not a member of any of the associations, and so this figure gives us the most conservative number of signers, providing a lower limit for our estimates. The different figures reviewed here are summarised in Table 1.

<table>
<thead>
<tr>
<th>Number</th>
<th>Group</th>
<th>Source (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,100</td>
<td>Deaf signers based on ‘Severely or totally’ deaf (age 6-64)</td>
<td>INE – Spanish Statistical Institute (1999)</td>
</tr>
<tr>
<td>2,950</td>
<td>‘Certified’ deaf (age &lt;65)</td>
<td>Regional Councils (2003)</td>
</tr>
<tr>
<td>750</td>
<td>Members of Deaf people’s associations</td>
<td>Regional Deaf People’s Associations (2006)</td>
</tr>
</tbody>
</table>

Table 1. Summary of statistical information available for the number of Deaf Signers in the Basque Country. (Numbers rounded to the nearest 50.)
The most striking impression that these figures give is the dire need for clear statistical data on sign language users (and on hearing loss more generally); in our review of the information made available by official statistical bodies, we have become aware of this shortcoming and also of the lack of uniformity of categories across different questionnaires. To a certain extent it is understandable that each data collector imposes its own criteria when deciding what type of information is of interest, but all too often we have come across definitions which lack scientific rigour and render the resulting data useless (or even worse, no explanation at all about what a given label such as “severe hearing loss” means).

The second observation we wish to make, which is more directly to the point of this paper, is the discrepancy between the prediction these figures make for the number of second-generation signers in the Basque Country and the reality of the situation. Frequently cited in the literature is the figure of 5-10% for the proportion of deaf individuals born to deaf parents (Schein & Delk 1974; Kyle & Woll 1985; Neidle et al. 2000). If we apply this figure to our estimates of the number of deaf signers in the Basque Country, even on the most conservative estimate, we would expect there to be between 40 and 75 second- (or higher-) generation deaf signers. In our work within the deaf signing community, we have not managed to find even 7 second-generation signers.

It seems clear that, despite the shortcomings of our statistical data, the problem lies with the figure of 5-10% for deaf-of-deaf. This figure was arrived at on the basis of statistical data for the population in the US, and has generally been assumed to be applicable to other populations. However, the validity of this mythical 5-10% has begun to be questioned and it appears to be the case that it greatly overestimates the proportion of deaf children born to deaf parents (cf. Johnston, 2006: 161-2). These claims that 5-10% is too high a figure for the number of deaf-of-deaf individuals are supported by what we know about the deaf signing population of the Basque Country. It may be that figure of 5-10% does not hold true for the Basque deaf population because of a lesser degree of endogamy within this population group. Unfortunately, although somewhat unsurprisingly, there are no reliable statistics available for the level of intermarriage among deaf individuals in the Basque Country, but our experience within the deaf signing community suggests that there is at least a popular perception of relative endogamy within the community, as tends to occur in deaf populations in the western world.

Alternatively, the explanation for the 5-10% deaf-of-deaf not attaining in the Basque deaf signing population may be to do with demographics and genetics. The relatively small size of the Basque population may mean that genetically hereditary deafness does not manage to become a common phenotypic trait among the population; the genes responsible for deafness do not manage to spread as the population size is not at the threshold level for such mechanisms to come into play.
This idea that a population must attain a critical mass before higher frequencies of genetic deafness occur is supported by the fact that larger deaf communities, as may be found in cities such as Madrid or Barcelona, do tend to have multigenerational deaf families. However, statistical data and genetic research are required to provide empirical evidence to flesh out these hypotheses.

Recent work on a specific type of hereditary deafness suggests that the explanation may be a combination of both intermarriage and genetics. A specific type of hereditary deafness is caused by mutations at the connexin-26 gene locus, and this gene may be responsible for up to half of all cases of genetic deafness in many populations (Nance et al. 2000). The claim has been made that connexin-26 deafness is ‘higher in large populations with a long tradition of intermarriages among deaf people than those without such customs’ due to a combination of assortative mating (that is, deaf people tend to form couples with other deaf people) and relaxed selection (the social circumstances which prevented deaf people from being genetically fit and reproducing have been removed). This claim is supported by the unexpectedly high frequency of this type of hereditary deafness in the US coupled with continued endogamy within the deaf population over the last 200 years. The absence of high levels of genetic deafness in the Basque Country may be because there has not been as much intermarriage or because the population is just not large enough for the mechanisms of assortative mating and relaxed selection to have an effect.

This work on connexin-related deafness suggests there may be a third possible explanation. In order for a particular type of genetic deafness to become frequent, it has to be there in the first place:

To explain why connexin deafness has been amplified in so many large populations, we must assume it was the most frequent form in those populations at the time that relaxed selection and assortative mating began, possibly because of a somewhat higher intrinsic mutation rate. (Nance & Kearsy, 2004:1083)

It may well be the case that there is a very low incidence of connexin (or other forms of) genetic deafness in the Basque Country, and so the right conditions were never in place for a high frequency of genetic deafness among the population. When we turn to the deaf population of countries like Australia, which is fairly large and has conditions apparently similar to those in the US (assortative mating and relaxed selection), and find that they do not fulfill the mythical 5-10% deaf-of-deaf, we may infer that they have a much lower rate of genetic hereditary deafness. As such, the US case may be exceptional in that there was initially an abnormally high rate of one type of genetic deafness which laid the foundations for the marked increase of this particular genetic deafness in the population.
At the moment, for want of clear statistical data on the incidence of hereditary deafness in the Basque Country, no answer may be found to these questions and the hypotheses outlined above remain mere speculation. What we do know is that there is an incredibly small number of deaf-of-deaf signers in the Basque Country. As linguists looking for native signers to provide us with data on the language, this has important consequences for the way we can go about studying the sign language used in the Basque Country. In the next section, we describe the methodology we have adopted in our research group in order to deal with this situation.

3. Methodology
As we have seen in the previous sections, data from native informants is one of the main means for examining the workings of a given language, and yet it is debatable whether the language which is the object of study for our research group has any native informants at all in the Basque Country: at best we have a few second generation signers who learnt their sign language from birth, from their non-native parents. What linguistic research can be done in the context of a community where there is a mere handful of (possibly) native signers?

In order to widen our informant base among the sign language users in the Basque Country and to have a better idea of what being a native user might or might not mean, we decided to use a data collection method which included registering sociolinguistic data associated with each informant and each data collection session. In this way, our data are not necessarily coming from native informers, but we would have as clear a picture as possible of where our data were coming from. To record these sociolinguistic factors we use the IMDI database for sign language metadata, which was developed for the ECHO project (Crasborn & Hanke 2003). The IMDI standard comes with a viewer and editor which were developed at the Max Planck Institute for Psycholinguistics in Nijmegen, Holland, and allow the information to be examined and manipulated. The set of metadata for sign languages was established for the sign language section of the ECHO project, which was designed to establish a corpus of data for various European sign languages.

We video-record our informants in various situations and contexts, such as spontaneous conversations, controlled interviews and elicitation from stimulus material. Each recording session is logged in the IMDI database to ensure that all the related metadata are recorded. The metadata relate to the informant, for example:

− age, place of birth and sex
− hearing status, parents’ hearing status, type of hearing aid used (if any)
− age of exposure to sign language
− place and context of sign language exposure
– primary language of communication within the family
– schooling (age, educational program, type of school)

and also to the specific context of the recording session, such as:
– type of communicative act (dialogue, storytelling, question and answer)
– degree of formality
– place and social context
– topic of the content

These data allow a sociolinguistic profile of both the informant and the recording session to be established as precisely as possible. In one sense, this allows us to put the cart before the horse. Normally in the study of language, native competence is defined internally to the language, by means of specific features of the language: “a native speaker would say this, this and this.” However, in the case of sign language, and of LSE specifically, we do not have enough understanding of how the language works to be able to say what is and what is not native competence. As we saw in section 2, in the field of sign language research we find ourselves defining native language competence in terms of language-external factors, that is, sociolinguistic characteristics of the individual: “this person is a native speaker because she is this, this and this.” And, as we saw in section 1, the characteristics usually given are of the following type: hearing status, family hearing status, age and length of exposure to sign language, level of use of sign language.

Fortunately, there is some justification for this inside-out way of defining native competence, and for the sociolinguistic characteristics which are singled out as being relevant for defining native competence. The evidence comes from the findings of language processing studies: an independent means of judging nativeness is the speed with which an individual processes language. Put crudely, native users are quick, non-native users are slower. Experimental work on grammaticality judgement reaction times in sign language has shown that an individual’s age of exposure to sign language is crucial to how quickly he processes the language. If a person starts acquiring sign language after the age of three she is significantly slower (and less accurate) in detecting ungrammatical sentences than signers who began learning before age three (Boudreault & Mayberry 2006). This finding shows that the age of three is an important threshold which delimits the individual’s final proficiency in the language. On the basis of this result, we use ‘age of exposure to sign language’ as the principal characteristic which indicates whether or not a person is a native user. (We also include the related factors of ongoing contact with sign language and parents’ hearing status.)
By having a sociolinguistic profile of each informant, we are able to identify those who are (likely to be) native signers. In addition, for those who are not native signers, the metadata give us an insight into the extent to which they deviate from the prototypical native profile. If we then look at their language use, we can make tentative claims about native use of the language and about how non-native use diverges from this. In the following section we look at an example of differing language use for a specific sign language structure from the data we have collected: role shift.

4. A case study: role shift

Role shift is a mechanism used in sign language to convey somebody else’s thoughts or utterances, and it has been widely studied in a variety of sign languages (see Quer 2005 for an overview). Role shift plays a similar role to both direct and indirect speech in spoken languages, and from a semantic/pragmatic point of view, it involves changing the frame of reference to that of the character whose thoughts or utterances are being conveyed. When role shift is used, all deictic elements which identify the context of the utterances must be understood as referring to the recreated (or ‘shifted’) context and not the immediate communicative context. The referential anchors which give meaning to all deictic reference (“me-here-now”) are substituted by an imaginary or constructed frame of reference (that of the role shift character). This strategy is grammatically coded in sign language and is commonly used in signers’ discourse. As such, role shift represents a cognitively complex structure and is a part of the grammar that may be affected by a delay in an individual’s acquisition of the language, which is to say the degree to which an individual’s language use is native.

On the basis of the expression of role shift in the data we have collected, we have conducted a pilot study to look for a correlation between the expression of role shift and the degree of nativeness. Our findings are based on few signers (5) and are only qualitative at the moment: more data are required to furnish quantitative results. Before looking at the results of the study, we give a brief description of the markers used to signal role shift in LSE.

4.1. Role shift markers

Role shift may be marked by various means (which have been identified in most sign languages studied, Zucchi 2004):

(i) a change in orientation of the body, head or gaze throughout (or to introduce) the role shift

(ii) a nominal marker: a noun phrase which identifies the role shift character is signed to introduce the role shift (e.g. FRIEND)
(iii) facial expression associated with the role shift character throughout (or to introduce) the role shift.

None of these three markers is obligatory all the time. Facial expression alone is never used to mark role shift whereas orientation or a nominal marker alone may be used. An example of role shift in LSE, in which the signer uses various markers, is given in (1):³

\[
(1) \text{YESTERDAY POSS}_{1p} \text{ MOTHER INDEX}_{1p} \text{ SAY}_{1p} \text{ TOMORROW INDEX}_{2p} \text{ POSS}_{2p} \text{ HOUSE GO} \\
\text{‘Yesterday my mother said to me: tomorrow I’ll go to your house.’}
\]

We now turn to the results of our examination of the expression of role shift in signers with different degrees of nativeness.

### 4.2. Results

Our findings may be exemplified by three different signers who are representative of the correlations between nativeness and the expression of role shift which we have found in the entire sample. The first signer, “Andrea”, was brought up in a hearing family and did not come into contact with sign language until the age of 16; the second signer, “Klara”, also has a hearing family but began learning sign language earlier, at the age of 11, and has become a sign language teacher; the third signer, “Iratxe”, is from a deaf family and learnt sign language from birth. According to our definition of nativeness in terms of age of exposure to sign language, ongoing contact with sign language and family hearing status, Iratxe is the most native signer, followed by Klara, then Andrea.

In terms of the expression of role shift that we found in the recordings of these signers, we will concentrate on the use of formal markers as described above. Recall that we set out to find some sort of correlation between nativeness and the expression of role shift. Andrea used a great deal of facial expression and changes in head orientation, while the nominal marker was infrequently used, and when it was used it was often inconsistent or incorrect. Klara also used facial expression but made greater use of changes in orientation, drawing upon other articulators such as the shoulders and eyes; she made occasional use of nominal markers and when used together with other markers, these were articulated sequentially rather than simultaneously. Iratxe’s use of facial expression was more reduced than the other two signers, as was her use of orientation, which at times was not used at all; in contrast, the nominal marker was consistently used to mark role shift. These results are summarized in Table 2.

³ Signs are glossed by the standard convention of using capital letters (e.g. SIGN). Subscripts mark the locus of the sign, or the start/end location features: \(i\) is a point in the signing space; \(1p\) and \(2p\) are first and second person loci, respectively. INDEX is a pointing sign (which may be pronominal); POSS = possessive.
4.3. Discussion

As already mentioned, our findings do not allow us to establish a direct correlation between a given social factor and a specific grammatical form used in marking role shift since much more data would be needed to achieve this type of quantitative result. Nevertheless, we have been able to identify two progressive scales which draw out two different relationships between nativeness and role shift markers:

(i) The degree of coarticulation of the markers increases with nativeness. A native signer may use several markers to signal role shift, and will invariably articulate these markers all at the same time. For example, a nominal marker may be signed on the hands while the head turns to one side and facial expression changes slightly. A less native signer, in contrast, will tend to produce each marker sequentially, such that a change in body orientation is followed by a marked facial expression and then a nominal marker. Obviously, this difference leads to greater fluidity and density of information in the native signer’s production.

Interestingly, in the least native-like case there is also a relatively high degree of coarticulation. This may appear to go against the coarticulation-nativeness scale that we claim to have found, but a closer look at the markers the non-native signer is using and the way she is using them offers an explanation. The least native signer uses facial expression and orientation simultaneously to mark role shift, but does so in a way which is sometimes ambiguous. It is as though the mechanism of role shift is not grammatically governed and her use of facial expression and orientation are closer to mime rather than formal markers of role shift. This signer shows a high degree of coarticulation for the role shift markers, but is not using those markers to signal role shift as a grammatical construct, but rather as a communicative strategy. This scale, then, may be better described as a U-shaped curve, a pattern which so often crops up in language acquisition processes:
in the initial (non-native) state, markers are used simultaneously but ungrammatically; when grammaticalization occurs and the markers take on linguistically governed functions, the near-native signer will break down the expression into separate segments which are articulated sequentially (perhaps due to cognitive processing limitations); the native signer will be able to automate the process of role shift marking to a much greater degree, thus permitting simultaneous articulation of various markers, if need be.

(ii) The more native the signer, the more abstract the use of space. As a visual language which is articulated in physical space, sign language makes use of space to mark grammatical distinctions. In the case of role shift, a change of orientation (of the body, head or eye gaze) in real space is one of the markers which may be used to indicate a shift in the frame of reference. We have found that the use of space for marking role shift becomes more abstract for more native signers, to the point where space is not used at all by the most native signers.

As mentioned above, it is most likely that the least native signer is not using grammaticalized role shift but rather a series of communicative strategies; the change in orientation to mark role shift is akin to mime, and the use of space is limited to being a reflection of spatial relations in real space. For example, if the signer is relating a conversation between a lion, situated on her left, and a mouse, situated on her right, a role shift to the character of the lion must always be marked by a change in orientation to the left, and the mouse to her right. The limitations of mime dictate that without this spatial coherency there will be a loss of clarity and possibly a breakdown in communication. The near-native signer also tends to respect the coherency of these spatial representations, with each character being assigned a given point in space, but not as strictly. We have come across many incidences of role shift in which the direction of the change in orientation does not fit in with the spatial map that has been established in the discourse (e.g. lion left, mouse right); what is important here is not the direction of the change in orientation but the fact that there is a change in orientation at all. This change in orientation marks the role shift, but it does not necessarily uniquely identify the frame of reference that is being switched to; this is achieved by means of other role shift markers, such as the nominal marker, and by discourse considerations. The change in orientation no longer means “Now I’m the mouse” but just says “Now I’m somebody else”. The final step in abstracting the use of space, which occurs in native signers, involves doing without orientation as a mark of role shift altogether. There is a tendency in native signers to lessen the articulation of orientation, not only by making reduced movements but also by using smaller articulators such as the eyes and the head, rather than the shoulders and the body. However, there are instances of role shift when absolutely no orientation is used, and the marking is achieved solely by means of the nominal marker (and possibly also facial expression). The different uses of space
by signers with different degrees of nativeness reflect the extent to which role shift is a part of the grammar: the use of space changes from a mime-like representation to an arbitrary marker and may even disappear completely.

<table>
<thead>
<tr>
<th>CO-ARTICULATION:</th>
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<tr>
<td>Co-occurrence of various expressive devices</td>
<td>Consecutive articulation of markers</td>
</tr>
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<table>
<thead>
<tr>
<th>ABSTRACT USE OF SPACE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mime-like</td>
<td>Arbitrary use of space</td>
</tr>
</tbody>
</table>

Table 3. Two correlations between the degree of nativeness of the signer and different aspects of the expression of role shift: i) coarticulation; ii) abstract use of space.

In our discussion of both of these scales, represented in Table 3, we have touched upon the process of grammaticalization and how the expression of role shift may change according to the degree to which it forms a part of the signer’s grammar. Can this observation offer an insight into the way in which language develops in the individual, or even the way language itself evolves? We turn to this question in the conclusion.

5. Conclusion

In this paper we have examined the notion of native speaker/signer, the motivation for which came from a lack of native signers in the deaf population of the Basque Country who can participate as informants in sign language research. A survey of the somewhat haphazard statistical information on this population has revealed that the common assumption that 5-10% of deaf people are born to deaf families does not hold true in the Basque Country. We have examined various definitions of native signer that have been used in sign language research and have described the methodology that we have developed in order to get around the lack of native informants, which involves adopting a notion of nativeness based on a number of language-external factors (age of acquisition, family hearing status and contact with sign language). Finally, in analysing the use of role shift markers by our informants, we have looked at a specific aspect of the variety of LSE used in the Basque Country which displays variation according to the nativeness of the signer. This variation may be captured in terms of two progressive scales dealing with the degree of coarticulation, on the one hand, and the extent to which the use of space is abstract, on the other.
From what we have described in our work on the sign language of the Basque Country we would like to draw attention to two points:

Firstly, the importance of recording metadata which permits a sociolinguistic profile of informants to be created. In the context of sign languages in small populations, the absence of unquestionably native signers makes it imperative to know exactly where data are coming from and what they represent. Our principal lines of study as a research group are not sociolinguistic in nature, but we have felt the need to adopt a sociolinguistically informed methodology in order to be able to substantiate our data. As a secondary effect, the compilation of sociolinguistic data will help to give the scientific community a better picture of the makeup of deaf populations, and provides a starting point for demographic, anthropological and social work.

Our second observation relates to the pilot study of the effects of late acquisition on the expression of role shift. Given the particular social conditions in which they exist, sign languages offer the chance to study the language faculty in states other than the native condition, according to the age of exposure to the first language. The classic work by Jakobson (1941) draws attention to the parallels between the stages of development during the construction of the phonological system and the stages of decline due to aphasic conditions. According to this study, the fact that the stages of development and decline of the phonological system coincide in nature and sequential ordering constitutes evidence of the internal organization of the linguistic system. In Jakobson’s own words, this organization is subject to the following general principle:

Just as the high-level structure may not be constructed unless the foundations have been previously laid down, the foundations may not be dismantled without first removing the high-level structure.

(Jakobson 1941: 396. Authors’ translation)

The case of late acquisition in sign languages represents a hybrid between normal language acquisition and language deterioration in aphasics. If we accept Jakobson’s general principle that the processes of language acquisition and loss reflect the fundamental nature of the hierarchical organization of language, it may be predicted that the various levels of grammatical competence resulting from late acquisition are also a reflection of this hierarchical organization. As such, grammatical studies involving non-native signers may reveal important information about the human language faculty. Our pilot study on role shift is by no means the first step in this direction: Lillo-Martin & Berk (2003) study the effects of late acquisition on sign order in ASL; Coppieters (1987) analyses the relationship between age of acquisition and lexical knowledge for ASL; and, as we saw in section 3, Boudreault & Mayberry (2006) have looked at differences in sentence processing time with respect to age of acquisition. Additionally, groundbreaking work on home
signing (Goldin-Meadow 2003) and emerging sign languages, such as Nicaraguan Sign Language (Kegl, Senghas & Coppola 1999), has made use of non-native signing to provide significant insights into the nature and development of language.

As mentioned earlier, role shift in sign languages is a grammatical mechanism which is analogue to direct/indirect speech in spoken languages. Both structures involve a change in the frame of reference for deictic expressions, and both involve grammatical constructions which entail a certain amount of morphological complexity. The progressive scales for the grammaticalization of role shift which we have identified reflect this complexity. A comparison of this process with the stages of acquisition of role shift or direct/indirect speech by native signers/speakers, and the manifestation of these structures in aphasics could provide a valuable source of evidence for: (i) the internal organization of the grammar of sign languages, (ii) the fundamental differences and similarities between signed and spoken languages, and (iii) the structural makeup of Universal Grammar.

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Inalienable Possession in British Sign Language

Jordan Fenlon & Kearsy Cormier
Deafness, Cognition and Language Research Centre, University College London

Introduction
When expressing possession, some languages make a systematic, grammatical distinction between nouns that are either inalienable or alienable. Inalienable nouns refer to permanent phenomena (those that cannot be separated from the possessor). In contrast, alienable nouns refer to non-permanent entities. Amongst spoken languages which have an inalienable/alienable distinction, inalienable possession is used consistently with body-part and kinship terms. Other semantic categories which are considered inseparable from the possessor are additionally marked inalienable in some languages, though none as consistently as kinship or body parts.

Inalienable nouns marked for possession morphologically: Yavan (Australasian)

Inalienable possession marked with possessive pronoun: ngoc amda ‘my house’, nam ‘your face’

Inalienable possession marked with suffix: gəadə-c ‘my uncle’, dəm ‘your body’

Inalienable nouns marked for possession morphosyntactically: French ( Indo-European)

Alienable possession marked with possessive pronoun: il ‘sees utter’ he opened his eye

Inalienable possession marked with definite article: I count tea years ‘he opened his eyes’

Based on a small informal study, Sutton-Spence & Wil (1999) claim that British Sign Language (BSL) encodes inalienable possession using the personal pronoun INDEX and alienable possession using the possessive pronoun POSS. The current project aims to investigate inalienable possession more formally and with more data.

Research Questions
- Is there evidence supporting a grammatical alienable/inalienable distinction in BSL?
- If there is evidence for an inalienable/inalienable distinction in BSL?
- Are these categories the same as those found in spoken languages?

Method
Data were collected from native BSL signers using the following tasks:

Storyboard Task: Three participants created a story outlining the relationship between a person (the possessor) and a set of pictures (designed to elicit use of possession with kinship terms, NAME and typically alienable objects).

Doctor-Patient Task: Two participants performed a role-playing task where one was a doctor and the other a patient. The ‘doctor’ had to diagnose the patient’s mystery illness by asking questions. (Designed to elicit use of possession with body-part nouns.)

Family Tree Task: In an interview setting, two participants asked each other questions about their families and drew a family tree based on responses. (Designed to elicit use of possession with kinship terms.)

Data were also collected from the following sources:

Conversational data: Two signers (one native signer and one who learned to sign from the age of 8) discuss their attitudes towards work.

Deaf Century video: A 3-part British television series which include interviews with older deaf BSL signers recounting previous experiences in school and Deaf culture. Information concerning the signer’s background was not available.

Results

Proportion of INDEX and POSS with inalienable nouns

Body-part terms (N=4) and NAME (N=13) and kinship terms (N=7) marked with INDEX BSL

Data from all tasks revealed INDEX consistently used with the sign NAME and with body parts. However, we identified fewer tokens of INDEX in our data for these categories. A small proportion of kinship terms were also marked with INDEX.

INDEX-1qg NAME-INDEX-1qg P A M ‘My name is Pam’

POSS-1qg BETTER ASK POSS-1qg MOTHER ‘You’d better ask my mother’

POSS-2qg FAMILY ‘I want to ask about your family’

Kinship terms marked with possessive pronoun POSS (N=75) BSL

The possessive pronoun POSS was used much more than INDEX with kinship terms. This contradicts traditional (spoken language) patterns for inalienable possession.

Discussion
Overall these data do not provide strong evidence for grammatical marking of alienable/inalienable possession in BSL.

- Kinship terms are marked with possessive pronoun in most cases. The 14% where we see the use of INDEX all come from the same source, the Deaf Century video, which feature older signers with unknown backgrounds. All other data are known to be from native signers or early learners of BSL.

- The data do show consistent use of INDEX with body parts and with NAME. However:
  - The number of tokens for each is small.
  - It is not clear whether NAME is acting as noun or verb (if verb INDEX may not be acting as possessive at all – e.g. INDEX-1qg NAME R O B ‘I am called Rob’).

Despite problems with claiming that BSL grammaticizes inalienable, the possession constructions in these data that do use INDEX are consistent with patterns across spoken languages, where body parts and kinship terms are crosslinguistically inalienably marked in languages that have the distinction, and the existence of any other semantic categories marked as inalienable in a given language implies that body parts and/or kinship terms will also be marked as inalienable (Kilner 1996; Nichols 1988, 1992). Further research (and more data) is needed to determine more definitively whether BSL truly has a grammatical inalienable/inalienable distinction.

Conclusion
Research in inalienability and similar features within signed languages highlights the importance of including signed languages in language typologies and studies of linguistic diversity. Language typologies that do not include signed languages may be making inaccurate generalisations about the world’s languages and about the possibilities of human languages in general. Likewise, patterns found in signed languages can help support claims about language universals.

Future Questions
- Do BSL signers accept the use of the possessive pronoun with body part nouns and NAME? If so, in what contexts?
- What kinds of patterns are found with plural pronouns in possessive contexts?
- Is alienable/inalienable marking in BSL structurally similar or different from spoken languages?
- Is the strong preference for use of the possessive pronoun with kinship terms due to BSL’s close relationship with English (a language that does not grammaticises inalienably)?
- Do other signed languages grammatically mark inalienable possession?

Acknowledgements
The present study is based in part on an earlier BSL dissertation project which was supervised by Rachel Sutton-Spence with additional input from Beren Wod. We would like to thank Rachel for assistance in collecting, analysing and discussing data for the present study. We also thank Usha Deas for identifying the conflation project on possession which these data have contributed towards (for BSL), and the Centre for Deaf Studies (University of Bristol) for partial financial support.
The systems of numerals in Catalan Sign Language (LSC) and Spanish Sign Language (LSE): a comparative study

Maria del Pilar Fernández Viader* & Mariana Fuentes**
*Universitat de Barcelona, Departament de Psicologia Evolutiva i de l’Educació.
Pg. de la Vall d’Hebrón 171, 08034, Barcelona, España.
pfernandez@ub.edu
**Universitat Autònoma de Barcelona, Departament de Pedagogia Aplicada.
Ed. G-6, Campus UAB, 08193, Bellaterra, Barcelona, España.
Mariana.Fuentes@uab.cat

Abstract
This is a contrastive study between systems of numerals in Catalan Sign Language (LSC) and Spanish Sign Language (LSE), the two sign languages used in Spain.

The description concentrates in cardinal numerals and includes the lexical primitives, the operators and emphasizes in the resources these languages use to indicate decimal values. In the comparison we considered: numeral series and its variants, formational parameters, use of change in hand orientation to convey different values, signing of intermediate and final zeroes.

LSE and LSC coincide in that their numeral systems derive from manual counting, with the exception of one variant of some numerals in the decades in LSE. Both show one one-handed and one two-handed variant.

Differences concentrate in some hand shapes, particularly of the operators; in hand orientation with regard to the basic lexicon (from ONE to NINE); and in some signs in the movement parameter.

1 This research is part of the project Cicyt BS 02003-04614 of the Ministry of Science and Technology, Spain.
Key words: Numeral system-contrastive study-Spanish Sign Language-Catalan Sign Language-

We performed a contrastive study of numeral systems in Catalan Sign Language (LSC) and Spanish Sign Language (LSE), concentrating in the cardinal series.

Contrastive studies between these two languages are scarce and do not include comparisons between these two languages’ numeral systems. Because of this, this research aims to complete and deepen previous studies done on each of these languages separately (Fernández-Viader, M.P.; Segimon, J.M.; Boronat, J.; Codorniu, I.; García, C.; Jarque, M.J.; Serrano, E., 1997; Fernández-Viader, M.P., Segimon, J.M.; Boronat, J.; Codorniu, I.; Frigola, S.; García, C.; Jarque, M.J.; Serrano, E., 2002; Fernández-Soneira, 2000; 2003; Fuentes, M., 1999, 2000; Fuentes, M. y Tolchinsky, L., 2004; Pinedo, F., 1989).

We consider that these studies are especially necessary nowadays when the Deaf Community in Spain is seeking the full recognition of its sign languages. Also, linguistic descriptions are the reference point in language acquisition studies. The description we present includes the phonological features of the basic lexicon of cardinal numerals: the lexical primitives, the operators, and some morphosyntactic compounds, and emphasizes in the resources the languages use to indicate decimal values.

The description considers similarities and differences between LSC and LSE. Comparissoon will consider: the numeral series and their variants, the formational parameters, use of change of hand orientation in each language to indicate different values, signing of intermediate and final zeroes, use of a sign ZERO as a place holder, transparency with regard to decimal notation and cardinality, lexicalization of certain numerals.

This is a preliminary study and our conclusions are still not definitive, due to the scarcity of previous contrastive studies on these languages: LSE and LSC. Also, with regard to LSE, we are broadening the research to include informants from different regions of the country.
1. Method

1.1. Sources of data collection

For LSC:
– Consultation with informants.
– Observations in deaf associations over a two year period.

– Sign language courses.
– Permanent consultation because of continued contact.
– Study of dictionaries and LSC teaching materials.
– Study of existing bibliography on the subject.

For LSE:
– Consultation with informants.

– Study of dictionaries.
– Study of existing bibliography on the subject.

1.2. Informants

They were 9 deaf native signers in LSC, considered competent signers as they are or were sign language teachers and are part of the Deaf Community in Barcelona. With regard to LSE they were 3 native signers, and 2 hearing competent signers, sign language teachers.

1.3. Procedure

Informants were asked to read a series of numerals written in Hindu-Arabic notation, and to record all the variants they knew of each numeral. They also answered questions concerning the contexts of use of numeral signs.

Instruction was given in sign and in written form. All productions were video recorded.
1.4. Materials

Three collections of numerals that included the complete series from one to twenty as well as a group of numerals chosen according to a set of criteria: number of digits; absolute and place values of the same number; presence or absence of internal and final zeros; and repeated or different digits. Some numerals were the first ones of a unit of order (e.g., 1,000). Many of numerals of the these collections were the same.

The informants signed one of the three collections of numerals.

We presented the numerals as a list, one under the other on a sheet of paper, or written on cards, one numeral on each card. We included the following instruction in Spanish: “Please sign all the correct signs—two, three, or more—for each of the numbers that follow” and “If there is more than one sign for a number, please show the two or more existing signs.” The same instruction was given in sign.

2. Analysis

The analysis took into account the following parameters: hand-shape, orientation, location, and movement.

As previously said we analized the basic lexicon, including lexical primitives, the operators and some morphosyntactic compounds.

The analysis aims to compare both languages with reagard to the existence of one or more series of numerals and its variants, use of change of hand orientation to indicate different values, and use of the sign ZERO.

3. Description

As a general feature, both languages distinguish between cardinal and ordinal use of numerals. Our description includes only the cardinal series, we are now comparing the ordinal numerals in both languages.

Numeral signs in LSC and LSE present two variants: one is one handed and the other two handed. In the two cases the numeral lexicon derives mostly from manual counting, the same as in a great part of sign languages. Both language’s basic numeral lexicon includes signs for the nine digits, for the numerals zero and ten, and specific signs that function as operators or multipliers. These are HUNDRED, THOUSAND, MILLION, BILLION, and so on. The basic lexicon, signs ZERO, ONE to TEN, and operators, combine to form the rest of the numeral signs. LSE also includes special
names for some decades that do not derive from manual counting. We found differences in hand-shapes and hand orientation between LSC and LSE.

3.1. Numerals ZERO and ONE to TEN, two handed variant:

Both languages sign ONE with the index finger extended, this means a difference with other number systems where ONE is signed with the thumb extended.

Hand-shape of non-dominant hand is the same in LSC as in LSE. Dominant hand is distinctive.

Hand-shape varies in some numerals: There are differences in signs SIX and SEVEN. In LSC, SIX is signed with the non-dominant hand and thumb of the dominant hand extended, SEVEN with the thumb and index fingers extended; in LSE, SIX is signed with the nondominant hand and index of the dominant hand extended, SEVEN with the nondominant hand and the index and the middle fingers of the dominant hand extended.

Hand orientation also varies. We found that this parameter is stable in LSC: from ONE to FIVE, the palm faces the signer, from SIX to TEN the palm faces the interlocutor.

In LSE we found that use of hand orientation does not vary from 1 to 10, the palm always faces the signer. Nevertheless, when the communication situation requires it, the orientation parameter changes and the palm faces the interlocutor. Also, we did not find agreement with regard to this parameter between informants. Nevertheless, an important difference with LSC is that hand orientation does not vary from ONE to TEN.

For both languages location of numerals is a chest height, medial distance.

With regard to movement, numerals ZERO and ONE to NINE are holdings, TEN may have local movement.
3.2. **Numerals ZERO and ONE to TEN, one handed variant:**

Hand-shape:

In LSC: SIX is signed with the extended thumb, SEVEN with the extended thumb and index, EIGHT with the thumb, index and middle fingers, NINE, with the index, middle, ring and little fingers.

In LSE: SIX is signed in two movements: 1st dominant hand in FIVE, 2nd hand closes and extends index of the same hand. For SEVEN extends index and middle finger, for EIGHT, thumb, index and middle fingers and for NINE, index, middle, ring and little fingers.

Hand orientation varies between languages, in LSC the palm faces the signer from ONE to FIVE, the palm faces the interlocutor from SIX to NINE. This is a very important feature of this language that allows to distinguish between numerals in the one handed variant (examples: Numerals THREE and EIGHT, numerals FOUR and NINE).

In LSE the palm faces the signer from ONE to NINE (please take into account the statements made above for the two handed variant).

Location is the same as the two handed variant.

Movement: LSC: the wrist turns: the palm initially faces the signer, and then faces the interlocutor; in LSE, as explained before, has also a local movement but a different one: hand in FIVE closes and extends as many fingers as numerals over five, beginning with the index finger.

3.3. **operators HUNDRED**

In LSC, we found two ways to sign numerals in the hundreds: HUNDRED as operator (Example: 103: HUNDRED-THREE) and a transparent way to sign (Example: 103: ONE-ZERO-THREE). In whole hundreds -it is, hundreds with no decades or units without grouping, for example: 100, 200- we found a lexicalization and a change of

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2 We mean, the signer signs the face value of the numerals in the units, decades and cents place. For example: 123: ONE-TWO-THREE.
orientation in the non-zero digit.

In LSE there are three variants for signing numerals in the hundreds. Two of them are operators that function as numeral incorporating roots. The third is transparent.

THOUSAND
The signs for thousand differ completely between the two languages. In LSC there are three variants; one is a numeral incorporating root. In LSE there are four variants; one is the same as in LSC. Two of them are numeral incorporating roots.

MILLION
The signs vary in all parameters between both languages.

![MILLION (LSC)](image1)

![MILLION (LSE)](image2)

3.4. Morphosintactic compounds
Operators show changes in units of order and its use is obligatory in both languages: from thousands onwards in LSC and from hundreds onwards in LSE. In LSC, TEN does not function as operator, it is, 11 is signed ONE-ONE and not TEN-ONE. In LSE the same happens between 11 and 15. Nevertheless, in this language, from 16 to 19 TEN does function as operator: to perform the numerals between 16 and 19, one signs one variant of numeral TEN, that includes a special movement and then as many units

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3 In many sign languages, there are roots capable to incorporate numeral hand-shapes in its phonetic form to indicate the number of things to be counted. This phenomenon is described as numeral incorporation. Each sign has two morphemes: the classifier root and the numeral hand-shape (Massone y Machado, 1994).
as needed in the two handed variant: so for example 16 is signed TEN-SIX.

In both languages, when the operator sign is absent—in LSC always in tens, sometimes in hundreds, in LSE sometimes in tens and sometimes in hundreds—, the only clue for place value is the order when signing, the displacement to the signer’s right while signing each digit, and use of the sign ZERO when necessary. So, in the decades’ unit of order, we sign first the numeral for the decades and then the numeral for the units. In the hundreds’ unit of order, we sign first the numeral for the hundreds, then the numeral for the decades and then the numeral for the units. Use of sign ZERO to indicate decimal values in both languages is a common feature of these sign languages that differs from spoken languages and deserves being emphasized.

![Image of SIXTEEN (LSC)]

![Image of SIXTEEN (LSE)]

### 4. Conclusions
This is a preliminary study and our conclusions are still not definitive. Nonetheless, the following results can be presented at this stage:
The similarities can be summarised as follows:

- both languages have cardinal numerals with at least two variants,
- one one-handed and the other two-handed; numeral signs from ONE to TEN derive from manual counting;
- both languages use a ZERO sign as a place holder;
- ONE is signed with the index extended; in both of the numeral TWENTY (the sign differs in LSE and in LSC) that does not derive from manual counting.

Main differences are the following:

A major difference regarding the cardinal series in the two languages is the variation between contexts. In LSC, cardinal numeral signs are signed in the same way regardless of the context of use, but in LSE the signs change if the signer is referring to time, to money or to concrete objects.

Another difference lies in a phonological aspect: hand orientation. In LSC its use is stable and always has a numerical meaning: in one-handed numerals it indicates differences in cardinal meaning (for example: numeral signs NINE and FOUR in the one handed variant only differ in orientation). In LSE, hand orientation does not seem to be a distinctive feature (indeed, its use varies between informants).

Future research should focus on:

Hybrid productions, with both operators and use of intermediate zeros, in both languages. In LSE from hundreds upwards we found hybrid variants with both operators and use of internal zeros at the same time. In LSC from thousands upwards we found hybrid variants.

The corpus should be enlarged with more informants in different contexts of use and in other regions of the country.

We have started on the study of numeral incorporation roots and ordinal series and use of numerals in different measurement units in both languages.

Contrastive analysis of both languages would also allow us to obtain data for language teaching and educational intervention with these language users.

Our special thanks to all our informants.
References


**Sign description: how geometry and graphing serve linguistic issues**

*M. Filhol, A. Braffort*

LIMSI-CNRS, Orsay.
michael.filhol@limsi.fr, annelies.braffort@limsi.fr

**Abstract**

Sign language dictionaries presently describe conventional lexicons as sets of isolated lexemes, where each unit—be it drawn or transcribed in a more or less advanced formalism—specifies a value for each of a fixed set of manual parameters and sometimes facial expression. Quality of computer sign synthesis or recognition systems strongly depends on that of the lexicon description architecture. The point here is to give an overview of the enhanced formal representation of lexemes described in [Filhol 06], and to discuss it so as to give an idea of its potential for help in sign language studies and of how linguists might want to use it.

**Keywords**

Lexical model, sign representation, parametric dependencies, graph theory, sign structure, space geometry.

1. Introduction

The goal of this research is to perform automatic sign generation by virtual characters (3-dimensional avatars), as illustrated in fig. 1. The difficulty is that the avatar needs an input representation of signs to articulate its bones and muscles, and incidentally utter a sign or a sign sequence. The program whose job is to parse this input and generate the bone commands to the avatar is none of this paper's interests.
In a first part, this paper goes through the current work in the field of sign representation, but we will see that the usual free drawings or verbal descriptions for signs are not implementable as such in a computer program. It then addresses the issue of a new formal lexical representation per se. It starts emphasising three major limitations to the only type of model that can be implemented, and suggests a brand new geometric and sequential model, supposed to make for these limitations. The point of the third section is to show the roots it has in graph theory. By sticking only to the basics of this theory, it defines a couple of useful notions, and explains how it can be applied to the geometric model. The last section discusses its possible impacts on linguistic studies, as well as some hints on how it can be used for linguistic purposes, in the context of creating descriptions first, and that of analysing signs then.

2. State of the art on sign representation

How do we represent the signing units of a sign language (SL henceforth)?

The basic use of sign representation is for creating either bilingual dictionary entries or teaching books. They are usually drawings of human figures containing different types of arrows and contour lines to make for the "4d-to-2d" projection loss. The shape of the arrows are altered according to their direction, as in a 2-dimensional system "forward" and "backward" become meaningless if the drawn character is facing the reader. Several figures are often superimposed or juxtaposed to illustrate sequences, as a drawing inherently has no duration in time, unlike a sign. This is a major loss, as we also lose the chance to represent speed and tension easily. To avoid losing all dynamics of all signs, which is pretty unacceptable, speed indications like strokes along arrows can be added to the drawing. Moreover, a caption using an external written (and dominant)
language is quite often added next to the picture to provide additional information on how to perform the sign or simply to make the drawing clearer.

These models have long time been around the linguistic world and signing classes and we could probably argue that they were suitable for their purpose. But the target reader here is always human and there is no chance they can be interpreted by a computer, if ever used as its input. They are neither formal nor can they be formalised, i.e. be turned into unambiguous input, which is what computers need; they do not interpret anything.

We may consider SignWriting [Da Rocha 03] as a little more formal. The different graphical elements available for sketching a sign is limited and thus forms a finite vocabulary. However, the rules on how to arrange the icons are insufficient. To figure out what sign a picture stands for, a lot still has to be "humanly" interpreted, especially when contacts and movements are mixed.

The only current model suitable as an input to a computer generation platform is SigML, which is basically a machine-readable form of HamNoSys. HamNoSys is virtually the only formal model for signs and has already been encapsulated in sign generation software (eSign, ViSiCast) [Hanke et al 02]. It is based on Stokoe's 4-parameter model. It describes every sign with the same fixed set of parameters, each of which must be given a discrete value.

![HamNoSys notation](image)

**Fig. 2: Example of HamNoSys notation**

However, we argue that not all signs require all parameters, and that not all the parameters that are needed can be given at the same time in the same way. We discuss these limitations in the next section.

### 3. A geometric model

Widely inspired by [Filhol 06], this section underlines three problems we see with the fixed parameter models, and brings up a new one that avoids them. It takes each problem in turn and explains the differences between the two types of models.
3.1. Limitations of the parametric models

3.1.1. Over-specification

The trouble when filling a parameter list with values is that all parameters inherit the same status. Yet often, some are crucial to the sign in that changing them would result in a loss of the whole sign, whereas others are only given so as to enable, say, a signing avatar to perform the target sign but could well be specified differently.

For instance, the palms of both hands in the sign [WHAT] (all examples in this work are from French Sign Language, LSF henceforth) need be horizontal and facing up, but the fingers may point anyway away the signer's body (fig. 3a). Actually, the direction they point in may even vary through time, as signers usually prefer to shake their wrist or forearm rather than rotate the whole arm around the shoulder and keep the fingers pointing in the same direction.

HamNoSys defines "finger extension" as being the direction taken by the fingers if they were fully extended, i.e. the direction from the wrist to the base of the fingers, even if the fingers are bent; it is part of the orientation parameter specification. With a HamNoSys (parametric) notation, both "finger extension" values "forward" and "forward-left" would properly define the right hand's orientation parameter in the sign [WHAT], but one must arbitrarily be chosen. The trouble then is that the finger extension is hard-wired to a particular value, so there is no way after that we can guess how flexible the value actually is when it comes to performing the described sign in a sign utterance.

Instead of over-specifying the orientation parameter, we suggest that the sign contents be constrained enough to define the target sign, but that whatever is not necessary be banned from its description. On our example, constraining the palm to a horizontal plane is enough about hand orientation for [WHAT] in LSF.

![Fig. 3a: [WHAT]](image1.png)  ![Fig. 3b: [DESK]](image2.png)

Pictures from [Moody 86]
3.1.2. Parameter dependencies

Parameter models consider parameters separately. Each of them is assigned a distinct value, regardless of the other parameters. It means that these assignments could all be carried out simultaneously, in other words all at once and independently. Though, this does not account for inter-parameter dependencies, such as the one in [DESK] (fig. 3b above): the strong hand movement depends on the finger extension (in HamNoSys terms) of the weak hand, whichever finger extension that is.

The issue of parameter dependencies was already addressed but only partly resolved in HamNoSys with the subscript "¬" operator. It is applicable to palm orientation or finger extension to make it relative to the path of the corresponding hand. It allows for easier descriptions of signs like [BALL] shown in fig. 4a, making palm orientation relative to its path on each hand. In [DESK] however, the dependency is not one of a hand orientation on its path, but that of one hand's path on the other's orientation. HamNoSys fails to define this type of dependency, and strong hand movement will have to be specified with no reference to weak hand finger extension.

Moreover, two different parameters could well depend on a common non-parameter object, such as in [BUILDING] (fig. 4b). The strong hand moves along and close to a line, say \( L \). Its palm is constantly facing \( L \) and the weak hand's location and orientation is defined as being symmetric to those of the strong hand's, with respect to \( L \). Both location and palm orientation of both hands depend on the same object \( L \). Although it is obviously crucial to the sign as a great part of the description depends on it, \( L \) is no parameter in Stokoe's sense. It is why we call \( L \) a non-parameter common dependency.

\[
\text{Fig. 4a: [BALL] Fig. 4b: [BUILDING] showing symmetry axis}
\]
To account for all the cases mentioned above, we claim that any part of a sign description should even be allowed to make use of other parts of the same description. This way, internal dependencies become part of the description.

3.1.3. Signs with highly iconic features

Above all, using C. Cuxac's theory of iconicity [Cuxac 00] as a framework for ours, it has become obvious that the many possible influences of discourse context on the signs that are used cannot be ignored in the process of devising a lexical description model. A great part of the beauty of SLs and their power in conciseness comes from the potential for signs to be altered according to the context in which they are used, thereby switching discourse from a conventional sign flow to highly iconic structures (HISs) [Cuxac 00]. For instance, the sole sign [BOX] can be used to sign the phrase "large box" in LSF, only the distances between the hands will be greater than the ones involved in the plain conventional [BOX] sign (plus the signer will probably also puff his cheeks and raise his elbows). There are many forms of iconicity in SLs: size&shape transfers, personal/situational transfers, use of time lines... Formalising such features for automatic sign generation is not trivial. Some work has been initiated with the ViSiCAST project to include use of proforms and signing space, (Hanke et al, 2002) in particular. [Huenerfauth 06] also generates "classifier predicates" to account for a type of HIS Cuxac calls situational transfers, but we found nothing close to the richness emphasised in his book. An HIS can not only alter the location or the hand shape involved in a sign, but also a path, a direction, eye gaze, etc. Virtually, anything can be acted upon, and these actions being commonplace in SL, we claim a description model should allow signs to behave accordingly. Back to the example above, describing [BOX] without making the distance between the hands responsive to the contextual size weakens –if not destroys– the sign's re-usability.

3.2. Geometric model summary

In [Filhol 06], a new model is suggested, where these limitations are avoided. The three main wanted properties are as follows, and constitute the three challenges addressed in the following sections:

- unnecessary parts do not appear in the description;
- descriptions account for all dependencies between its internal elements, i.e. have variable structures according to the signs they describe;
- descriptions are flexible enough to be adaptable to context influences.
3.2.1. Stop over-specification

A statistical analysis of LSF [Braffort 96] shows that geometric objects are commonplace in sign languages: most two-handed signs include a symmetry or a parallelism, a large number of signs sketch out or move along planes, lines or circles... Almost every sign makes people use geometric notions in spontaneous descriptions. Realising how essential geometry is in every sign, we no longer regard it as a universal list of placeholders but as a geometric construction in space. Like any spatial geometric figure, objects like points, planes, etc. are built step by step using a formal description language in an unambiguous way to form a desired figure. Specifying a sign requires that, from an empty space (the signing space), the necessary objects are built one by one, and then constrained as the description goes to create a dynamic figure, to which parts of the body then just have to be connected.

The first challenge above becomes easy: as we are free to build whatever we decide, there is no need to build superfluous objects. Starting in an empty space, we just have to build as much –and indeed as little– as required for the description. Nothing is added for the only sake of fitting into the model.

For example, to describe the sign [BALL], we will need to build different things:

- a symmetry plane through the centre of the ball;
- a starting point for the path of the strong hand, in this plane;
- a semi-circle path for the strong hand;
- a path for the weak hand, symmetric to the first path, across the symmetry plane.

Fig. 5: Geometric objects for [BALL]
Figure 5 shows geometric objects present in sign [BALL], superimposed on a snapshot of the signing avatar under development in Limsi [Bolot et al 06]. Only the symmetry plane is missing, as it would simply have covered half the picture if it were inserted.

### 3.2.2. Reveal sign structures

This geometric approach also beats the second challenge. One object being built at a time, descriptions are iterative and sequential. Each object can well refer to one or several other objects already in place, like the starting point above is said to be in the plane defined in a first place. Allowing objects to rely on other objects this way makes the whole process account for internal object dependencies: when an object is specified with a reference to another (or others), the former is explicitly dependent on the latter. Thus, contrary to parametric models, a sign-dependent structure is visible in each description.

Figure 6 shows the type of language we actually plan to describe the signs with. It includes object building and different constraint statements, each on a separate line. Please refer to [Filhol 06] for more on this topic as it argues these features in further details. But we can have a quick look at the way the description is built.

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**Fig. 6: Description for [BALL], using the geometric model**

It consists of a list of lines, whose order cannot randomly be changed. If a line includes a reference to other objects, it has to come after the ones defining these objects. This happens for
instance on line 7, where the path of the strong hand is constrained to start at point $S$, which itself is defined earlier in the description.

In a less direct sense of the term, we can infer that the path of the strong hand also depends on the ball's centre point $\{Loc\}$ (see next session for a word on why $\{Loc\}$ is the centre point): line 5 tells us that the starting point $S$ depends on $\{Loc\}$. But, and as we just stated, the strong hand path depends on $S$. Hence transitively, we may say that the path of the strong hand depends on the centre of the ball. We can picture that well, as if we move the centre of the ball, the path taken by both hands (hence the strong hand) will necessarily change accordingly.

If we push this property further to a 3-step transitivity, we could infer from the symmetry between the hands that the path of the weak hand also depends on the ball's centre. We call these indirect dependencies.

### 3.2.3. Enable real productive sign units

It has always been intended that the model handle iconicity in sign descriptions. Enabling iconicity in signs can be done by extending the language with a new type of reference. Every time a value or an object is expected in the description, a call to a context element can be placed instead. For instance, instead of specifying an arbitrary distance between the hands' positions in the description for [BOX], we may refer to an external reference called size. This way, whenever the description is used to perform the sign in discourse (i.e. in context), it can be tagged with a size attribute, so that the distances are changed accordingly, with no extra rule about how to sign "big * box" or "small * box". This brings us to allow elements within the description to depend on values that are "outside" the lexeme itself. In fact, they are to be found in –or given by– the context when the description is used to utter an actual sign.

On figure 6, these external dependencies are noted in curly brackets. $\{Loc\}$ illustrates a dependency on the location of the ball in the signing space; $\{Rad\}$ represents the radius of the ball.

### 4. Dependency graphing

Before we go on, we will need to provide the reader with a little tool box taken from graph theory. While it may not yet look obvious why such a formal and abstract (in its whole) theory would help, we will be needing some of it in the next sections, so we introduce a couple of basic notions here.
4.1. What is it?

A directed graph is only a set of vertices (or nodes) together with a set of edges. An edge is simply what can be represented by an arrow connecting two of the nodes of the first set. For example, the following graph is defined by a first set of four nodes \{A,B,C,D\}, and a second set \{AB,BC,AD,DB\} of edges between these nodes:

As far as the graph structure is concerned, this is basically it. There is virtually no limitations to it, graphs can be arbitrarily big.

Now a dependency graph is a graph like the one above, which illustrates a situation where some things or events (the nodes of the graph) can only exist or take place once another already has already beforehand. Each \(XY\) edge in the graph denotes that element \(X\) is needed before element \(Y\).

Let us build a small example. Say you are in your underwear and want to put the following clothes on in the easiest way: socks, shoes, trousers, shirt, pullover, glasses. To dress up easily, you decide that:

- socks should be put on before the trousers;
- trousers and socks can only be put on before the shoes;
- it is better to put on the trousers over (after) the shirt;
- the pullover obviously comes after the shirt, but must be worn over the trousers (i.e. put on afterwards);
- glasses must be put on after the pullover, not to be knocked off.

Now if we plot as many nodes down as there are clothes, and connect them using each of the rules above as a dependency, we get the dependency graph given in fig. 7.

Fig. 7: A dependency graph
To solve the problem, you may start putting your clothes on one by one, provided you choose a piece whose node has no arrows pointing to it (i.e., depends on nothing), and that you rub out the node afterwards, along with all the arrows pointing out of it. For instance, the thing you must do first is to put on either your socks or your shirt, as all the other nodes in the graph have arrows pointing to them. Whichever you pick first, the other will be second as you will see no other choice. Then come the trousers, then you can choose either of the shoes or the pullover, etc.

This is all we will present here on graphs, though we very briefly come back to the theory further down, as we will need a couple more short definitions for cycles and degrees.

4.2. Applied to sign descriptions

We can apply the construction above to the descriptions sketched in section 3.2 to get graphical representations of them. Each description can be associated a dependency graph as follows:

- the set of all the objects used in the description constitute the set of nodes of the associated graph;
- every object \( A \) spotted to depend (in the sense of section 3.2.2) on another object \( B \) in the description defines an edge in the associated graph from \( B \) to \( A \), i.e., edge \( BA \).

For example, line 3 of the example given in fig. 6 connects two objects, \( P \) and \( \{\text{Loc}\} \), with a direct dependency of the former on the latter, so the graph should show an arrow from \( \{\text{Loc}\} \) to \( P \). All together, the resulting graph is the one in fig. 8.

![Fig. 8: Dependency graph for [BALL]](image-url)
The point of applying the dependency theory to our descriptions is that a computer will be able to infer the order in which to compute and build the different objects in the description, just like it can be decided what to wear first in the dressing-up problem. Besides, the graphical side of it simply makes description more human-readable, making all internal dependencies more legible than when reading the descriptions as plain text, which can be seen as a second advantage. It might indeed be easier to draw the description as a graph first, and then build the equivalent description sequence. More than visualising internal dependencies, such graphical models help visualising the external dependencies of a sign, which the model also accounts for.

5. Impacts on sign linguistics

This section puts forward some of the impacts of the geometric model on sign linguistics, how dependency graphing can be used by and help linguists in their various tasks, especially in building and analysing lexicons, and what new prospect it brings in devising writing systems for sign languages.

5.1. Redefinition of the lexical level

Traditionally, computer linguistic research regards a language as a system that builds discourse and meaning (semantic level) from sentences, and sentences (syntactic level) are built using a syntax over words (lexical level). However the words are described, they can be listed without any mention of where nor how they might be used. Each unit of the lexicon has an autonomous and complete representation, regardless of its final semantic use. Only then comes mechanisms to arrange them and build the semantics of a full discourse, just like one would arrange bricks to build a wall and eventually a house.

With the geometric model, the presence of external dependencies in the descriptions make it possible for elements of context, i.e. elements of the semantics of the discourse, to make their way...
as far down as into the lexical level. It is no longer feasible to consider separate layers, one on top of the other for the different levels of linguistic mechanisms like lexicon, syntax and semantics (fig. 9), because what was the bottom layer now has notions of what was the top layer.

We still believe it makes sense to talk about lexicons and semantics, but not in terms of separate hierarchical layers. Semantics is still the interpretation of an arrangement of signs, but a lexicon describes signs using different things, including the final wanted meaning and context. Lexical and semantic issues overlap, are not separate, and none of them comes first in building the model, hence they form no hierarchy.

Practically speaking, there is a big impact on how one would have to describe a sign using this model. He will have to think of all that may vary in the sign and tell the system. He will no more be able to give an out-of-context description and rely on the system for what might be called "exceptions" when the sign is to be performed in context.

This is an impact of the model itself on the philosophy of how to regard linguistic features. The next section shows how dependency graphs, as we have seen they had a potentially strong link to the model, can be used to study signs.

5.2. Designing the descriptions

This is where we will need a bit more theory. As we saw earlier on, the model has roots in space geometry, but also in graph theory and dependency graphing. Therefore, studies to be carried out on signs described this way are bound to use concepts from this theory too. To a linguist of course, the idea of studying graph theory might not be a happy one, but the great thing about it is that huge research (be it computer science or mathematics) has already been done in this field and already come up with a lot of useful results. In fact, graph theory should here only be viewed as a tremendous, powerful and ready-to-use tool kit, providing far more than will ever be used in our context. To give an little idea of the kind of help is brought by graph theory, we first introduce two notions and apply them afterwards.

Cycle

A cycle in a graph is a sequence of nodes in which: (1) the last node is equal to the first; (2) a node $B$ follows a node $A$ if and only if there is an edge from $A$ to $B$.

Basically, if you follow the edges of a graph with your finger, from node to node along arrows, and loop back to a node you have already had your finger on, it means you have gone through a cycle somewhere. Figure 10a shows an example of a cycle in a directed graph.
**Degrees**

The degree of a node is simply the number of edges incident to it. The number of edges departing from the node is called the outdegree of the node; the number of edges ending on it is its indegree. The degree of a node is the sum of both its indegree and its outdegree.

The degree of $N$ is written $\text{deg}(N)$; its in- and out-degree are respectively noted $\text{deg}^+(N)$ and $\text{deg}^-(N)$. Figure 10b illustrates these concepts with a sample graph.

![Fig. 10a: A cycle in a directed graph](image)

![Fig. 10b: Illustration of degrees](image)

**deg**($d$) = 2
\[ \text{deg}^+(d) = 1 \]

Designing a valid sign description is not always straightforward. The more a sign needs lines of description, objects or constraints, the more they are likely to depend on each other, and the less obvious any sort of inconsistency in the description (if any) will become. Back to our dressing-up example, say we think it is sensible to put the glasses on before the shirt, as they might help to see better while buttoning up. It looks quite sensible, but if we take this extra rule to the associated dependency graph in fig. 7, we need an extra edge from the glasses to the shirt. Thereby, the following cycle appears in the graph: (shirt, pullover, glasses, shirt).

But to solve an ordering problem like what object to build first or what piece of clothing to start with, we have seen that we need a starting node with no edges ending on it—we now know this means a zero indegree—, take the node (and its edges) off the graph, and go on until all the nodes are used. Quite evidently, there is no way to go through all the nodes if there is a cycle. None of the nodes in the cycle will ever have a zero indegree, so no full sequence of nodes will ever be found to solve the ordering problem. We can rephrase and emphasize this with the following statement:

A cycle in a dependency graph makes the description invalid.
This is useful to keep in mind when building a description. For example, it will avoid things like defining the ball's centre point between the two hands, while the hands' paths themselves depend, among other things, on the centre point.

Also, if we look at the dependency graph associated with the description for [BALL], we notice that there is only one node with a zero outdegree: it is the node representing the target sign. The point of a description is to build a sign, not anything else, so what would it mean if there were other nodes with no edges coming out of them? These nodes would illustrate the fact that objects are built somewhere in the description, but remain unused until the end. While this is nothing as serious as the problem above, it still warns that there either might be a mistake or superfluous items in the description, and that it might require a little clean-up. So we have a second golden rule:

The dependency graph associated with a sign description should have a single node with zero outdegree.

5.3. Analysing descriptions

Once we have our descriptions, we can carry out studies and measurements over them all, using more of our graph tool kit. We have used the concept of outdegree for description nodes, why not try and interpret a zero indegree?

A zero indegree occurs when a node depends on nothing and whose object can be built regardless of any other object. Consequently, the set of nodes whose indegrees are zero is the set of objects on which the whole description depends. For [BALL], we notice that this set is reduced to the two external dependencies \{Loc\} and \{Rad\}, but there could be other things. It is no wonder that at least all external dependencies have zero indegrees. It would make no sense if they were made dependent on an object of the lexical sign. Remember that external dependencies bring values as the sentence, the story or the discourse is put together.

We can choose to ignore the external dependencies, and focus on what we call the core of the sign, i.e. what is left when no context is available. The resulting graph for [BALL] is given in fig. 11. We see that the set of nodes with zero indegree changes to the symmetry plane \(P\) and the starting point \(S\). We would have to repeat this process over a large number of signs to see if this has any liable linguistic interest, but at least it tells a computer what to build first to perform a sign from the input description. Intuitively, we see that if we "pour water" on nodes \(P\) and \(S\), and if arrows mean "downslope", the whole graph is "flooded", which underlines the potentially special role they play in the sign. All other nodes depend on something; \(P\) and \(S\) do not.
Over a certain amount of descriptions available, computerised databases always come in useful, as:
- their storage capacity is virtually infinite;
- their look-up time (i.e. the time needed to search through the data) is virtually zero.

With parametric entries, data-bases could only be searched for specific values of specific parameters (or lists thereof). A typical query would be "all 2-handed signs", or "all signs whose hand shape for the strong hand is [...]". Now with our more flexible and detailed model, we are free to build queries that are more complex. Of course, we can still search the descriptions for values, but more important than not, we may look at their structure. In other words, using the associated graphs rather than the original descriptions, we may not only look up values in each graph, but also use the layout of the graph itself as a base for our query.

For example, it may be interesting to look for all the signs whose strong hand has a feature that depends on one of the weak hand, however indirectly. Remember we introduced indirect dependencies in section 3.2.2. We said that $A$ transitively depends on $B$ if it depends on an object $C$ and $C$ depends on $B$. In fact, we can say that $A$ indirectly depends on $B$ if a path (a sequence of nodes) can be found from $B$ to $A$, however long the path might be. Thus, any graph with a path from the weak hand node to the strong hand node will satisfy the query above. The sign [DESK] would, unlike [BALL], whose path is the other way round: from the strong hand to the weak hand. The interpretation is that some signs have a weak hand that "follows" the strong hand (e.g. [BALL]), like when there is a symmetry, whereas others would need a weak hand reference to define the strong hand's behaviour (e.g. [DESK]).
We see it becomes easier to extract signs from the database, and that queries become more specific and enable finer studies. Grouping the signs according to finer filters paves new ways for sign typology, as it helps building quick and reliable statistics.

Another idea is to group the signs by their set of external dependencies. If, by doing this, we end up with clear clusters of signs, we want to think there will be a semantic reason for them. This method is an efficient way to confront statistical results with the intuition that the way in which a sign accepts distortion in a sign utterance is guided by its semantics.

If we play around with the graphs some more, we may ask ourselves things like:

- what proportion of signs have both hands depend on a same object;
- which signs have no external dependencies;
- which signs cannot be relocated;
- which signs have unspecified hand shape for such a hand;
- whether there are more signs depending on size than on shape;
- etc.

6. Conclusion and prospects

What we have outlined here is a new way of addressing the description of sign language lexicon units. Instead of merely giving independent values to a given set of parameters, it is based on sequences of geometric constraints, which unlike previous models make use of internal dependencies between the elements of the descriptions. We have shown how this internal structure of the signs can be graphically represented using a set of tools from graph theory, and how powerful the method is. It makes way for better database systems, as queries on the graphs are finer than what parametric values allowed us to do, and designing the descriptions in the first place can turn into a self-checking process.

Limsi is currently developing a full signing avatar platform. A good way of evaluating the geometric model will be to make it the underlying representation system of the platform, and see how acceptable the signed output is. The criteria for the acceptability of the sign utterances are accuracy of the signs, fluidity in movement and quality of the transitions between positions. So far, a full geometric tool kit is implemented and under test. It will be needed for all geometric issues of the descriptions, which we made clear were numerous. The next step is to implement the actual description interpreter, so that the avatar can finally be given articulatory orders.

In addition to what was presented in this paper, we would like to mention a further prospect we see in this work. The LS-Script project [Garcia 06], whose objective is to build a written form of LSF, focuses, among other aspects of signs, on geometric features contained in them. A lot are now
taken into account: rotations, symmetries, but also invisible reference points, shapes and so on. Even more importantly, it includes discussions about what is "core" to a sign and what can be seen as "peripheral". It is vital indeed, with the goal of offering a writing system usable for taking quick notes, to be aware of what must end up on the paper and what elements may be left out.

These two questions are very much compatible with our model. The first question is in fact the essence of it, as all objects of all descriptions, except body parts of course, are either numeric or geometric. The second question is a possible and interesting database query, already discussed in the previous section.

It is with great hope and excitement that we suggest this model is potential material for designing writing systems for sign languages.

References
The morpho-phonetic structuring of LSF (French Sign Language)¹

Brigitte Garcia¹, Dominique Bouter² Gaëlle Roch³,
¹ UFR de Sciences du Langage, Université Paris 8 & UMR 7023, CNRS, Paris
² Université EVE & UMR 7023, CNRS, Paris
³ UMR 7023, Université Paris 8 & CNRS, Paris

1. Introduction

This paper presents the initial results of a study concerning morpho-phonetic analysis of French sign language (LSF), centring on a sign language dictionary in an interactive database that is comprised of all the standard signs² (STS) presently catalogued (Girod et al, 1997). Beginning with an overview of the context in which the study is situated, and the subsequent presentation of the theoretical framework adopted, we outline the aims assigned to the database which are related to the broader context of exploring the bases of a writing system for LSF. Next we will describe the architecture of the database, which in fact constitutes a method for testing the falsifiability of a modellisation of the lowest level in LSF and which makes an analysis of the relationship between parameters possible. From this point of view, the results presented here corroborate the hypothesis advanced by Cuxac (2000, 2004) concerning the structuring of the lowest level in sign languages (SL), which would be more morphemic than phonemic. The results also indicate the existence of close relations between parameters, which in return calls into question their structural status.

¹ The present paper is a revised version of the poster presented by Brigitte Garcia and Gaëlle Roch at the TISLR 2006 meeting in Florianopolis, Brasil (Garcia, Roch & Boutet, 2006). We gratefully acknowledge financial support from different ongoing projects: the French National Research Agency (ANR) and the French RIAM (Réseau Informatique Audiovisuel et Multimédia) Network, for funding the French Project LS Script (2005-2007); the Italian and French National Research Councils (CNR-CNRS Project “Language, its formal properties and Cognition: what can be learned from Signed Languages”). We also thank the partners of the UMR 7023 (Université Paris 8) in the LS Script project: the research laboratory in computer science LIMSI (CNRS-Orsay) which greatly contributed to the conception of the database presented here; the research laboratory in computer science IRIT-TCI of Toulouse, the cooperative firm WebSourd, specialised in the uses of new technologies for the deaf; and especially the IRIS association of Toulouse, assembling the deaf teachers of the bilingual educational structures of Toulouse, whose sustained collaboration in our research was essential.

² Standard signs, term used by Cuxac (1996, 2000) are defined here as those signs that are currently listed in SL dictionaries. They are commonly described in SL literature as constituting the « frozen lexicon » of SL.
1.1. *Context and theoretical background*

The framework of our study, the *LS Script* project\(^3\), includes among its objectives the study of the conditions for a graphical formalisation of LSF, as well as the elaboration of the linguistic and semiological bases for such a formalisation (Garcia, 2006 and Garcia *et al.*, in Press). In this sense, a systematic analysis of inter and intra-parametrical relations focusing on an extended corpus of standard units (4000 signs) aims to bring to light the nature of the links between parametrical components, and even to suggest rules of compositionality responsible for the formation of signs. In a graphical perspective, a central problem is to reduce the number of combinations, which increase both the number of graphic symbols per parameter and their numerous arrangements.

We place our study in the framework of a theoretical model that posits iconicity as the organising principle of SL (Cuxac 1996, 2000, 2004). This model assumes therefore that two basic types of minimal gestural units coexist in signed discourse; they can be described as structures resulting from the implementation, or not, of the signer’s intent to “tell and show” (“illustrative intent”). On the one hand, this involves lexical signs, which Cuxac terms “standard signs” – lexicalised units of a generic nature, whose iconicity although often present does not intervene in the production of meaning (“telling without showing”). On the other hand, the so-called minimal units of “high iconicity” (“Highly Iconic Structures” (HIS) or “transfers”\(^4\)), for which the intent is purely to specify. In these HIS, iconicity constitutes the very principle of the production of meaning (“telling and showing”). These transfers represent the implementation of a semiological process of producing meaning in SL that is closely related to the figurative potentiality inherent in the visuo-gestural modality; for this reason they have few equivalents in verbal languages. The two types of units, STS and HIS, have long been identified under various terminologies and in various theoretical frameworks in SL literature, and are most often known, respectively, under the name of “frozen signs” and of “productive signs” (*e.g.*, Brennan 2001, Johnston & Schembri 1999, Schembri 2003). Cuxac’s model (2000) however is based on two hypotheses which attribute a truly central role in the model to iconicity, and which are in our view of the utmost importance.

The first hypothesis, strongly corroborated by recent studies on the ontogenesis of emerging SL among deaf adults in a non-hearing-impaired environment (Fusellier-Souza 2004, 2006) finds that the formation of signs in SL is essentially based on primitives in a process of iconizing

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\(^3\) *LS-Script* Project, 2005-2007, under the responsibility of the UMR 7023, Université Paris 8 (cf. note 1)

\(^4\) Cuxac distinguishes three major types of transfer which constitute HIS: personal transfers (the signer becomes one of the actants of his utterance), transfers of form (which allow one to describe any type of form via a finite list of constituent elements) transfers of situation (which allow one to represent the movement of an actant in relation to a stable localising referent). These transfers are defined as the trace of cognitive operations which enable the signer to create an anamorphosis of his experience of reality in the quadrimensional signing space.
perceptual/practical experience. In this semiogenetic process, which results first in the production of transfers, the STS are thought to result from the routinization of these HIS, lexicalised through the deactivation of the intent to ‘tell and show’ and the implementation of a generic intent (for the hypothesis of a lexicogenesis based on a diachronic derivation of frozen signs from productive signs, see also Brennan 2001 and Johnston & Schembri 1999).

The second hypothesis follows from the first and is based on the observation that has long been known for several SL (e.g., Studdert-Kennedy & Lane, 1981, Jouison, 1995) that the parametrical components of STS appear regularly as form-meaning constants which are highly productive in the lexicon. While the most common modellisations of the lowest level in SL are phonological (e.g. Brentari 1990, Perlmutter 1990, Sandler 1990, Liddell 2003), Cuxac formulates the hypothesis of a compositionality of this low level which is more morphemic than phonemic, both for HIS and STS. In this framework, STS can be analysed as minimal units of realisation comparable to molecules clustering from atoms of meaning (bound morphemes), that is, partially commutable but non-autonomous elements, some of which derive semiogenetically from HI units. Basing this theory on the principles of Optimality Theory (Prince & Smolensky, 1993), Cuxac (2004) describes the stabilisation of STS (and thereby the ultimate definition of sublexical components) as resulting from an optimal equilibrium between two major types of constraints. This involves: 1) high-level constraints (maintaining iconicity, and so permitting the alternation in discourse between STS and HIS; the constraint of homonymic avoidance); and 2) low-level constraints, phonetic in nature, imposed by the characteristics of the apparatus of production and of reception (for a maximum of articulatory ease and a maximum of perceptive salience).

In a graphical perspective, the promise of the model is that it opens up the possibility of a morphemo-phono-graphical representation making it possible to account for both HIS and STS. Opting for such a notation of the signified content, at least for clearly identified and productive form-meaning constants, would most nearly correspond to the SL structures and to their functioning in discourse (sub-lexical morphemic compositionality, discursive alternation between intents and productive structures of neologisms).

The assessment of this hypothesis of a morphemic compositionality, which constitutes general theoretical objective for the database presented here, in our opinion calls for three lines of inquiry: first, an inventory and description of morphemic values (1), second, the assigning of these values to (formal) parametrical components and/or to combinations of parameters (2), and thirdly a more detailed definition of the nature and the respective role of constraints involved in the stabilisation of STS (3).
1.2. Objectives and working hypotheses

As regards the first point (1), the precise and exhaustive inventory and description of morphemic values of lowest-level units were conducted exhaustively and in minute detail as far as the handshapes of HIS are concerned (Cuxac, 2000). However, for the other constituent parameters for units of transfer, they have as yet to be more defined and modelised; and for the entire inventory of STS, to be systematically analysed. The work of inventorying and labelling cannot be dissociated from the assigning of these morphemic values to formal components (2). This point leads us however to call into question the nature of this formal correlate. In order for the various potential morphemic values of a single parametric component to be differentiable from a formal point of view, these values have to be combined: 1) due either to some internal specificity, as when morphemic values within a single parametric value can be distinguished by differences in form, which can be slight (e.g. different spacing of the fingers in the handshape ‘5’) but which are in fact active; 2) or due to larger differences of form that include the context (the interplay of parametric associations). In both cases, one has to look closely into the existence of phenomena that explain the differentiation and the stabilisation of forms within a single parametrical value, or alternatively the emergence of formal differentiation over the range of present parametrical associations. In the latter case, one has to postulate that an obligatory association of parameters is not without consequence for parametrical and morphemic values. Moreover it is difficult to see how these parameters, which are unavoidably inter-related categories functioning simultaneously due to the modality, could leave the relations between the instances of their co-occurrence in each sign intact and autonomous. But the principal advantage there is in taking these associations into consideration resides in the fact that formal internal differentiations in every single parametrical value — the possibility of slight variations — could never guarantee these values a sufficiently stable existence amid the wide range of interpersonal gestural variations.

The current modellisation of the sublexical structuring of SL, deriving from the Stokoe’s analysis in terms of manual parameters, allows no flexibility as to the number of parameters that can be taken into consideration. As it is never isolated in fact, each parameter manifests certain values that then acquire an identity. Beyond the logical consequences of this theoretical constraint, this model implies a certain cost: that of multiplying the number of combinations by the number of values for each parameter. In the model of morphemic structuring (with a more finely detailed analysis) that we have adopted here, this cost is increased, due to the fact that several values, morphemic in this case, can be associated with the same parametric component. But in so doing,

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5 No parameter can appear alone: a handshape is necessarily oriented and a movement puts it in place in a particular location.
this model shifts the focus to the potential iconic-morphemic values by minimizing the parametric value. In this iconic overlay, nothing prevents a single iconic-morphemic value from occurring in different parameters: a handshape here, a movement there. This possibility will have to be tested on the STS appearing in the database. Thus, while the main phonological models proposed for various SL attempt to circumscribe the rules of forming sequences of features and teasing out the impossible cases, our method consists in circumscribing the impossibilities of the association of features in order to isolate the rules of morphemic composition.

Finally we will add that up until now the inventory of morphemic values has mainly focused on handshape. Several factors help to explain this. On the one hand, the relative weighting in the definition of the parametrical values for movement\(^6\), for orientation\(^7\) and to a lesser degree for location\(^8\), does not depend on a single referential scale constituting an absolute norm for differentiation. On the other hand —and this has more theoretical implications, an interdependence between parameters and more exactly between certain of their corresponding values renders them less distinguishable (the handshape ‘3’ and the alternate movement of the hand are associated for all the signs including this handshape, except for numbering: what can be said then of the morphemic values for the handshape ‘3’? ). We actually have every reason to think that a morphemic value associated with a handshape must be distributed over several parameters. Thus, what is attributed to a handshapeal value could either be shared by those parameters whose values are interdependent in the sign in question (inter-parametric interdependence), or they could constitute a composition: this morphemic value would have been entirely attributed to a single parametric value whereas it could be a construction having two morphemic values (intra-parametric interdependence). One of the objectives of the database is to explore these parametric interdependences. The recurring association of parametric values in several signs for which we have systematically the same morphemic value leads us to suppose that it is a case of a composition mistakenly attributed to a single parameter; for such a composition we must find the value of each term\(^9\). The flexibility of the mechanism makes it possible to reverse the line of reasoning: starting from one morphemic value, we can proceed toward the components of parameters. Beyond establishing these interdependences, we need to assess the existence of parametric incompatibilities, which would support the hypothesis

\(^6\) The direction of the movement, the figure outlined by the hand and the repetition of movements constitute as many sub-parameters whose independence is doubtless not complete and for which we need to define the exact interrelations.

\(^7\) This last parameter only has a value in an egocentric frame of reference; but numerous signs can be analysed outside of the body of the signer.

\(^8\) What about the location of signs where the hands are in contact with one another, with the exclusion of any other meaningful corporal location? The very notion of location is profoundly egocentric and limited to the body without consideration of the upper member; this notion is thus relative and singular. Therefore in the LSF sign [SEMAINE] (“week”) should we see – or not – a handshape of the dominated hand that includes the forearm up to the elbow?

\(^9\) In the hypothesis that we can still distinguish two morphemes.
of compositionality. At the next higher level of analysis, composition would then pass from its status as empirical fact to that of structural integration.

Concerning the point (3), the central working hypothesis here concerns the role to concede to a physiological determination in the definition of parametric components and the nature of their interrelations. In fact, the structure of the database results from a deconstruction and from a new descriptive approach (i.e., a reconstruction) of the parameters, based in part on a previous study of conversational gesturing which was analysed in its physiological dimension (Boutet, 2001). Thus we propose a new approach to orientation; the classical analysis of this parameter reposed on an egocentric frame of reference (in relation to oneself). We approach it here using an allocentric frame of reference (i.e. in relation to specific elements other than oneself, which are themselves mobiles: thus in relation to the hand, which continually changes direction). The orientation is then considered as a localisation of the palm in the frame of reference for the degrees of freedom (DOF) of the hand\textsuperscript{10}. This relative localisation (in time as well as in space) finds a new point of reference in the forearm; the latter segment is in its turn perfectly capable of being situated in the articulatory possibilities expressed in relation to the arm\textsuperscript{11}. Moving in this manner up to the shoulder\textsuperscript{12}, the localisations follow one upon another until finally they compose a location. The breaking down (into its constituent parts) of the location of the hand in a series of topological localisations connected in this way (DOF for each segment) thus establishes another type of frame of reference. The latter authorises another expression for the location\textsuperscript{13} at the same time as it provides one for the reconstruction of the orientation. In this allocentric frame of reference, the changing of these two parameters in the course of a sign frequently corresponds to the frame of reference that is imposed by the entire group of articulatory constraints. Considered alongside their physiological determinations, the changing of a location or of an orientation is inscribed in the dynamic reference frame consisting of the juxtaposition of the articulatory positions occupied by each segment. The changes realised in the course of the sign are expressed in the matrices of segments that move; this happens in such a fashion that in its turn, the movement is expressed in an articulatory manner.

Location, orientation and movement are thus constructed starting from the same type of reference frame; they can be broken down and distributed according to a model of physiological determinations. We therefore dispose simultaneously of infra-parametrical levels of analysis that are highly dependent, for which some rules are known, (Boutet, 2001) and of the means of translating

\textsuperscript{10} Within the three matrices of the hand: flexion/extension, pronosupination and abduction/adduction.

\textsuperscript{11} The two matrices of the forearm: interior rotation / exterior rotation and flexion/extension.

\textsuperscript{12} The two matrices of the arm are flexion/extension and abduction/adduction.

\textsuperscript{13} Topological expression of a location according to an allocentric frame of reference distributed across the upper member which can be translated \textit{in fine} in egocentric terms (location as it is currently defined).
these parameters into an egocentric frame of reference\textsuperscript{14}. In this reconstruction of parametric components, our taking into account of physiological determinations we have identified should enable us in the long term to specify the nature and the incidence of physiological constraints in the formation and in the stabilizing of STS.

Thus by bringing to light the inter-parametric constraints, their definition and their hierarchization in both quantitative and qualitative terms, we aim at specifying the nature and the productivity of sublexical components and the constraints governing the creation and the stabilisation of STS. The relationship between form and meaning has to be explored to the extent that the constraints linking the individual instances of a parameter can be found to exist: what semantic repercussions are brought about by such a series of formal dependencies?

2. Methodology and principles for the structuring of the database

The interactive database was written in MySql to allow us to work together (online). For each of the 4000 STS that make up the database, we record the morphemic and parametrical components according to the type of interpretation of these parameters presented above. The handshape is treated on the basis of the inventory of 38 HI handshapes proposed by Cuxac\textsuperscript{15}. This inventory of handshapes is completed by the 19 handshapes (apparently unique to the STS) catalogued in addition to the preceding by the dictionary that serves as the basis of the corpus (Girod \textit{et al}, 1997). This inventory makes no claim to exhaustiveness, as the work on the database on the contrary should in the long term make it possible to validate it in structural terms. The inventory and the labelling of morphemic values according to handshape are entered in a field in the database; this inventory brings together values resulting from the iconisation process (values identified in HIS) and those coming from pre-existent gestural signifiers (borrowings from gestures accompanying the spoken word, from the manual alphabet, etc.). Each label is refined little by little, before its review at the end of the analysis.

Location and contact (appearing in two tables) are treated according to the most exhaustive method possible, starting from the work on the inventory carried out by the team that is developing HamNoSys\textsuperscript{16} and for contact, from the analysis proposed for Sign Writing\textsuperscript{17}. The number of possibilities thus taken into account is in theory considerable. The progressive description of the

\textsuperscript{14} Let us notice that the inverse path which starts with the data in an egocentric frame of reference towards their translations in the articulatory allocentric frame of reference is impossible; hence the primacy that must be accorded to physiology.

\textsuperscript{15} Cuxac, 2000, p. 102-130

\textsuperscript{16} http://www.sign-lang.uni-hamburg.de/Projekte/HamNoSys/HamNoSysErklaerungen/englisch/Contents.html

\textsuperscript{17} http://www.signwriting.org/lessons/lessons/sw/080%20Contact-Symbols.html
signs should however make it possible to extract a mapping in which the points of density are highly contrasted and clearly indicative of physiological constraints. The orientation, which is essentially encoded in a distributed manner (see above) derives from the articulatory categories for each segment (there are as many tables as there are physiological segments). In this section a table also gives information on the orientation of one hand in relation to another, which simultaneously makes it possible to localize the hands in relation to one another, and to qualify from the outset this putting into relation that makes up a particular figure. The movement is recorded on several tables. A general table brings together several sub-tables giving details on the movement of the hands: the movement is expressed in relation to each handshape in a quasi-dimensional manner, thus dissociating the structure of the movement from that to which it is put into relation with. The movement can thus be expressed as one of three types of forms: an axis, a plane or a point. The type “axis” enables one to account for the influence that a finger can exert on its own salience; the plane can be likened to a homogeneous surface represented by the palm or even by the joined fingers; the point, in the form of contact of the fingertip, of an articulation of the fingers or of a fingernail, makes it possible to measure more precisely where the movement finds its point of origin. For each of these three tables, the possible values give information on the direction, on the place in relation to which the movement is to be conceived, on its form and on its frequency.

In this approach, a distributive relationship links handshape and movement parameters. The robustness of this link between artefacts will evidently have to be tested; it will however not be presented here. The description of movement seen as a pattern applicable to an object (the hand), which is also recorded as to its internal form (handshape) and in regard to its orientation, presents the advantage of doing away with the cumbersome consideration of space. The latter is reduced to an extension in the instance of the deployment of a form whose determination depends on a situated object. Beyond this algorithmic understanding of movement, another reconstruction of movement is made possible by the range of different DOF in the matrices of interrelated segments (arm, forearm and hand): it breaks down that which moves and makes it possible to envisage the direction and the unfolding of movement in a distributed (non-egocentric) manner. Finally, for the great number of signs with two active hands, the description of the type of symmetry (plane, axis or centre) and of their orientation will enable us to test the validity of a graphical economy such as one would note that orientation and movement with a single hand, the position of the other being deduced from the type of symmetry.
3. Initial results

About 1300 signs have been entered to date (a third of the signs in the dictionary). Not all of the tables have been completed; some fields will be filled in only much later, especially those that concern the morphemic values for the parameters of orientation, of movement and of location (the list remains to be drawn up). When in the course of filling in information, it has become necessary to create new fields, we have added them. We do not limit a priori the development of the structure. The principal criterion guiding the choice of the first signs recorded is the handshape; as second criterion of choice, we opted for handshapes both diversified in articulatory terms and characterised by a high frequency of occurrence (‘pointing index’, ‘closed fist’, ‘5’, ‘key’, ‘closed fist with extended thumb’…). The following results deal with data relative to the first three of these handshapes.

3.1. For the handshapes

The analysis concerned in fact 645 simple signs from the standard lexicon currently catalogued in the IVT dictionary (Girod et al 1997) for which the handshape is either ‘closed fist’ (180), or ‘pointing index’ (285), or ‘5’ (180). Above all else, it was necessary to propose labelling, and from there, to dress an inventory of the morphemic values associated with each handshape among these signs. The first results bear out the confirmation of the hypothesis of a morphemic type of infra-lexical structuring, i.e., the unambiguous attribution of a value of meaning to the handshape concerning a minimum of 83.7% of signs for ‘closed fist’, 79.7% for ‘pointing index’, and 79% for ‘5’. If the attribution, the definition (labelling) and the assigning of the morphemic values are – as we suggested – always revisable, certain theoretical choices underpinning the method benefit from the promise of validation in return. The three handshapes concerned having been attested in the HIS (“proforms”\(^{18}\)), the deliberate point of departure for each of them was the taking into account of the morphemic values recorded by Cuxac (2000). The hypothesis of a direct anchoring of these values (form-meaning constants) in the iconisation process of the perceptual/practical experience of the real world is corroborated by the fact that they can be analysed according to three major principles of constitution (iconic primitives): specification of shape, repetition of shape, repetition of size (see also Johnston & Schembri, 1999 and Schembri, 2003). Our inventorying work, through the internal coherence that it sheds light on in a considerable number of STS, confirms two non-trivial points: 1) the massive transfer of values coming from HIS in these STS: thus these values represent 65.6% of

\(^{18}\) In the specific sense given to this term by C. Cuxac (Cuxac 2000): HI handshapes that correspond to generic forms (percepts) and which allow the signer to specify the form of the referent occurring in discourse (illustrative intent). See on this topic Pizzuto et al, this volume.
the values of meaning present for the handshape ‘closed fist’, 45.7% for ‘pointing index’ and 56.8% for ‘5’. This observation clearly supports the hypothesis of lexicogenesis anchored in the implementation of an illustrative intent; 2) the robustness of the categorization according to the three primitives of construction of form-meaning units, as the HI values present in the signs studied revealed themselves to be categorizable in such a way.

We can add a group of other values – coming from the STS – to those coming directly from the HIS, and which are equally categorizable: dactylological values (and more generally, gestural repetitions of pre-existent written symbols), culturally-induced values linked to direct borrowings from non-verbal gestures, (natural gesturing that is more or less culturally induced). The percentage of borrowings from shared gesturing is far from insignificant: 14.7% for ‘5’ and 6.4% for ‘closed fist’. The percentage seems slight for the handshape ‘pointing index’: 1.8%. This handshape constitutes however a special case, linked to the essential linguistic investment (morpho-syntactic in value) that SL make of its pointing utilization. And in fact, the deictic value of this handshape represents 30.6% of the morphemic values for the 285 signs concerned: it would be legitimate for us to include this deictic value coming from a pointing gesture in the category of borrowing phenomena from natural gesturing.

Finally, this analysis brings out the fact that for each handshape, the inventory of morphemic values is limited — 6 morphemic values at most per handshape — two prototypical values, also coming from the HIS, that systematically stand out for their remarkable level of productivity: as an example, the two values of the ‘grasping a slender cylindrical form’ and of the ‘repetition of a more or less spherical form’ represent 65.6% of the morphemic values associated with the handshape ‘closed fist’. From that point on, it is possible to envisage a morphemo-graphical representation of such form-meaning constants.

3.2. For the relative position

We will limit ourselves here to the presentation of results for the manual matrix, that is, the three DOF corresponding to flexion/extension, to pronosupination and to abduction/adduction (for more details on the geometry of these DOF, see Kapandji 1981 or Boutet 2001). The first two degrees have a wide amplitude of roughly 180°, while abduction/adduction is rapidly limited in its movement (15° for the first pole and 45° for the second). For each of these values, the amplitude has been encoded according to 7 possible items for flexion/extension and for pronosupination (90°, 60° 45° for each pole plus the intermediate position -0°); the encoding of amplitudes for abduction/adduction over 5 items gives 2 maximum values (max), 2 average values (mid) and an intermediate position (0°). Among the three DOF of the hand, only
the movement of pronosupination has no direct incidence on the forearm. The movement of the two others (flex/exten and abd/add), if it is maintained, leads to a transfer of movement to the forearm. These two DOF are in continuity with those of the forearm. This structural inter-segmental abutting between the DOF exerts a considerable influence on the signs, notably for the stabilized amplitude of the DOF of the hand. The principle is the following: within each matrix, the most stable amplitude is that which exerts the least influence on another DOF. Beside these transfers of movement between segments, the geometrical relations between the matrices of the hand — when the latter is in position of maximal flexion or extension — generates a transitory fusion between abduction/adduction and pronosupination (Boutet, 2001, 2004). It can be seen that if the hand is in a marked position of flexion or extension, then firstly, this favours a transfer, and secondly, a position of marked pronosupination will cause — by fusion with abduction/adduction — a transfer of increased movement to the forearm. The constraints present at several levels rather drastically reduce the relative stable positions of the hand.

In the table below we have detailed the positions for more than 600 signs according to the three DOF of the hand, expressed within each of the matrices. Let us recall that a position is expressed simultaneously by all three matrices. The number of positions accounts for the two hands and at times for three moments for each (three successive positions in the sign), so that total number of positions here amounts to 1613. The percentages express the proportion of positions for each DOF. Identical amplitudes were accounted for together, so as to present the positions in relation to each matrix. Therefore a position of pronation measuring 90° and a position of supination also measuring 90° were combined.

<table>
<thead>
<tr>
<th></th>
<th>Pronosupination</th>
<th>Flexion/extension</th>
<th>Abd/adduction</th>
</tr>
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<tbody>
<tr>
<td>90°/max</td>
<td>49,8%</td>
<td>8,9%</td>
<td>28,8%</td>
</tr>
<tr>
<td>60°</td>
<td>15,1%</td>
<td>19,6%</td>
<td></td>
</tr>
<tr>
<td>45°/mid</td>
<td>9,6%</td>
<td>34,6%</td>
<td>20,7%</td>
</tr>
<tr>
<td>0°</td>
<td>25,5%</td>
<td>36,9%</td>
<td>50,5%</td>
</tr>
</tbody>
</table>

Table 1 : Proportion of positions in the matrix of the hand

The positions are marked, and they correspond in part to the constraints mentioned above. In approximately 65% of the cases within the matrix pronosupination, the signs are turned toward the two maximal positions (90° and 60°) whereas for flexion/extension and abduction/adduction, more than 71% of the signs are centred around the intermediate position (45°/mid and 0°). On the one
hand, due to possible direct transfers to the forearm, the stabilisation induces a positioning around the situation intermediate (0° and 45°), and on the other, the avoidance of an intra-segmental transfer – which is an unstable situation – explains that a maximal flexion/extension is the least represented position (8,9%). These results are valid no matter what the handshape. If slight changes affect the relative position of the hand because of differentiated relations between the fingers and the palm, none of these argues against the proportions borne out in the table. One question arises however. As the DOF pronosupination does not imply a transfer of movement to the forearm, for what reason(s) are the signs, in the majority of cases, in a maximal position? Is it a question of stability conferred simply by the articulatory stops on either side of the amplitude of the pronation and of the supination, or does this particular position emanate from another segment?

When the two DOF of the forearm move simultaneously (int.rot/ext.rot and flex/exten) or when a DOF is in a marked position while the other moves, an involuntary repercussion affects the pronosupination (see Boutet & Garcia, 2006). The phase of the placement of the sign and the accompanying movements aiming to position the forearm affect the relative position of the hand. Thus, we can retrace a priori the path traced by the forearm during the placement of the sign starting with the simple relative position of the hand (pronosupination matrix). Whether the relative position of the forearm is connected to a previous sign or it is established in isolation, the pronosupination at the beginning of the sign keeps the imprint of movement effected by the forearm. When we dig deeper into the data, we note that the positions of pronosupination of 90° represent 78,8% of the cases where a DOF of the hand at least is at maximum amplitude from the beginning of the sign. It appears even more clearly that for those very stable signs for which there is no relative movement of the hand in relation to the forearm during the entire unfolding of the sign, the position of maximal pronosupination (90°) represents 83,5% of manual positions that have at least one maximal position. In nearly all of the cases where the pronosupination remains at 90° for the entire duration of the sign (151 signs), the relative positions of the forearm at the beginning of the sign are very marked; only 13 cases depart from these maximal positions of the forearm. The latter can all be explained by determinations due to contact ([AMORTISSEUR], [JUSQU’AU BOUT], [AU FOND], [REGARDER AU MICROSCOPE], [ETRE PARESEUX], [ETRE CONTENT])¹⁹, etc.). Here a clear determination and a strong correlation between the relative position of the forearm and the position at maximal pronosupination can be noted.

¹⁹ [BUMPER], [UP TO THE END], [IN THE DISTANCE], [LOOK INTO THE MICROSCOPE], [BE LAZY], [BE HAPPY]
Moreover, the relative position of the forearm participates very actively in the location of the hand (in the current acception). It should be noted however that the arm also plays a role here, even if it most often remains in a position close to the side of the body. In addition, the 3 matrices of the hand that participate to the same extent as the position of the forearm in the orientation (in an egocentric frame of reference) are limited in their amplitude, as we have seen. Thus a strict interdependence between location and orientation can be observed. It will be possible in time, starting from this interdependence, to measure the probability of associations of the positions of DOF between them, and to determine hierarchical relations for them. In a physiological approach for which we have validated a few rules, the continuous connection between the segments enables us to test the relations between the relative positions of the fingers in their matrix, and those of the hand. By retracing associations in this way, the handshape and its various stabilisations, the orientation and its declinations, and the location in its diverse segmental components can all be linked by the movement in the allocentric and distributed frame of reference accounted for by this database.

4. **Summary and concluding remarks**

The initial results of the morpho-phonetic database of the LSF lexicon presented here corroborate the hypothesis of a morphemic sublexical structuring. The economy of this database brings to light moreover the pertinence of a shift away from the current referential framework of analysis (egocentric) toward allocentric and distributed reference points. This new frame of reference makes it possible to explore the inter- and intra-parametric relations while at the same time establishing a condition of falsifiability for their evaluation. The initial analyses reveal, for the recorded handshapes, the presence of morphemic values (form-meaning constants) in 80% of the signs, which are shown to be, in their majority, identical to those attested in the HIS (‘productive signs’). These findings corroborate the hypothesis of the crucial role of these structures in lexicogenesis. The inventorying of these values by handshape is limited, making it possible to conceive a morphemo-graphical representation. Finally, the relative allocentric positions of the hand correspond to physiological determinations connecting the location, the orientation and the movement for which we have begun the inventory.

**References**


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1. Introduction

Memory is a quite complicated aspect of human nature where several systems are at play. Short-Term Memory (STM) is the one that is devoted to store a limited amount of information for a few seconds. For instance, the ability to remember a series of numbers (like a new telephone number) relies on the capacity of individual’s short term memory.

Since the first studies on this topic by Klima and Bellugi (1979), it was shown that STM capacity for signs is significantly lower than STM capacity for words. One of the first accounts for the lower sign span was that, on average, signs take longer to be articulated than words, affecting articulatory rehearsal in sign users. This explanation, originally proposed by Klima and Bellugi (1979), has been recently undermined by Boutla, Supalla, Newport and Bavelier (2004). Although, their results are relevant, as already observed by Emmorey and Wilson (2004), there are many reasons of concern. One of these is that none of these more recent studies explore STM with real verbal material: in these tests either digits or fingerspelled letters are used. Therefore, it cannot be excluded that signs and words with the same articulatory rate would yield a similar span. In this paper, we will present three experiments that investigate the role of STM with both deaf and hearing people (section 2). In particular, we assessed: a sign span to Deaf people and a word span to a control group of hearing people (rigidly controlling for articulation rate), an Emblem Span and a Visuo-Spatial Span (Corsi Block Test) to both groups. After having discussed the results of these three experiments, we will draw some general conclusions (sections 3 and 4).

* We want to thank Anna Folchi and Flavia Adani, our actresses for the sign span and emblem span materials, Emilano Mereghetti and Sandro Zucchi for helpful discussion.
2. Overview of the Experiments

2.1. Participants

The three experiments have been assessed to the same two groups of subjects: the first group was composed by 16 (10 man and 6 women) deaf adults who are signers of Italian Sign Language (LIS), either native signers or exposed to LIS before the age of 6; the second group was a control group of 16 hearing adults, native speakers of Italian. The hearing participants matched the deaf ones for age, sex and education.

2.2. Experiment 1: Verbal (Word/Sign) Span

The first experiment aimed at measuring the capacity of STM with verbal material belonging to the native language of each participant. This is the reason why a sign span was assessed to the deaf group (stimuli were sequences of real signs of LIS presented on a computer monitor). A verbal span both in the oral modality (which is the natural channel for oral languages) and in the written modality (which is somehow closer to the visual modality of signs) was assessed to the hearing group.

2.2.1. Materials

Verbal STM span was prepared by assembling comparable sequences of signs and words of increasing length. For the sign span, we choose 35 monosyllabic, one handed signs, whose movement is short or local (for instance, signs with long path movements were excluded). For the word span, we choose 35 highly frequent words that are disyllabic and that correspond to the Italian translations of the 35 signs used for the sign span.

Since one of our crucial aims is to verify whether articulation rate is the real source for the lower sign span, as claimed in the literature about ASL, two methods were adopted in order to control for the articulation rate of the items included in the study: one measures the length of each LIS sign and compares it with the length of the corresponding Italian words; the other consists of a speeded articulation task.

The first measurement was done considering the production of the actress who produced the signs for the sign span and the actress who produced the words for the word span in the oral presentation. As for sign length, it was measured the amount of time that occurs between the moment in which the hand reaches the place of articulation until the end of the movement of the sign. As for word length, time was measured from the first to the last sound of each word. The
difference between signs and words is significant: the words we selected for the experiment take longer to articulate than the corresponding signs, \( t(68) = 11.049, p < .001 \).

The speeded articulation task was assessed to the subjects after the verbal span. In this task, signers and speakers have to repeat a sequence of two items 20 times in a row, as fast as they can. The length of the sequences was of two items in order to remain below span for all the subjects, and the items for these tasks were chosen among those that were selected for the sign span. With this measure the difference in the two conditions is not significant \( t(10)=1.39, p=.19 \), showing that LIS signers are as fast as Italian speakers.

### 2.2.2. Procedure

Subjects had to repeat the items in the exact order of presentation, starting with sequences of two items. The items were presented at a rate of 1 item per second. Sequences increased in length only when the subject correctly recalled 2 out of 3 sequences. Span is therefore defined as the longest sequence at which serial recall was correct at least 2 out of 3 times. For the sign span, stimuli were displayed on a Macintosh PowerBook G4 using the DVD player of the laptop. LIS was the only mean of communication between the deaf participants and the experimenter. For the word span, the stimuli were both in a written and oral presentation. For the written presentation, PowerPoint slides were used: the items were printed in lowercase 44-point Arial font in black on a white background; while the items for the oral modality were presented using iTunes software and participants listened to the stimuli through headphones. The modality of response was LIS in case of deaf participants, who were consensually filmed during the experiment, and spoken Italian in the case of hearing participants.

### 2.2.3. Results

The sign span was 3.31 (SD = 0.48, range 3-4), while the word span was 4.94 (SD = 1.06, range 4-7) for the oral modality and 4.69 for the written modality (SD = 1.8, range 3-7). The difference of the word span between the oral and written modality is not significant \( t(15) = 1.46, \text{n.s.} \).

The overall result of the experiment is that sign span is significantly lower than word span, both when compared with the oral presentation \( t(30) = -5.58, p < .001 \), and with the written one \( t(30) = -4.45, p < .001 \).
2.3. Experiment 2: Emblem Span

In the second experiment, we measured deaf and hearing participants’ serial recall employing lists of commonly used gestures, called emblems (Kita, van Ingeborg, and van der Harry, 1998, Kita, 2001). Emblems, like signs, are produced using the visuo-spatial modality and are conscious communicative symbols. This condition allows us to compare speakers and signers’ span using the same set of visual stimuli for both groups. The emblems we choose are gestures shared by both the Italian Deaf culture and the Italian hearing culture, they can be paraphrased by using Italian words, and are very similar to LIS signs.

2.3.1. Materials and Procedure

Twelve emblems clearly understandable for the two groups of participants, were selected (see Kita et al., 1998 for a review of the arguments that clarify the distinction between signs and gestures like emblems and Kendon, 1992 on gestures in Italy). In order to make sure that all the items included in the experiment were intelligible to the subjects, five people, not included in the experimental study, were asked to name the emblems of the selected set, and the items were straightforwardly recognized.

The sequences for the span task were created following the same procedure used for LIS signs. Each sequence was presented using the Quick Time Pro software on a Macintosh PowerBook G4 computer screen, at the rate of one item per second. As in experiment 1, span is defined as the longest sequence at which serial recall is correct 2 out of 3 times.

2.3.2. Results

Hearing participants’ mean span was 3.56 (range 2-5), while it was 3.06 (range 2-4) in the case of deaf participants. This difference was not significant \([t(30) = 1.62, \text{n.s.}]\).

However, an intriguing fact emerges when intra-group differences are considered. The fact has to do with the strategy adopted by the hearing subjects: eleven reported using a verbal strategy (namely, they associated a word or a phrase to each emblem), while five reported using a visual strategy. Once this aspect is considered, an advantage for the verbal strategy seems to emerge. The 11 hearing participants adopting a verbal strategy had a mean span of 4 while the 5 hearing participants adopting a visual strategy had a mean span of 2.6. The difference was significant \([t(14) = 2.90, p < .05]\). Interestingly, the 5 hearing participants had a lower emblem span than the 5 matched deaf signers, although the difference was not significant \([t(8) = 1, \text{n.s.}]\), while the 11 hearing participants in the first group had a higher span than the 11 matched deaf signers and the
difference was significant \[t(20) = 2.65, p < .05\]. This fact indicates that a verbal strategy may be more effective than visuo-spatial coding for hearing people.

2.4. Experiment 3: Visuo-Spatial Span (Corsi Block Test)

2.4.1. Materials and Procedure

The Corsi Block Test (Orsini et al., 1987) consists in reproducing videotaped sequences of blocks, of increasing length, starting from a 2-item length, in the same order as previously performed by the examiner in the videotape. Sequence length is progressively increased once the participant correctly reproduces three out of five sequences of the same length. The span is defined as the longest sequence at which recall is correct three out of five times. The raw score is adjusted for gender, age, and educational level, the cut-off being 3.50.

2.4.2. Results

All participants had a normal adjusted score in this task. The mean visuo-spatial span was 4.81 (SD = 0.83, range 4-6) for hearing participants, and 5.94 (SD = 0.77, range 4-7) for deaf participants. The difference was significant \[t(30) = 3.96, p < .001\].

3. Discussion

The results of the visuo-spatial span suggest that language expertise in a particular modality exerts an influence on nonlinguistic working memory within that modality. On the other hand, the results of the emblem span indicate that subjects using a verbal strategy outperformed subjects using a visual strategy. So, verbal recoding seems to be superior to visual coding in hearing people.

Let’s now turn to the word/sign span. Assuming that the length of the items plays a crucial role in determining the span, a previous account for the limited short term memory in deaf subjects relied on a sort of length effect for the sign span. The line of reasoning was more or less the following: it is known from several experiments done with spoken languages that lists of longer words are harder to remember than lists of shorter words, and it is also known that STM with signs has similar properties as STM with spoken languages; therefore the source of lower span with signs was attributed to the fact that on average signs take longer to articulate than English words. However, we measured the length of words/signs by using two different methods and could exclude that signs in our experiment were longer than words. Therefore, the explanation based on the length effect can be rejected and we conclude that there must be something intrinsic to the phonological structure of a sign that makes serial recall particularly hard to perform.
Considering that a sentence becomes available word by word (or sign by sign) over time, and that language comprehension must involve a temporary storage of the linguistic information in the working memory, the results of our experiments lead us to ask how sign languages can be fully-fledged grammatical systems given that they depend on a limited STM.

In principle there are two possible approaches to this question: one is to admit that the capacity measured by standard STM tests is not involved in on-line language processing, a position assumed among the others by Waters and Caplan (2005). The other approach is to maintain that STM is an important aspect of language processing (Papagno, Cecchetto, Reati, and Bello 2007), and entertaining the possibility that signed languages have an internal organization that reduces the load on verbal STM.

The latter approach seems more promising to us, since the linguistic evidence suggests ways in which sign languages can cope with a reduced verbal STM. A crucial aspect in signed languages is the use of space to express a series of grammatical information, such as: subject and object agreement, tense and aspect. This peculiar use of the signing space has two main consequences: it minimizes the number of functional signs in a sentence (spoken languages have affixation and functional words to a larger extent), and reduces the number of signs that must be maintained in the memory buffer. Furthermore, signed languages adopt another fundamental way to reduce the STM overload, namely the use of non manual markers to vehicle grammatical meanings. This strategy is massively employed in the cases of: yes/no questions, if clauses and negation, among other grammatical phenomena. Our claim is also supported by the result of the visual-spatial span, suggesting that signers capitalize on these abilities to cope with memory limitations. What we have considered thus far helps us to shed light on an intriguing fact observed in Cecchetto, Geraci and Zucchi (2006), namely that ASL and LIS do not tolerate centre embedding. Centre embedding is the structural configuration instantiated by the following English example:

(1) [A dog [that the cat annoys] barks]

The peculiarity of this configuration is that it embeds a clausal structure (the relative clause), between the subject and the verb of the main sentence. What is relevant for our discussion is that also in spoken languages centre embedding is strongly restricted. Although there is nothing wrong with this structural configuration, the sentence in (2), in which there are two levels of centre embedding, cannot be processed:

(2) * [The dog [that the cat [that Mary annoys] chases] barks]
The impossibility to process the example in (2), is generally attributed to an overload of the working memory (Miller and Chomsky, 1963; Frazier and Fodor, 1978).

It is suggestive to follow the speculation of Cecchetto, Geraci and Zucchi (2006) that even a single level of centre embedding might be banned in sign languages because the lower sign span would prevent the processing of these structures. This does not mean that sign languages do not have a form of relativization. They do, but relative clauses are constructed in a way that avoids centre embedding (cf. Cecchetto et al. 2006).

4. Conclusions

In this paper, we showed that sign span is lower than word span also when articulation rate is controlled for. Nonetheless, sign languages are fully-fledged grammatical systems, probably because the overall architecture of the grammar of signed languages reduces the STM load. Our hypothesis is that the faculty of language is dependent on STM, being however flexible enough to develop even in a relatively hostile environment. We also showed an advantage of deaf signers over hearing subjects in a visuo-spatial memory task.

References


1. INTRODUCTION

While seeking a new perspective on the use of classifiers, we came upon Geraldí’s (1993) writings on linguistic activities (epilinguistic and metalinguistic) which, in a nutshell, are “the group of activities which take as their object one aspect that characterizes language: the fact that it can refer to itself, that is, with language we not only talk about the world or about our relations to things, but we also talk about how we talk” (Geraldí, op.cit.: 189). In this sense, the classifier is not viewed merely as a resource of the grammar of sign language, but rather as an element that is part of the use and function of sign language, as a part of all that can be done through language.

Descriptive studies have shown that sign language has a legitimate grammar, demonstrating the importance of classifiers, but teachers interested in fluency and in enunciation contexts need to understand how classifiers emerge and what they reveal about the workings of the discursive aspects of this language.

From here on, we proceeded to observe and discuss the workings of classifiers, searching for discursive situations where classifiers emerged, looking specifically at the conditions of discourse production:

- who is talking
- who are they talking to
- what are they talking about.
2. Objective

The aim of this paper is to reflect upon the use of sign language in the classroom, specifically analyzing the use of classifiers in particular enunciation events, such as storytelling and reporting experiences.

Classifiers are an integral part of the grammar of sign language and for deaf children to acquire sign language, they must interact with fluent deaf adult signers.

3. Different views on classifiers

Brito (1995) defines classifiers as morphemes existing both in oral and in sign languages. They are often used in sign language due to its visual-spatial nature. She explains that hand configurations that have hitherto been considered as sign language phonemes come to be viewed as morphemes, which explains the fact that they are used as classifier affixes connected to verbs, to represent characteristics of the entities to which they refer.

The classifier should not be confused with descriptive characteristics of the object, that is, when attributing qualities to an object, we might be using one kind of classification, but not a classifier in the linguistic sense of the term. Classifiers are hand configurations which, when related to an object, a person or an animal, function as markers of verbal agreement (Felipe, 2001).

Pimenta, the Brazilian deaf sign language teacher from São Paulo, included in his handouts for a sign language workshop (Pimenta, 2000) the theme of classifiers as elements which assist in determining the specificities of an idea; he divided them as

- Descriptive (of size, body shape, and of body part)
- Spatial-locative
- Semantic
- Instrumental (of the body, plural, of elements, of letters and numbers).

These issues are discussed in Columbian, Venezuelan, American, Argentine and other sign languages as presented by Ovídeo (2000), who explains that “predicates with classifiers are very special signs. The hand positions in these signs constitute a closed list (I will present 21 of them here), but the possibilities that hand movements can describe in space are so varied that it is very difficult for someone to repeat the same predicate with a classifier twice” (Ovido, op. cit.: 62; our translation).

Based on this statement, we can consider the use of classifiers as pertaining to the realm of the discursive functioning of language, that is, “uninterrupted linguistic work is constantly in process,
producing ‘an open systematization’, which is the result of balancing two opposing requirements: a tendency towards differentiation, seen in each use of an expression, and a tendency towards repetition, through the coming back to the same expressions with the same meanings present in earlier situations” (Geraldi, 1993: 12). In other words, the different uses of the classifier stem from social and historical production of discourse as it crystallizes when used in varied signing by the deaf community. Since the hearing majority barely recognizes sign language, there is a danger that the attempt to legitimize sign language may lead to the elaboration of a closed code system, rather than an “open system”.

Stemming from these considerations on classification systems, we henceforth present extracts from reports of cases (using Perroni’s (1992) typology of narrative discourse) which occurred in the classroom during interactions between deaf children and their deaf and hearing teachers.

4. THE CLASSROOM CONTEXT

The data which are the basis for our considerations were taken during classroom activities from accounts by two deaf children, who were part of a group of 6-7 year old students from the “Language and Deafness” Program at the Center for Study and Research in Rehabilitation “Prof. Dr. Gabriel O. S. Porto” (CEPRE/ FCM/Unicamp). Thirty minute sessions were periodically videotaped over a one year period, during which the children interacted with hearing and deaf teachers.

We present an excerpt recorded during a moment of conversation, in which a deaf girl, B., tells about something that happened with her family and friends.

B. is the deaf daughter of hearing parents, and her mother both signs and talks to her. In the deaf teacher’s opinion, this mother is a good sign language user.

We used the format proposed by Pereira and Nakasato (2001):

- **HIGH CASE** = signs as interpreted by the sign language instructor;
- (between parentheses) = descriptions of hand and body movement and facial expressions, as well as other relevant aspects;
- numbers (1, 2, 3, ) = possible occurrence of classifiers

B – I SAY FRIDAY I GO OUT SWIM OTHER SCHOOL AFTER SATURDAY DAD FIX POOL HOME
B – SWIM I HOME POOL SWIM HOME I POOL BIG (1) (hands open, palms downward together before body, making circular movements around her body).
Researcher – HOUSE FIX POOL (questioning facial expression).
B – WATER POUR (2) FILL (2) FRIEND TOGETHER SWIM
Researcher – COME YOUR HOUSE WHAT MAKE EAT (questioning facial expression).
B – RICE BEANS SALAD MEAT TOMATO. SUNDAY SWIM TOGETHER FRIEND I GOGGLES.
Researcher – GOGGLES NOT AFRAID (questioning facial expression).
B – NO. CLIMB TRAMPOLINE (3) (movement with index and middle finger for jump off trampoline) GLASSES GET OFF TO SLIDE (3) (right hand, palm downward in circular downward movement) DIVE SWIM WATER. FRIEND TWO AFRAID.
Researcher – AFRAID TWO FRIEND.
B – TO SLIDE (3) (right hand down in circular movement) I SLIDE (4) (makes movements for going down a slide with arms raised, slow downward movement) FALL (3) (right hand, palm downward, making continuous movements for going down on the side of her body, until she hit the water, as if she were in a pool) WATER SWIM I GO UNDER (4) (hands crossed on top of head with arms descending as if diving) GO UP (hand in 5 below waist, raising her arm as if reaching the surface of the pool) WATER DIVE (4) (beats feet rhythmically on the floor and makes diving movement with arms over head) I.

In order to analyze the classifiers used in this enunciation, our references are Pimenta (2000) and Ovídeo (2000) mentioned above.

(1) BIG – The child is talking about using the pool at home, and she uses an unconventional way of signing this adjective so as to describe the size and also the shape of the pool.
We will consider this to be a descriptive type of classifier (CL-D) used to describe the appearance, shape and size of an object. Lidell and Johnson (1997) use a category that corresponds to the roots of movement called static-descriptive roots, in which the sign describes a state, that is, a hand movement describes the object itself. This is also considered a perimeter morpheme, in which the hand configuration represents the external shape of an object.

(2) POUR FILL – We consider another kind of classifier, called element (CL-E), used in relation to a verb to explain the amount of liquid used to fill the pool. B. used the verb specifically to characterize using the pool, explaining the actions that happened in this context. This classifier portrays the movement of non solid elements, such as air, fire, liquids, in that the hand
configuration establishes a category of morphemes for quantity or extension, representing a given quantity or volume.

(3) TRAMPOLINE, SLIDE, and then the verb TO SLIDE – These signs portray an action or movement of a specific body part (CL-BP). Here the child represents the movement of the legs jumping on a trampoline (TRAMPOLINE) and the movement of the body (lying back) when she shows the action of sliding down the slide (TO SLIDE).

In Portuguese, there will be several different hand configurations for a Portuguese word, but not for the same sign, that is, she used what we call a body classifier (CL-B) for the same verb (TO SLIDE) (4) which, in context, refers to the movement of the arms when sliding (probably sitting with arms raised). This way, the verb TO SLIDE (3) probably refers to the action of sliding lying back and TO SLIDE (4) refers to the action of sliding seated with arms raised. This data shows differences between sign language and Portuguese since the classifier is “specific to sign languages, and is difficult for hearing people to learn” (Pereira and Nakasato, 2001: 360).

Here, TO SLIDE is used as a body part classifier (CL-BP), and the child uses hand configuration to represent the body lying back during the sliding action. And we have TO SLIDE (raising arms above head) as a body classifier (CL-B), where her upper body (arms) represent the phrase verb, turning into a classifier.

For GO UNDER and DIVE, we find the same kind of classifier (CL-B) where the child uses her upper body (arms raised above her head) to represent her intended meanings.

In this episode, there is no evidence of the instrumental classifier (CL-I), where the hand configuration represents an instrument used in an action. To illustrate this type of classifier, let us look at a brief exchange involving W., a girl who was also recorded during a spontaneous interaction. W. is the deaf daughter of hearing parents and she goes to a regular elementary school. The parents are actively involved in her learning process.

RESTAURANT MAN THERE SING (5) (right hand closed in front of mouth as if holding a microphone) SEE (next, she puts her hands to her face with an expression of admiration).

Here we have a verb SING represented by the use of an instrument (the microphone), which the child moves as if she were singing. This classifier is characterized by the use of an instrument (instrumental morpheme) in which a hand configuration represents the shape that refers to a specific object.
5. **Final Remarks**

The data shows that deaf students use classifiers in various dialogic situations, and especially in narrative discourse. The incidence of classifier use appears to be much greater than suggested by the literature, possibly because it also depends on the subject of ongoing dialogical situations, which are hard to be exhaustively described by grammatical analysis. If the classifier cannot be adequately described in the dictionary (Oviedo 2000), is it not likely that it is constituted dialogically in the course of language use?

There seems to be an emergence of undescribed classifiers, which are, nevertheless, understood by interaction partners. In this sense, it appears that researchers aren’t as concerned about the discursive functions of sign language as they are about isolated descriptive grammatical categories. Certain production conditions possibly suggest certain classifier uses and not others, which cannot always be readily described.

While not attempting to exhaust such issues, our aim is to instigate research that might contribute to better clarify sign language use and grammatical function. There are still a number of open issues related to classifier use, such as:

- How much are classifiers actually incorporated by deaf students in the process of sign language acquisition?
- Can we really affirm that classifiers are only related to verb use?
- Or do they constitute elements that are merely descriptive?
- Are classifiers construed only during ongoing language function?

At the end of the day, this study shows that further research is called for, investigating sign language from the approach of language as discourse.

**Keywords:** Deafness; Narrative; Sign Language, Classifiers

**References**


American Sign Language – Sentence Reproduction Test: Development & Implications

Peter C. Hauser
National Technical Institute for the Deaf
Rochester Institute of Technology

Raylene Paludnevičienė
Gallaudet University

Ted Supalla
University of Rochester

Daphne Bavelier
University of Rochester

Corresponding Author: Peter C. Hauser, Department of Research and Teacher Education, National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, NY, USA 14623; e-mail: peter.hauser@rit.edu

Abstract

The deaf community is widely heterogeneous in its language background. Widespread variation in fluency exists even among users of American Sign Language (ASL), the natural gestural language used by deaf people in North America. This variability is a source of unwanted “noise” in many psycholinguistic and pedagogical studies. Our aim is to develop a quantitative test of ASL fluency to allow researchers to measure and make use of this variability. We present a new test paradigm for assessing ASL fluency modeled after the Speaking Grammar Subtest of the Test of Adolescent and Adult Language, 3rd Edition (TOAL3; Hammill, Brown, Larsen, & Wiederholt, 1994). The American Sign Language—Sentence Reproduction Test (ASL-SRT) requires participants to watch computer-displayed video clips of a native signer signing sentences of increasing length and complexity. After viewing each sentence, the participant has to sign back the sentence just viewed. We review the development of appropriate test sentences, rating procedures and inter-rater reliability, and show how our preliminary version of the test already distinguishes between hearing and deaf users of ASL, as well as native and non-native users.
1. American Sign Language - Sentence Reproduction Test Development, & Implications

American Sign Language (ASL) is the natural language used by deaf people in the United States and parts of Canada, yet there are tremendous variations in fluency among users of ASL. The need for a robust test of ASL fluency for widespread use is probably felt most pressingly in two main domains. First, proper educational and clinical assessment requires us to evaluate the level of language skill achieved by the individual. However, there is no commonly accepted test to measure language performance in the sign modality. Second, studies of ASL processing and its functional brain organization can only be informative to the extent that they focus on individuals who indeed have native proficiency in the language. In this literature, the absence of an agreed upon benchmark renders participant selection a constant challenge. The lack of precise measurement of the ASL skill of participants is likely to be a source of unwanted noise and, in some cases, may corrupt the results, weakening the validity of the claims made by this body of work.

Research efforts toward a test of ASL proficiency are not a new development (see Haug, 2007 and Singleton, 2003 for reviews). Over the years, several groups have developed tests of ASL skill for use in their research (i.e., Anderson & Reilly, 2002; Boudreault & Mayberry, 2000; Caccamise & Newell, 1999; Hoffmeister, 1999; Maller. Singleton, Supalla, & Wix, 1999; Mounty, 1994; Shick, 1997; Prinz, Strong, & Kuntze, 1994; Supalla et al., 1999). In general, when reviewing available tests of ASL proficiency, two factors seem to have hampered their wider distribution: lengthy administration time and advanced skill requirements for scoring. A number of these tests were designed to provide a detailed picture of language use in signers, while others give a general profile of language proficiency. This is the case, for example, with the checklist paradigm developed by Maller and colleagues (1999) for deaf children aged 6 – 12. Their test, the American Sign Language Proficiency Assessment, covers a reasonable range of linguistic skills as well as interpersonal interaction skills in open-ended dialogue situations. Although the test takes approximately 30 minutes to collect specific sign samples, it takes 1– 2 hours for skilled raters to code each participant’s sign samples.

The ASL proficiency tests that provide detailed assessment of several different linguistic constructs elicited under controlled situations are extremely valuable for furthering our understanding of ASL processing. However these tests generally are time consuming to administer and require significant expertise and familiarity with the linguistic constructs being measured in order for them to be to be scored adequately. Many of the existing proficiency tests take one hour or more to administer and have components that range from one hour (Prinz, Strong, & Kuntze, 1994) to 15 or more hours to score
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Typically, ASL proficiency tests focus either on children (Anderson & Reilly, 2002; Hoffmeister, 1999; Maller et al., 1999; Schick, 1997; Prinz, Strong, & Kuntze, 1994) or on adults (Caccamise & Newell, 1999). Only one test is adequate for use with both children and adults: the Test Battery for ASL Morphology and Syntax (Supalla et al., 1999), however, it takes approximately two hours to administer and 15 hours to score. There remains therefore a need for a quantitative test of global ASL proficiency for both children and adults that involves a short administration time and scoring procedures that are robust across scorers and can be completed by individuals without intensive training.

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Our aim in adapting this test into what we will term the American Sign Language—Sentence Reproduction Test (ASL-SRT) is to converge on a test that is sensitive enough to discriminate between individuals who acquired ASL from their parents beginning at birth and those who did not (thereafter referred to as native signers and non-native signers, respectively). In addition, the test must discriminate within the native signer population individuals fully mastering ASL versus those not yet achieving full mastery.

This paper describes the development of the ASL test sentences, and piloting on populations with varied ASL background. In the first phase of test development, it was necessary to test the items’ difficulty and effectiveness in separating different levels of ASL proficiency. The results of these analyses are
presented here. This data will be used to determine the items to be included in the final version of the ASL-SRT and their arrangement in order of increasing difficulty.

2. Method

In the Speaking Grammar Subtest of TOAL3, participants are required to repeat orally presented sentences verbatim. Thirty English sentences are administered in increasing order of difficulty. One point is awarded for each sentence that is reproduced correctly and zero points are awarded for sentences that are reproduced with omissions or commissions. An aspect of the administration procedure that was not used in the ASL-SRT was the fact that the Speaking Grammar Subtest is usually administered live with the examiner tracking the performance of the subject as testing proceeds. Because our aim was (1) to develop a test that does not require a skilled interviewer and (2) to collect a full range of data from widely diverse groups of ASL users to determine complexity ranking of sentences, our ASL version presented pre-recorded videos of a native signer (author RP) signing all test sentences.

Forty sentences that increase in length and syntactic, thematic and morphemic complexity were newly developed for the ASL-SRT (see Figure 1 for examples). There are several issues specific to ASL that have to be taken into consideration when developing such a set of sentences. The first issue concerns lexical item selection. Our goal was to have a set of sentences that could be reproduced by ASL signers from different regions and of different ages, with a good distribution of difficulty to avoid floor or ceiling effects. Thus, when identifying signs for use in sentences, regional signs, signs that vary from generation to generation, and sign system variations were avoided. Sentence complexity was increased by allowing fingerspelling, signs with numerical incorporation affixes, and signs with assumed low frequency of occurrence in the language. The test sentences were also built so as to span a wide range from very basic to quite complex, given the widespread variations in sign proficiency observed in sign users.

A second issue is that in signed languages, longer sentences do not necessarily translate to more difficult sentences. Instead, a shorter sentence may be morphologically more complex than a longer sentence due to the way grammatical features are expressed in individual signs (e.g., polymorphemic signs). For example, classifier morphemes are used in descriptive constructions comprised of multi-layered tiers of handshapes, locations and movements. Such forms increase the difficulty level of a sentence without making it longer. For example, the sentence “MOTORCYCLE SPIN HIT TREE” can be roughly translated by only four English glosses that describe the general concept of each sign (see Figure 1). However, the English gloss for SPIN does not convey all of the concepts expressed by the sign. SPIN was signed with the 3 handshape, which is a classifier indicating a vehicle. The base hand faces downward with the palm open representing the surface
that the vehicle is on. The movement of the sign shows the vehicle moving from back to side. This single signed form conveys a wealth of information that is missing from the English gloss (and translation in the figure), and would require a higher level of cognitive processing, likely corresponding to a more difficult sentence.

Taking these factors into consideration, the sentences were arranged in the order of increasing complexity as determined by two deaf native signers (co-authors Paludnevičienė, Supalla). The sentences were pilot tested on a group of eight signers with varying skills in ASL, including novice hearing adult signers, hearing native and non-native ASL interpreters, and deaf native and non-native adult signers. Based on the results of this pilot study, sentences were re-ordered and changed as needed. In particular, sentences were modified to create a more even distribution of easy to difficult sentences and to avoid the use of grammatical or lexical features that were found to vary in the pilot participants’ sentence reproductions. A refined set of 39 sentences was further tested on a large number of participants to determine: (1) how well this material may differentiate native and non-native signers, deaf and hearing individuals, and children and adult signers; (2) whether rating of relative difficulty could be reliably derived by different scorers; and, (3) the extent to which a final sentence order could be agreed upon. The data from this study are presented here and will be used to create the final version of the ASL-SRT.

**Easy Sentence:** “The motorcycle spun and hit a tree.”

**Difficult Sentence:** “Two dogs walking by noticed each other, started growling, then jumped into a fight while people rushed in to pull them apart.”
Figure 1. ASL-SRT examples of an easy sentence (top) and a difficult sentence (bottom). English translations are provided instead of sign glosses.

2.1. Participants

The second phase of the ASL-SRT was administered to 120 deaf and hearing children ($M_{age} = 12.9$, $SD_{age} = 1.7$) and adults ($M_{age} = 27.6$, $SD_{age} = 10.1$) who are native or non-native signers. The participants were recruited from summer camps, schools, and colleges for the deaf and grew up in different regions of the United States. The participants had varying proficiency in ASL, ages, and hearing status (see Table 1). Data from six participants were excluded from further analyses due to technical difficulties during administration or confusion regarding test instructions.

<table>
<thead>
<tr>
<th></th>
<th>Deaf</th>
<th>Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n$</td>
<td>$M_{age}$ (SD)</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-native</td>
<td>13</td>
<td>14.1 (1.8)</td>
</tr>
<tr>
<td>Native</td>
<td>27</td>
<td>12.5 (1.5)</td>
</tr>
<tr>
<td>Adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-native</td>
<td>4</td>
<td>19.3 (1.9)</td>
</tr>
<tr>
<td>Native</td>
<td>23</td>
<td>23.4 (4.4)</td>
</tr>
</tbody>
</table>

Table 1. Number and age of deaf and hearing native and non-native children and adult signers.
2.2. Procedure

The test and its instructions were entirely administered through pre-recorded videos featuring a deaf native ASL user (co-author Paludnevičienė). Participants were tested individually. After viewing the instruction video, participants were then allowed to ask clarification questions to the investigator. To ensure that the participants understood the instructions, two practice sentences were given. After viewing each practice sentence, participants were asked to reproduce it. Participants were not corrected for the mistakes they made, but reminded that the goal of the task was to reproduce the sentence as signed by the model and not just reproduce its gist. The videos of the ASL-SRT sentences were then presented to participants, one sentence at a time in order of increasing complexity. Participants’ responses were recorded on video and they pressed the space bar each time they were ready for the next sentence.

In this preliminary version of the ASL-SRT, all 39 sentences were administered independently of the participants’ performance. Two deaf native ASL signers rated the participants’ responses off line. The raters were undergraduate psychology students with no formal education in linguistics and only brief training on how to rate the video data. They were trained to watch the original sentence on video and then watch the participants’ reproduction of the sentence. Scorers were instructed to mark a sentence as incorrect if they felt that the reproduction was not exactly the same as the original. The raters were also asked to describe errors in detail on a scoring sheet. While this is not intended to be a part of the final scoring procedures of the ASL-SRT, this data was requested for analyses of discrepancies between raters, and as a source of examples for the development of a rater manual for the final version of the test illustrating errors and acceptable variations in signs.

Sample sentence  
MOTORCYCLE SPIN HIT TREE

<table>
<thead>
<tr>
<th>Error Types</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>omissions</td>
<td>MOTORCYCLE HIT TREE</td>
</tr>
<tr>
<td>commissions</td>
<td>MOTORCYCLE SPIN HIT TREE FALL</td>
</tr>
<tr>
<td>syntax</td>
<td>MOTORCYCLE SPIN TREE HIT</td>
</tr>
<tr>
<td>variation</td>
<td>MOTORCYCLE SPIN (base hand up) HIT TREE</td>
</tr>
<tr>
<td>comprehension</td>
<td>MOTORCYCLE RIDE SAW TREE</td>
</tr>
</tbody>
</table>

Figure 2. Sample of ASL-SRT error types.

One of the co-authors (Paludnevičienė) reviewed the raters’ scores on a single subject, provided feedback and answered their questions. No further instructions were provided to the raters after their training, as our goal was to develop a test that required minimal training, and the two
raters did not communicate about their ratings or progress with each other. The scoring system awarded one point for each sentence that was signed correctly. No points were awarded to sentences that had omissions, commissions or changes in lexical items or syntactic constructions (see Figure 2 for examples of error types).

A total of 99 of the participants were scored by both raters and used in the following analyses. Data from the 99 participants were used to calculate reliability analyses. Data from the 48 hearing and deaf native signers were used to test the effect of hearing status on ASL-SRT scores. Data from the 67 younger deaf participants were used to determine the effect of age and native exposure on the ASL-SRT scores (see Table 1 for \( n \) and \( M_{\text{age}} \) for each group).

3. Results

3.1. Reliability

The mean scores for each of the raters were first computed. A paired-samples \( t \)-test revealed that grand mean scores from Rater 1 (\( M = 24.6, SD = 6.6 \)) and Rater 2 (\( M = 18.8, SD = 6.3 \)) were significantly different, \( t(98) = 15.28, p < .001 \). One rater had a higher criterion for accepting sentence reproductions as correct compared to the second rater. Despite this difference in baseline, significant inter-rater reliability was still found, Pearson \( R = .83, p < .01 \). This high reliability coefficient indicates a significant amount of agreement as to whether raters felt the sentence was correctly or incorrectly reproduced by the participants. In addition high internal consistency was found within each rater’s score, alpha coefficients are .87 (Rater 1) and .88 (Rater 2). The participants’ scores obtained from the two raters revealed high inter- and intra-rater reliability. The mean of the two rater’s scores for each sentence was combined for the following analyses.

![Figure 3. Deaf and hearing adult native signers’ ASL-SRT performance.](image-url)
3.2. Effect of Hearing Status in Adults

To assess whether deaf and hearing signers could both be used in the development of the sentence rank order required by the test, we first compared deaf and hearing native signers’ overall performance on all 39 sentences included in the test. Our analysis focused on adult signers. However, we experienced difficulty with screening control and finding hearing signers who had undergone a level of immersion in the language that was similar to deaf native signers. Even highly fluent hearing interpreters and professionals are more likely to achieve mastery via formal instruction rather than immersion. An independent sample $t$-test revealed that the mean total correct sentence reproductions made by the 25 hearing native signers ($M = 18.3$, $SD = 6.3$) was significantly worse compared to the performance of the 23 deaf native signers ($M = 25.9$, $SD = 4.0$), $t(46) = -4.95$, $p < .001$). The results of this analysis suggest that hearing and deaf adults have different levels of proficiency in ASL (see Figure 3). Therefore, the data from hearing participants will not be used to rank the sentences in order of difficulty for the final test product.

<table>
<thead>
<tr>
<th></th>
<th>Native</th>
<th>Non-native</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n$</td>
<td>Mean ($SD$)</td>
<td>$n$</td>
</tr>
<tr>
<td>Deaf Children</td>
<td>27</td>
<td>23.9 (4.4)</td>
</tr>
<tr>
<td>Deaf Adults</td>
<td>23</td>
<td>25.9 (4.3)</td>
</tr>
</tbody>
</table>

Table 2. Deaf children and adult native and non-native signers’ ASL-SRT scores

3.3. Effect of Native Fluency and Developmental Age in Deaf

We relied on the performance of deaf signers to determine sentence rank order. To insure enough variations in skill level, we have included native and non-native signing children between the ages of 10 to 17 years old, and adults between the ages of 18 and 60 years old. Before turning to sentence ranking, it was necessary to first confirm that our set of sentences as a whole was sensitive to developmental age and native fluency. A 2x2 ANOVA with native fluency (native vs. non-native) and developmental age (children vs. adults) was computed using the total scores on ASL-SRT (see Table 2). The results of the analysis revealed a main effect of native fluency ($M_{native} = 24.8$, $SD_{native} = 4.1$; $M_{non-native} = 18.3$, $SD_{non-native} = 7.2$, $F(1, 63) = 11.33$, $p = .001$), and of developmental age ($M_{children} = 21.7$, $SD_{children} = 6.2$; $M_{adults} = 25.3$, $SD_{adults} = 4.2$, $F(1, 63) = 5.10$, $p < .05$) without an interaction effect. The results reveal that the ASL-SRT is sensitive to differences in ASL fluency between native and non-native signers. It also distinguishes between children and adults (see Figure 4).
### 3.4. Item Reordering

The final goal of the ASL-SRT development is to rank order sentences according to their difficulty level, as being done in the TOAL3. We used only the data from the children native signers to determine item difficulty so that the test can begin with the easiest sentences and end with the most difficult ones. One motivating factor for not including deaf non-native signers is the possible discrepancy in developmental pattern. The psycholinguistic and sociolinguistic literature (e.g., Newport & Meier, 1985; Mayberry, 1994; Ross & Newport, 1996) has generally shown that deaf non-native signers appear to be less fluent than deaf native signers. Deaf non-native adult signers, although providing a wide range of skill level, may fail on some sentences because of their lack of native exposure rather than the true linguistic difficulty of the items. This discrepancy raises an issue as to whether the mistakes that non-native signers make are representative of the native user population, and for that reason non-native signers were ruled out. Deaf children who are native signers were the best candidates as their performance reflects native usage and yet they still exhibit a wide range of skill levels providing the necessary information to rank order the sentences.

The two raters’ mean total score of each item from the children native ASL signers’ data was used to establish the new ASL-SRT item order that is shown as a prototype model with 39 test sentences in Figure 5 on the right. Items were reordered from the items with the highest percentage correct to lowest. The two graphs on the left of the figure illustrate the total percentage correct for each item as scored by the two raters. Out of these 39, we will select a final set of 30 sentences that will be then checked again on a new sample of deaf signers.
4. Discussion

The results presented here represent the first attempt in ranking test sentences for the ASL-SRT. One compelling reason for pursuing this route for measuring ASL proficiency is that the test is easy to administer and can be scored with robust inter-rater reliability and internal consistency by native signers with no linguistic background and minimal training. In its present format, it seems sensitive to differences between native and non-native ASL signers and captures the difference between children and adult deaf signers. However, the claims made here about the effects of hearing status, and developmental age of exposure on native ASL fluency need to be confirmed with a wider population. It will also be necessary to demonstrate the inter-rater reliability and internal consistency of the final version.

Ideally, the final version of the ASL-SRT will be optimized by including only the items that best predict native fluency in ASL and are most sensitive to age differences in language skills. Qualitative analyses of participant errors are currently being performed to determine whether there are some natural sign variations that should be permitted (e.g., weak hand drop). The analyses will also help the authors explore how the raters determined whether sign reproductions were correct or incorrect. This information will be used to develop a rater training manual for the final version of the test.

Validity testing will also be necessary to confirm that the ASL-SRT actually measures ASL competence. One way to illustrate a test’s validity is by investigating whether the test can discriminate between different groups of signers (discriminant validity) using similar methods as presented here. It will also be necessary to determine the test’s concurrent validity by demonstrating that the participants’ ASL-SRT scores positively correlate with another measure of ASL...
competence. Finally, separate normative samples will be collected from child and adult native and non-native deaf ASL signers. The final set of sentences will be tested on a large sample of deaf and hearing individuals to confirm the results described here.

The ASL-SRT is a global, objective ASL proficiency test that involves receptive and expressive skills in both children and adults. This test takes less than 30 minutes to administer and less than 30 minutes to score by deaf native signers with minimal training. Currently, the inter-rater reliability and internal consistency of the preliminary version of the ASL-SRT are already high. To shorten the administration time, we will reduce the number of items in the final version. We will also develop an administration and scoring manual to establish standardization, and will include specific rater training components that will hopefully also shorten the scoring time. Upon completion of the development project and psychometric studies, the ASL-SRT test will be available for researchers’ use for cross-study comparisons.

References


Acknowledgements

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American Sign Language – Sentence Reproduction Test:
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Peter C. Hauser
National Technical Institute for the Deaf
Rochester Institute of Technology

Raylene Paludnevičienė
Gallaudet University

Ted Supalla
University of Rochester

Daphne Bavelier
University of Rochester

Corresponding Author: Peter C. Hauser, Department of Research and Teacher Education, National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, NY, USA 14623; e-mail: peter.hauser@rit.edu

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2. Method

In the Speaking Grammar Subtest of TOAL3, participants are required to repeat orally presented sentences verbatim. Thirty English sentences are administered in increasing order of difficulty. One point is awarded for each sentence that is reproduced correctly and zero points are awarded for sentences that are reproduced with omissions or commissions. An aspect of the administration procedure that was not used in the ASL-SRT was the fact that the Speaking Grammar Subtest is usually administered live with the examiner tracking the performance of the subject as testing proceeds. Because our aim was (1) to develop a test that does not require a skilled interviewer and (2) to collect a full range of data from widely diverse groups of ASL users to determine complexity ranking of sentences, our ASL version presented pre-recorded videos of a native signer (author RP) signing all test sentences.

Forty sentences that increase in length and syntactic, thematic and morphemic complexity were newly developed for the ASL-SRT (see Figure 1 for examples). There are several issues specific to ASL that have to be taken into consideration when developing such a set of sentences. The first issue concerns lexical item selection. Our goal was to have a set of sentences that could be reproduced by ASL signers from different regions and of different ages, with a good distribution of difficulty to avoid floor or ceiling effects. Thus, when identifying signs for use in sentences, regional signs, signs that vary from generation to generation, and sign system variations were avoided. Sentence complexity was increased by allowing fingerspelling, signs with numerical incorporation affixes, and signs with assumed low frequency of occurrence in the language. The test sentences were also built so as to span a wide range from very basic to quite complex, given the widespread variations in sign proficiency observed in sign users.

A second issue is that in signed languages, longer sentences do not necessarily translate to more difficult sentences. Instead, a shorter sentence may be morphologically more complex than a longer sentence due to the way grammatical features are expressed in individual signs (e.g., polymorphemic signs). For example, classifier morphemes are used in descriptive constructions comprised of multi-layered tiers of handshapes, locations and movements. Such forms increase the difficulty level of a sentence without making it longer. For example, the sentence “MOTORCYCLE SPIN HIT TREE” can be roughly translated by only four English glosses that describe the general concept of each sign (see Figure 1). However, the English gloss for SPIN does not convey all of the concepts expressed by the sign. SPIN was signed with the 3 handshape, which is a classifier indicating a vehicle. The base hand faces downward with the palm open representing the surface
that the vehicle is on. The movement of the sign shows the vehicle moving from back to side. This single signed form conveys a wealth of information that is missing from the English gloss (and translation in the figure), and would require a higher level of cognitive processing, likely corresponding to a more difficult sentence.

Taking these factors into consideration, the sentences were arranged in the order of increasing complexity as determined by two deaf native signers (co-authors Paludnevičienė, Supalla). The sentences were pilot tested on a group of eight signers with varying skills in ASL, including novice hearing adult signers, hearing native and non-native ASL interpreters, and deaf native and non-native adult signers. Based on the results of this pilot study, sentences were re-ordered and changed as needed. In particular, sentences were modified to create a more even distribution of easy to difficult sentences and to avoid the use of grammatical or lexical features that were found to vary in the pilot participants’ sentence reproductions. A refined set of 39 sentences was further tested on a large number of participants to determine: (1) how well this material may differentiate native and non-native signers, deaf and hearing individuals, and children and adult signers; (2) whether rating of relative difficulty could be reliably derived by different scorers; and, (3) the extent to which a final sentence order could be agreed upon. The data from this study are presented here and will be used to create the final version of the ASL-SRT.

**Easy Sentence:** “The motorcycle spun and hit a tree.”

**Difficult Sentence:** “Two dogs walking by noticed each other, started growling, then jumped into a fight while people rushed in to pull them apart.”
2.1. Participants

The second phase of the ASL-SRT was administered to 120 deaf and hearing children (\(M_{age} = 12.9, SD_{age} = 1.7\)) and adults (\(M_{age} = 27.6, SD_{age} = 10.1\)) who are native or non-native signers. The participants were recruited from summer camps, schools, and colleges for the deaf and grew up in different regions of the United States. The participants had varying proficiency in ASL, ages, and hearing status (see Table 1). Data from six participants were excluded from further analyses due to technical difficulties during administration or confusion regarding test instructions.

<table>
<thead>
<tr>
<th></th>
<th>Deaf</th>
<th>Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(M_{age} (SD))</td>
</tr>
<tr>
<td>Children</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-native</td>
<td>13</td>
<td>14.1 (1.8)</td>
</tr>
<tr>
<td>Native</td>
<td>27</td>
<td>12.5 (1.5)</td>
</tr>
<tr>
<td>Adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-native</td>
<td>4</td>
<td>19.3 (1.9)</td>
</tr>
<tr>
<td>Native</td>
<td>23</td>
<td>23.4 (4.4)</td>
</tr>
</tbody>
</table>

Table 1. Number and age of deaf and hearing native and non-native children and adult signers.
2.2. Procedure

The test and its instructions were entirely administered through pre-recorded videos featuring a deaf native ASL user (co-author Paludnevičienė). Participants were tested individually. After viewing the instruction video, participants were then allowed to ask clarification questions to the investigator. To ensure that the participants understood the instructions, two practice sentences were given. After viewing each practice sentence, participants were asked to reproduce it. Participants were not corrected for the mistakes they made, but reminded that the goal of the task was to reproduce the sentence as signed by the model and not just reproduce its gist. The videos of the ASL-SRT sentences were then presented to participants, one sentence at a time in order of increasing complexity. Participants’ responses were recorded on video and they pressed the space bar each time they were ready for the next sentence.

In this preliminary version of the ASL-SRT, all 39 sentences were administered independently of the participants’ performance. Two deaf native ASL signers rated the participants’ responses off line. The raters were undergraduate psychology students with no formal education in linguistics and only brief training on how to rate the video data. They were trained to watch the original sentence on video and then watch the participants’ reproduction of the sentence. Scorers were instructed to mark a sentence as incorrect if they felt that the reproduction was not exactly the same as the original. The raters were also asked to describe errors in detail on a scoring sheet. While this is not intended to be a part of the final scoring procedures of the ASL-SRT, this data was requested for analyses of discrepancies between raters, and as a source of examples for the development of a rater manual for the final version of the test illustrating errors and acceptable variations in signs.

<table>
<thead>
<tr>
<th>Sample sentence</th>
<th>MOTORCYCLE SPIN HIT TREE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Error Types</strong></td>
<td></td>
</tr>
<tr>
<td>omissions</td>
<td>MOTORCYCLE HIT TREE</td>
</tr>
<tr>
<td>commissions</td>
<td>MOTORCYCLE SPIN HIT TREE FALL</td>
</tr>
<tr>
<td>syntax</td>
<td>MOTORCYCLE SPIN TREE HIT</td>
</tr>
<tr>
<td>variation</td>
<td>MOTORCYCLE SPIN (base hand up) HIT TREE</td>
</tr>
<tr>
<td>comprehension</td>
<td>MOTORCYCLE RIDE SAW TREE</td>
</tr>
</tbody>
</table>

Figure 2. Sample of ASL-SRT error types.

One of the co-authors (Paludnevičienė) reviewed the raters’ scores on a single subject, provided feedback and answered their questions. No further instructions were provided to the raters after their training, as our goal was to develop a test that required minimal training, and the two
raters did not communicate about their ratings or progress with each other. The scoring system awarded one point for each sentence that was signed correctly. No points were awarded to sentences that had omissions, commissions or changes in lexical items or syntactic constructions (see Figure 2 for examples of error types).

A total of 99 of the participants were scored by both raters and used in the following analyses. Data from the 99 participants were used to calculate reliability analyses. Data from the 48 hearing and deaf native signers were used to test the effect of hearing status on ASL-SRT scores. Data from the 67 younger deaf participants were used to determine the effect of age and native exposure on the ASL-SRT scores (see Table 1 for \( n \) and \( M_{\text{age}} \) for each group).

3. Results

3.1. Reliability

The mean scores for each of the raters were first computed. A paired-samples \( t \)-test revealed that grand mean scores from Rater 1 \((M = 24.6, SD = 6.6)\) and Rater 2 \((M = 18.8, SD = 6.3)\) were significantly different, \( t(98) = 15.28, p < .001 \). One rater had a higher criterion for accepting sentence reproductions as correct compared to the second rater. Despite this difference in baseline, significant inter-rater reliability was still found, Pearson \( R = .83, p < .01 \). This high reliability coefficient indicates a significant amount of agreement as to whether raters felt the sentence was correctly or incorrectly reproduced by the participants. In addition high internal consistency was found within each rater’s score, alpha coefficients are .87 (Rater 1) and .88 (Rater 2). The participants’ scores obtained from the two raters revealed high inter- and intra-rater reliability. The mean of the two rater’s scores for each sentence was combined for the following analyses.

![Figure 3. Deaf and hearing adult native signers’ ASL-SRT performance.](image-url)
3.2. Effect of Hearing Status in Adults

To assess whether deaf and hearing signers could both be used in the development of the sentence rank order required by the test, we first compared deaf and hearing native signers’ overall performance on all 39 sentences included in the test. Our analysis focused on adult signers. However, we experienced difficulty with screening control and finding hearing signers who had undergone a level of immersion in the language that was similar to deaf native signers. Even highly fluent hearing interpreters and professionals are more likely to achieve mastery via formal instruction rather than immersion. An independent sample $t$-test revealed that the mean total correct sentence reproductions made by the 25 hearing native signers ($M = 18.3, SD = 6.3$) was significantly worse compared to the performance of the 23 deaf native signers ($M = 25.9, SD = 4.0$), $t(46) = -4.95, p < .001)$. The results of this analysis suggest that hearing and deaf adults have different levels of proficiency in ASL (see Figure 3). Therefore, the data from hearing participants will not be used to rank the sentences in order of difficulty for the final test product.

<table>
<thead>
<tr>
<th>Native</th>
<th>Non-native</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n$</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Deaf Children</td>
<td>27</td>
</tr>
<tr>
<td>Deaf Adults</td>
<td>23</td>
</tr>
</tbody>
</table>

Table 2. Deaf children and adult native and non-native signers’ ASL-SRT scores

3.3. Effect of Native Fluency and Developmental Age in Deaf

We relied on the performance of deaf signers to determine sentence rank order. To insure enough variations in skill level, we have included native and non-native signing children between the ages of 10 to 17 years old, and adults between the ages of 18 and 60 years old. Before turning to sentence ranking, it was necessary to first confirm that our set of sentences as a whole was sensitive to developmental age and native fluency. A 2x2 ANOVA with native fluency (native vs. non-native) and developmental age (children vs. adults) was computed using the total scores on ASL-SRT (see Table 2). The results of the analysis revealed a main effect of native fluency ($M_{native} = 24.8, SD_{native} = 4.1; M_{non-native} = 18.3, SD_{non-native} = 7.2, F(1, 63) = 11.33, p = .001$), and of developmental age ($M_{children} = 21.7, SD_{children} = 6.2; M_{adults} = 25.3, SD_{adults} = 4.2, F(1, 63) = 5.10, p < .05$) without an interaction effect. The results reveal that the ASL-SRT is sensitive to differences in ASL fluency between native and non-native signers. It also distinguishes between children and adults (see Figure 4).
3.4. Item Reordering

The final goal of the ASL-SRT development is to rank order sentences according to their difficulty level, as being done in the TOAL3. We used only the data from the children native signers to determine item difficulty so that the test can begin with the easiest sentences and end with the most difficult ones. One motivating factor for not including deaf non-native signers is the possible discrepancy in developmental pattern. The psycholinguistic and sociolinguistic literature (e.g., Newport & Meier, 1985; Mayberry, 1994; Ross & Newport, 1996) has generally shown that deaf non-native signers appear to be less fluent than deaf native signers. Deaf non-native adult signers, although providing a wide range of skill level, may fail on some sentences because of their lack of native exposure rather than the true linguistic difficulty of the items. This discrepancy raises an issue as to whether the mistakes that non-native signers make are representative of the native user population, and for that reason non-native signers were ruled out. Deaf children who are native signers were the best candidates as their performance reflects native usage and yet they still exhibit a wide range of skill levels providing the necessary information to rank order the sentences.

The two raters’ mean total score of each item from the children native ASL signers’ data was used to establish the new ASL-SRT item order that is shown as a prototype model with 39 test sentences in Figure 5 on the right. Items were reordered from the items with the highest percentage correct to lowest. The two graphs on the left of the figure illustrate the total percentage correct for each item as scored by the two raters. Out of these 39, we will select a final set of 30 sentences that will be then checked again on a new sample of deaf signers.
Figure 5. Reordering of the ASL-SRT items based on the deaf children native signers’ data.

4. Discussion

The results presented here represent the first attempt in ranking test sentences for the ASL-SRT. One compelling reason for pursuing this route for measuring ASL proficiency is that the test is easy to administer and can be scored with robust inter-rater reliability and internal consistency by native signers with no linguistic background and minimal training. In its present format, it seems sensitive to differences between native and non-native ASL signers and captures the difference between children and adult deaf signers. However, the claims made here about the effects of hearing status, and developmental age of exposure on native ASL fluency need to be confirmed with a wider population. It will also be necessary to demonstrate the inter-rater reliability and internal consistency of the final version.

Ideally, the final version of the ASL-SRT will be optimized by including only the items that best predict native fluency in ASL and are most sensitive to age differences in language skills. Qualitative analyses of participant errors are currently being performed to determine whether there are some natural sign variations that should be permitted (e.g., weak hand drop). The analyses will also help the authors explore how the raters determined whether sign reproductions were correct or incorrect. This information will be used to develop a rater training manual for the final version of the test.

Validity testing will also be necessary to confirm that the ASL-SRT actually measures ASL competence. One way to illustrate a test’s validity is by investigating whether the test can discriminate between different groups of signers (discriminant validity) using similar methods as presented here. It will also be necessary to determine the test’s concurrent validity by demonstrating that the participants’ ASL-SRT scores positively correlate with another measure of ASL.
competence. Finally, separate normative samples will be collected from child and adult native and non-native deaf ASL signers. The final set of sentences will be tested on a large sample of deaf and hearing individuals to confirm the results described here.

The ASL-SRT is a global, objective ASL proficiency test that involves receptive and expressive skills in both children and adults. This test takes less than 30 minutes to administer and less than 30 minutes to score by deaf native signers with minimal training. Currently, the inter-rater reliability and internal consistency of the preliminary version of the ASL-SRT are already high. To shorten the administration time, we will reduce the number of items in the final version. We will also develop an administration and scoring manual to establish standardization, and will include specific rater training components that will hopefully also shorten the scoring time. Upon completion of the development project and psychometric studies, the ASL-SRT test will be available for researchers’ use for cross-study comparisons.

References


Acknowledgements

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1. Introduction

The verb system in sign languages traditionally depends on morphosyntactical criteria. Padden (1988) has divided verbs in ASL into three groups: simple verbs, spatial verbs and agreement verbs. Simple verbs do not inflect for person or number, but can inflect for aspect. Agreement verbs have a movement path and/or a change of hand orientation, which mark the subject and object in the signing space. The beginning point of the movement path or the back of the hand marks the subject, whereas the end point of the movement path or the fingertips and/or palm of the hand marks the object. In spatial verbs, the beginning and end points of the movement path do not, like agreement verbs, point to object and subject, but rather to topographical locations.

Agreement verbs are one of the most studied phenomena in the sign language literature. However, there have been no descriptions of verb agreement in Korean Sign Language (KSL), neither in the English nor in the Korean literature. The aim of this paper is to introduce, describe and classify the agreement verbs in KSL. My list of corpus-based KSL agreement verbs comprises almost one hundred entries (Hong in preparation). Compared with other sign languages, this is quite a large number and probably related to the fact that KSL agreement verbs very often involve a person classifier in the form of an extended thumb (or extended little finger, if the classifier is marked female) in the non-dominant hand. This person classifier represents in most cases the object argument and allows a wide range of articulation, as the dominant hand can relate to the person classifier in a wide variety of ways.

I will first describe background methodological matters of when, where and how the data was collected and define what I understand as an agreement verb. The main part of this paper will then focus on phonological and morphological features of agreement verbs in KSL.
2. Background

To explore the relatively unknown agreement verbs in KSL on an empirical basis, I am using data that were collected in Korea from July to October 2003 as well as in September 2005. More than 25 informants contributed to the data corpus, whereby there are different amounts of data from each informant. All informants are prelingually deaf and about half of the informants have deaf family members or deaf partners. Informants without deaf families learned KSL in school between the age of 6 and 13. At the time of the testing, the informants were 20 to 70 years old and 2/3 of them were under 40 years old. There are equal numbers of male and female informants.

The corpus consists of spontaneous conversation, of signing for didactical purposes, as well as elicited responses. The spontaneous conversation data involve at least two informants talking to each other about every day issues. The signing for didactical purposes are discourses prepared for a specific audience, e.g. sermons from a deaf pastor or short stories as teaching materials for KSL learners. This material is less spontaneous than the conversations, but doesn’t have any mis-signings. The elicited responses were to video clip and drawing stimuli especially made for this study. The video clips depict different actions viewed from various perspectives. The drawings and picture sequences were used to elicit agreement verbs in a variety of constructions. Very few agreement verbs were elicited by word lists. With the help of all the above methods, as well as various acceptability tests, that were used to confirm or refute some working hypotheses, a corpus of 21 hours of film material was collected. The data was transcribed with iLex (Hanke 2002), a tagging system combined with a lexicon and transcription database, which has been developed at the Institute of German Sign Language and Communication of the Deaf at the University of Hamburg.

3. Definition of agreement verbs

3.1. Two animate arguments

Agreement verbs in KSL always have two animate arguments. Padden’s list of agreement verbs in ASL (1988) shows only verbs, which have two animate arguments. Janis (1995) describes ASL agreement verbs in hierarchies of semantic relations and syntactical features and the arguments are labeled agent, patient and recipient, which implies that all arguments are animate. Meir describes agreement verbs in Israel Sign Language in Jackendoff’s framework as an event of transfer in which a concrete or abstract entity changes their owner.
As Meir points out, an owner is always animate. Rathmann & Mathur (2002) have analyzed the role of animacy in German Sign Language (DGS) and ASL and argue that there is a correlation between the morphosyntactical differences of agreement verbs and the animacy of their arguments. They differentiate between four verb groups:

- Verbs that appear **only** with two animate arguments;
- Verbs that appear with two animate arguments **or** with one animate argument and one inanimate concrete argument;
- Verbs that appear with two animate arguments **or** with one animate arguments and one inanimate abstract argument;
- Verbs that always appear with one animate argument **and** one inanimate argument.

The authors provide four tests to distinguish between these verb groups. In the first test, which applies only to DGS, they look at whether the verbs can appear with an auxiliary-like element called “Person Agreement Marker (PAM)” that is inserted to show agreement if a verb does not show agreement overtly. The second test checks if the verbs can be inflected for the “multiple” number which involves adding a horizontal arc to the verb root. The third test is whether the verb can cause the locus of an object to shift, as in the ASL sign GIVE-CUP which has an animate subject that causes the theme to shift its locus from one (source) place to another (goal), as described by Padden 1990. The last test looks at whether object agreement can be optionally omitted.

By applying these tests, the authors conclude in line with Janis (1992) that verb agreement marks the argument of the indirect object, which tends to be animate. Otherwise the verb agrees with an animate direct object. Following this approach only KSL verbs with at least two animate arguments can be candidates for agreement verbs.

### 3.2. Use of space

Agreement verbs and spatial verbs refer to established loci in space, but Padden (1988) and others have argued that spatial verbs use space topographically, and agreement verbs use space syntactically. Padden illustrates this difference by comparing two very similar ASL signs, the classifier verb CARRY-BY-HAND and the agreement verb GIVE. Both verbs have a movement path from one locus to another, but the two classes of verbs differ in their use of space. The signing space in CARRY-BY-HAND is analogous. The movement path can be modified to reflect the shape of the path, and changes in the initial or final location are
meaningful. In contrast, for GIVE the signing space is used in a discrete and abstract way. The movement path cannot be modified to reflect the form of the path, and changes in the initial or final location are interpreted as phonetic variants. That means that the end-points of the movement path represent abstract grammatical reference points.

KSL agreement verbs use space syntactically and therefore cannot have morphemes that specify the manner of motion, e.g. circling or zigzagging. But KSL agreement verbs can modify their movements for aspect such as durative or iterative (Padden 1990, Engberg-Pedersen 1993, Meir 1998, Mathur 2000).

3.3. Classifier handshape

Linguists such as Padden (1988) and Janis (1992) note that person agreement cannot co-occur with classifier morphology in ASL, with the implication that agreement verbs cannot have a classifier handshape. Meir (1998) found that this generalization does not hold for Israel Sign Language. She describes agreement verbs, which contain instrumental classifiers (for example, in the ISL signs for SHOOT-WITH-GUN, SPOON-FEED, and VIDEO-CAMERA.

I have found that KSL agreement verbs can also contain handshapes that are used in semantically related classifier verbs. Following the terminology of Langer (2005) and König, Konrad & Langer (in preparation) the handshapes are divided in substitutive and manipulative handshapes. A substitutive handshape stands for an object or a significant part of the object. It usually displays some of the features of the object's form. The location, orientation and movement of the substitutive handshape in the signing space correspond to the relative location, orientation and movement of the object in space. In KSL agreement verbs can have a substitutive handshape in the dominant as well as in the non-dominant hand in form of an extended thumb or a little finger. A manipulative hand stands for the hand of a person touching, holding or using an object or doing something else. The signer's movements demonstrate the actions of the person's hand. This includes but also goes beyond the typical handling classifiers.

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1 For a recent discussion of classifiers see Emmorey (2003).
2 Based on the works of Mandel (1977) and Johnston & Schembri (1996) the authors distinguish six so called image-producing techniques. These techniques help to determine the underlying image of iconic sign lexemes and the main criteria for this classification are the function of the handshapes and the movements in the production of the image. I will only use two of the six classes.
3.4. Direct and inverse forms

Authors such as Zeshan (2000) and Engberg-Pedersen (1993) have observed in their data, that agreement verbs with two non-first arguments occur very rarely.

"… in discourse that involves a number of different loci, very few clauses contain signs modified for more than one locus different from c. That is, even when signers talk about the interaction of two referents associated with two loci different from c at some point in the discourse, they rarely use both loci within a single clause" (Engberg-Pedersen 1993, 195).

This means that agreement verbs whose movement path would typically start at a locus left from the signer and end at a locus right from the signer and vice versa are more or less uncommon.

Instead, signers tend to take over the role of one of the arguments so that the path of the agreement verb moves from the signer (c) outwards in the direction of the non-first argument or from the locus of the non-first argument towards in the direction of the signer.

This is also true for KSL. Although the stimuli shows scenes in which a non-first person does something to another non-first person, informants described these scenes by using an agreement verb in which they were involved as one of the arguments.

Minoura & Ichida (2000) describe this phenomenon in Japanese Sign Language (JSL) as a kind of inversion, which is also known from examples from Algonquian spoken languages. The authors distinguish a direct and an inverse form of the JSL agreement verb. The direct form of an agreement verb contains a movement directed out from the signer and the inverse form shows a movement that is directed in towards the signer. Each time a verb has two non-first person arguments, the signer can choose between a direct and an inverse form. Minoura & Ichida argue that which form is to be taken is determined by topicality of the agent or patient (in contrast to Zeshan and Engberg-Pedersen, who claim that in such a case it is a matter of agentivity).

All KSL agreement verbs contain a direct and an inverse form. The agreement of a verb between two non-first arguments is not a criterion for an agreement verb. This point is different from Mathur’s theory (2000) in which the agreement between two non-first arguments is seen as a relevant principle.
4. Phonological Features

The phonological features pertinent to the description of KSL agreement verbs are the following: Direction of movement, facing, contact with the thumb, and body anchor.

4.1. Direction of Movement

Probably the most obvious feature of an agreement verb is the direction of the movement path. The movement usually begins from the locus of the subject argument and ends at the locus of the object argument. KSL agreement verbs like MAIL 메일보내다 (figure 1) and MISTRUST 의심하다 (figure 2) have such “forward” movement.

Figure 1: MAIL: 메일하다
Figure 2: MISTRUST 의심하다

Verbs like ENTICE 꼬시다 (figure 3) and HATE 미워하다 (figure 4) however seem to have a movement in the opposite direction, i.e. from the object locus to the subject locus. These are known as “backwards verbs” and have been at the center of debate regarding whether verb agreement in sign languages is best described in terms of semantic relations (source and goal) or in terms of syntactic relations (subject and object) (cf. among others the discussions in Janis 1992, Meir 1995, Brentari 1988).

Figure 3: ENTICE 꼬시다
Figure 4: HATE 미워하다

There are also KSL agreement verbs, which don’t have a movement path at all, such as the verb TEACH 가르치다 (figure 5) and INTERROGATE 심문하다 (figure 6). Verbs like
these are often called “orientated verbs”, since not their movement, but only the orientation of the hands mark subject and object argument. Most of the orientated verbs have internal hand/finger movements.

Figure 5: TEACH 가르치다
Figure 6: INTERROGATE 심문하다

4.2. Facing
Meir (1998) defines “facing” as the direction towards which the fingertips or palm are oriented in agreement verbs, as determined by the reference points assigned to the arguments of the verb. The fingertips and/or the palm of the hands can realize facing. For KSL agreement verbs, facing can also be realized by the back of the hand and the finger base orientation and there are even verbs whose facing cannot be captured by a concrete configuration.

Since very often facing in KSL involves more than one element, the following hierarchy for facing was formulated for this data:

\[ \text{Palm} \supset \text{fingertip(s)} \supset \text{finger base orientation} \supset \text{back of the hand} \supset \text{indeterminable} \]

The hierarchy starts with the most prominent element; if more than one element is involved, the element with the highest ranking is used to describe the facing. If facing were regarded purely phonetically, there would be six possible facing elements: fingertips, carpus, palm, back of the hand, ulna side of the hand and radius side of the hand. Since there are no verbs with a facing element, that involves either side of the hand or the carpus, these elements were left out.

Examples of KSL agreement verbs whose facing is realized by the palm of the hand are the verbs INJURE 해치다 (figure 7) and HELP 도와주다 (figure 8), in which the palm touches the person classifier in the non-dominant hand.
In the verbs APPLY 신청하다 (figure 9) and FEED 먹여주다 (figure 10), the fingertip(s) face the direction of the object argument.

The facing of the verbs BEAT 때리다 (figure 11) and GLARE 쳐려보다 (figure 12) is better described by the orientation of the finger base than of the fingertips. In BEAT 때리다, the fingertips are in the inside of the fist; in GLARE 쳐려보다 the fingers are bent and directed to the left from the signer.
A rather exceptional facing is the back of the hand as in SELL 팔다 (figure 13) and JOIN 동참하다 (figure 14). JOIN 동참하다 can also be signed without the extended thumb in the non-dominant hand. The non-dominant hand then doubles the dominant hand.

As mentioned earlier, there are KSL verbs, whose facing is very hard to describe. The change of hand orientation cannot be described as that of the palm, fingertips, finger base orientation or the back of the hand. But as one can see, verbs like INSULT 욕하다 (figure 15 and 16) and REPORT 고발하다 (figure 17 and 18) do have a change in their hand orientation.

In the direct form of the verb INSULT 욕하다 (figure 15), the index finger of the dominant hand touches the back of the thumb of the non-dominant hand. The palm is directed downwards and the finger base orientation and fingertips are directed to the left and the back of the hand is directed upwards. In the inverse form (figure 16), the fingertips and finger base orientation are still directed to the left but the dominant hand is rotated 180 degrees so that the palm is directed upwards and the back of the hand is directed downwards.
The easiest way to distinguish the direct and inverse form of this verb is not the facing, but the point of contact with the extended thumb. This also applies for the verb REPORT 고발하다. The dominant hand, which forms a fist and then changes in a two-finger handshape, touches the non-dominant hand’s back of the thumb for the direct form (figure 17) and the inside of the thumb for the inverse form (figure 18). Verbs like INSULT 욕하다 and REPORT 고발하다 can thus better be described by the feature “contact with the thumb”, which is discussed in the following section.

4.3. Contact with the thumb

This feature describes the contact between the dominant hand and the non-dominant hand, when the non-dominant hand is a person classifier. Similar to the agreement verb’s vertical height in the signing space, which is defined in the lexicon\(^3\), the contact with the thumb can be also seen as a part of the lexicon entry.

Some verbs like INSULT 욕하다 and REPORT 고발하다 have contact with the back of the thumb in the direct form and a contact with the inside of the thumb in the inverse form. But there are also verbs (for example, CONSOLE 위로하다 (figure 19) and ENTRUST 맡기다 (figure 20)) that, in both the direct and the inverse form, the palm has to have contact with the back of the hand. As agreement verbs with a thumb contact can have different kinds of facing, facing and contact with the thumb have to be considered separate phonological features in KSL.

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\(^3\) A different point of view on vertical height of agreement verbs is found in Liddell (2003).
4.4. Body anchor

Some agreement verbs in KSL have initial contact with, or are very close to, the body of the signer. There are two groups of body-anchored verbs in KSL. One group of verbs is always body-anchored. Verbs like ASK 질문하다 (figure 21) and CATCH_SIGHT 눈マンション (figure 22) cannot give up their initial contact with the face and always start with a body contact. The body contact is also present in the inverse form of these agreement verbs.

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4 The body-anchored verbs in the following pictures were signed by Kang-Suk Byun.
Body contact can be omitted in the verb COMMAND 명령하다, especially in the inverse form in order to perform the subject agreement, i.e. the verbs drop their body contact and start at the locus of the subject argument which is the non-first person (figure 23).

5. **Dominant Hand**

The dominant hand of the verb MANIPULATE 주입하다 (figure 24) represents a hand giving someone an injection and therefore can be classified as a manipulative handshape.

![Figure 24: MANIPULATE 주입하다](image)

This is also the case for the dominant hand of the verb FEED 먹여주다 2 (figure 25), where the dominant hand has a handshape used for holding a spoon. Verbs like FAX 팩스하다 (figure 26) and STAB 죽이다_칼로 (figure 27) have a substitutive handshape, i.e. the hand stands for the object or a significant part of the object. The dominant hand in the
verb FAX 팻하다 represents a sheet of paper, which comes through the fax machine and the dominant hand in STAB 죽이다_칼로 represents a knife.

There are also verbs, whose dominant hand doesn’t seem to have a connection to the meaning of the verb, such as the verbs ASK_FOR 부탁하다 (figure 28) or SUGGEST 건의하다 (figure 29). These handshapes are lexical and don’t have any apparent relationship to classifiers.

6. Non-dominant hand: person classifier

KSL agreement verbs often have an extended thumb or a little finger in the non-dominant hand. The extended thumb form, which can also be used as a pronoun is a general person classifier and refers equally well to males and females. Although this thumb handshape has also been reported to be a person classifier in Japanese Sign Language (Fischer, 1996), Danish Sign Language (Engberg-Pedersen, 1993) and Taiwanese Sign Language (Smith 1990), it is however used differently in KSL. Smith writes that in all agreement verbs of Taiwanese Sign Language, the general person classifier can be replaced by the female person classifier. This doesn’t seem to be true for KSL. Informants didn’t accept verbs like INVITE 초대하다 (figure 30) with a little finger instead of a thumb. In KSL, the female person
classifier is used much less frequently than the general person classifier. It is more a device to contrast or to emphasize the fact that the referent is female.

The behavior of the person classifier in KSL also has ramifications for how agreement verbs are best grouped in this language. Based on my analyses in this study, I suggest the use of person classifiers as a basic criterion for KSL agreement verbs. KSL agreement verbs can be divided into three groups: agreement verbs in which the person classifier is an integral part, agreement verbs which do not have a person classifier, and agreement verbs which can be signed with or without person classifiers.

6.1. Agreement verbs with a person classifier

More than one third of all KSL agreement verbs have an obligatory person classifier in the non-dominant hand. Some of these verbs like FLATTER 아부하다 (figure 31) and CONSOLE 위로하다 (figure 19) have a contact with the thumb, so it seems clear why the person classifier is obligatory. But there are also verbs like TAKE_ADVANTAGE 이용하다

Linguists have used many different approaches to make groupings of agreement verbs. Agreement verbs can be divided according to the direction of the movement path, i.e. if the movement goes from the locus of the subject argument to the object argument or in the opposite direction. Linguists like Padden (1988) and Brentari (1988) therefore distinguish normal agreement verbs and backwards agreement verbs. Meier (1982) calls them GIVE-type verbs and TAKE-type verbs. Bos (1993) calls them s-V-o and o-V-s verbs, Smith (1990) refers to them as S-O and O-S verbs, whereas Johnston (1991) uses the expression centrifugal and centripetal to avoid the subject object terminology. Some linguists (Johnston 1991 and Zeshan 2000) take into account if an agreement verb is fully directional or only limited directional. A further phonological criterion that has been considered is, if whether agreement verbs change their movement direction and/or their hand orientation (Fischer & Gough 1978, Kyle & Woll 1985, Zeshan 2000, Janis 1992 and Meir 1998). Fischer, Kollien & Weinmeister (2000), Johnston (1991) and Mathur (2001) have developed an even more phonological classification, which summarizes all the above points. Mathur also bears in mind that some agreement verbs are two-handed. It is also possible to group agreement verbs depending on their number of arguments (Smith 1990, Meir 1998, Engberg-Pedersen 1993, Brentari 1988). Supalla (1992, cited in Lam 2000) has even grouped agreement verbs depending on whether subject and object can be inflected for numerus. Meir (1998) and Erlenkamp (2000) see agreement verbs as a kind of transfer and they distinguish if an agreement verb transfers a concrete entity or an abstract entity.
and TEACH 가르치다 (figure 5) which do not have a contact with the thumb and still have to have the person classifier.

![Figure 31: FLATTER 아부하다](image1)

![Figure 32: TAKE_ADVANTAGE 이용하다](image2)

**6.2. Agreement verbs without a person classifier**

There are agreement verbs that cannot have a person classifier. The articulation of some of these verbs (such as CHATTER 수다떨다 (figure 33) or SUGGEST 건의하다 (figure 29)) involves two hands, so there is no hand free for the person classifier. But there is also the verb TAKE_NOT_SERIOUS 가볍게보다 (figure 34), which is articulated only with the dominant hand and therefore the non-dominant could articulate a person classifier, but this doesn’t occur.

![Figure 33: CHATTER 수다떨다](image3)

![Figure 34: NOT_TAKE_SERIOUS 가볍게보다](image4)

**6.3. Agreement verbs with an optional person classifier**

The last class of KSL agreement verbs can, but doesn’t have to, have a personal classifier. Examples of this class are GIVE_MONEY 돈주다 (figure 35) and SCOLD 아단치다 (figure 36). These verbs can be used with the person classifier, but the classifier can also be left out.
The interesting question is when does the person classifier appear and when not? While there is no simple answer to this question, one can say for certain that whether a classifier is used or not within an agreement verb is not a matter of present or absent referent. If the optional person classifier only appears when the referent is absent, then the inverse form of an agreement verb with a person classifier would not be possible. But the inverse form with a person classifier in the non-dominant hand like in SCOLD 야단치다 (figure 37) was found in the corpus. The thumb as person classifier is used in cases when the referent is available as well as in cases when the referent is not available. Therefore its role within agreement verbs cannot be related to the referent's/object's presence or absence.

6.4. Productivity of the person classifier

To investigate the role of the person classifier within the agreement verbs, selected agreement verbs with a (optional) person classifier were shown to the informants, who were then asked if it was possible to

1. use a number handshape instead of the extended thumb,
2. use the person classifier not as a object, but subject argument,
3. move the person classifier right after the agreement verb,
4. use the person classifier right before an agreement verb, and
5. use a two-legged person classifier within an agreement verb instead of the extended thumb.

Question 1 is a test of whether it is possible in KSL to replace the person classifier with a number handshape as seen in figure 38. Smith observed this phenomenon for Taiwan Sign Language, but the answers of the KSL informants made clear that this is not true for KSL.

![Figure 38: TEACH 가르치다 (with a number handshape)](image)

Question 2 asks if the person classifier can be used as a subject argument instead of the object argument. The KSL informants accepted all tested verbs. This result shows that person classifiers within agreement verbs can be handled quite flexibly and that their role is not limited to the object argument. Figure 39 shows one realization of question 2.

![Figure 39: SAY 말하다 (person classifier as a subject argument)](image)

Question 3 asks if the person classifier within the agreement verb could be used as productively as if it were a classifier outside of an agreement verb. The informants were shown how the person classifier moved away after the agreement verb was articulated. It is important, that there is no other sign between the articulation of the agreement verb and the moving classifier. Figure 40 and 41 show the verb BEAT 때리다 followed by the classifier moving forward like someone would run away after he or she has been scolded by someone else.
Question 4 asks if the person classifier could be used immediately before an agreement verb. Here again it is important that there is no other sign between the classifier, which is held in the neutral signing space, and the following articulation of the dominant hand for the agreement verb. Figure 42 and 43 illustrate question 4 with the verb SCOLD 야단치다.

The answers to questions 3 and 4 were all too inconsistent to make general statements about the role of the person classifier in the non-dominant hand. However, the inconsistent answers to these questions as well as the inconsistent use of the person classifier in the group of agreement verbs with an optional classifier might indicate that the person classifier within the agreement verb is still going through a diachronic development in which the combination of classifier and agreement verb is becoming more and more “frozen”. The flexible use of classifiers within agreement verbs could therefore be described as a kind of delexicalisation, in which the classifier is ‘revitalized’ (Johnston & Schembri 1999).

7. Summary

KSL agreement verbs can be best described by the following phonological features: movement direction, facing, contact to the thumb and body contact. The most striking characteristic of the agreement verbs are that more than half of all agreement verbs show a person classifier in the non-dominant hand. All agreement verbs can be grouped in respect to
their use of the person classifier. There are verbs whose person classifier in the non-dominant hand is obligatory, verbs that cannot have a person classifier and verbs for which the person classifier is optional.

Many linguists have tried to distinguish classifier verbs and agreement verbs from each other. Since classifier handshapes are an essential part of KSL agreement verbs (in the non-dominant hand as well as possibly in the dominant hand), this language might provide an opportunity for a novel way of looking at the previously strict division of the two verb classes.

**References**


Symmetry in Sign Language Haiku

Michiko Kaneko
Centre for Deaf Studies, University of Bristol

1. Introduction

Sign language poetry is the height of artistic signing. It is an unusual linguistic phenomenon in that the communicative purposes of the language can be overridden by the importance of the language itself. As Sutton-Spence (2000) points out, “the language used [in poetry] enhances --and may even take precedence over-- the message of the poem.” (80-81). Klima and Bellugi (1979) state: “What is special about verse in general is a highlighted awareness of linguistic phenomena as linguistic phenomena….Like art for art’s sake, language for language’s sake would be pure poetic function” (341).

As a result, various formal devices are used in sign language poetry in order to achieve poetic effect, such as manipulation of parameters (handshape, movement, and location), visual and temporal rhythm, eyegaze, and so forth. Among those devices is the issue of symmetry. Symmetry, the arrangement of two elements in symmetrical locations, is an essential aspect of poetic signing. Its primary function is to create aesthetic signing. It can also metaphorically represent abstract concepts such as harmony, balance, equality, and peace, or contrast and duality. Absence of symmetry also plays an important role in sign language poetry.

This paper deals with how poets make use of symmetrical signing in sign language poetry, and what kind of symbolism it carries. It will start with a general introduction to the concept of symmetry, followed by examples both in spoken and signed language poetry. The particular genre of signed poems which will be the focus of this paper is haiku, the shortest poetic genre in the world.

1 I would like to thank the Alumni Foundation of University of Bristol for their support on my presentation at TISLR 9. I am also grateful to Linda Day for her kind permission to use images from her poem. Rosaria and Giuseppe Giuranna gave me their permission to use images from the LIS haiku. Images from Jesus Marchan and Sam Sepah’s work are courtesy of PEN-International, National Technical Institute for the Deaf, Rochester, NY. These two poems are available on their website (http://www.pen.ntid.rit.edu/news.php). I thank Chris John for his technical support.
2. Symmetry

2.1. Definitions of symmetry, asymmetry and non-symmetry

It is conventional to open a philosophical account of symmetry by giving two kinds of definition: broad and narrow (Weyl 1952, Walser 1996). The Oxford Advanced Learners’ Dictionary presents a narrow definition: “the exact match in size and shape between two halves, parts or sides of something”. This geometric definition of symmetry, restricted to two-sidedness of an entity, is also called “bilateral symmetry”. Many objects in our life show such bilateral symmetry, varying from our own body structure to the shape of an aeroplane, from a tiny little crystal of a snowflake and to the enormous Taj Mahal.

On the other hand, symmetry in its broader sense is identified with the notions of balance, harmony, invariance and equality, and ultimately with beauty. This broader notion of symmetry is based on our understanding of something symmetric as orderly and pleasing. Symmetry represents a “created order, beauty and perfection” in our world (Weyl 1952: 5).

In relation to sign languages, I would like to loosely define symmetry as the arrangement of two elements which are located across a certain plane or axis. This notion of symmetry does not form a strict dichotomy of what is symmetric and what is not. It is rather a continuum. For example, two-handed signs are more symmetric than one-handed signs; two-handed signs at the same height are more symmetric than those at different heights; two-handed signs with the same handshapes are more symmetric than those with different handshapes (see Figure 1).

Figure 1: a) one-handed signing, b) two-handed signing at different locations, c) two-handed signing with different handshapes, and d) most symmetric two-handed sign

The antonym of symmetry is considered to be asymmetry. However, the notion of asymmetry presupposes the notion of symmetry. In other words, asymmetry is understood as incomplete symmetry. In poetry, asymmetry is often considered to be the poet’s deliberate breaking of symmetry. We need to distinguish asymmetry from non-symmetry, absence of symmetry without any (poetic) intention.
Intended asymmetry, or symmetry breaking, is an important feature of sign language poetry. Symmetry in poetic signing is so pervasive that its absence stands out as something marked. This related to Geoffrey Leech’s notion of obtrusive regularity and irregularity. Leech (1969) illustrates two ways that poetic language can be foregrounded: either the language is used in a deviant and marked way (obtrusive irregularity) or in “abnormally normal” (Sutton-Spence 2005) ways so that such normality becomes noticeable (obtrusive regularity). Symmetry in sign language poetry first stands out as regularly obtrusive (unusual perseverance of two-handedness). But then it reaches the stage where such symmetry becomes a norm. At this point, any breaking of such symmetrical signing demands considerable notice. I will give one example of such symmetry breaking later in this paper.

2.2. Symmetry in Language

The fact that symmetry can be narrowed down to the notion of geometry shows that symmetry has fundamental appeal to our vision. A symmetrical pattern is primarily visual, synoptic, and two-dimensional. It does not involve the concept of time. This poses a big challenge in creating symmetry in language, because language is time-bound and time is non-symmetric. It flows unidirectionally from past to future. People need to make an extra effort to stop this unidirectional flow of the language in order to achieve symmetry in language. For example, conscious and intense efforts are required to make good palindromes such as “ABLE WAS I ERE I SAW ELBA”, ironically attributed to Napoleon (Walser 1996).

Sign languages have a unique status, in that they are both spatial and time-bound. As with all languages, they follow a linear structure. But at the same time, the visual-manual modality of sign languages makes it possible to create spatial arrangements. This is the reason why symmetry is a popular and important feature of sign language poetry.

2.3. Symmetry in Poetry

There are two ways to achieve symmetry in poetry (both in spoken and signed languages): in repetitive patterns along the time line (temporal symmetry), and in the actual, visual configuration of a poem (spatial symmetry). Temporal symmetry is closely linked to the rhythmic structure of a poem, to rhyme, meter, and repetition of parts of the poem. William Blake’s Tyger, Tyger (also known as Fearful Symmetry) provides many examples of temporal symmetry².

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² To read the full text of this poem, go to [http://www.artofeurope.com/blake/bla2.htm](http://www.artofeurope.com/blake/bla2.htm).
In this poem, the first and the last stanza are identical except for one word\(^3\), with four inward stanzas being “sandwiched” by them. Nöth (1999) points out that there are certain kinds of identification between the second and fifth stanzas, and between the third and forth stanzas, which promotes symmetry across the middle point. The rhyme of this poem contributes to the regularity of this poem.

Whereas temporal symmetry, by definition, is bound to time, spatial symmetry involves visual representation of a poem. Although in many cases the configuration of written poems is insignificant, there are some examples where the shape of the poems has a meaning. George Herbert’s following poem is a good example:

```
Easter-wings

Lord, who createdst man in wealth and store,
     Though foolishly he lost the same,
      Decaying more and more,
       Till he became
        More poore:
          With thee
            O let me rise
             As larks, harmoniously,
              And sing this day thy victories:
               Then shall the fall further the flight in me.

      My tender age in sorrow did beginne:
       And still with sickness and shame
        Thou didst so punish sinne,
          That I became
            Most thinne.
              With thee
                Let me combine
                  And feel this day thy victories:
                    And feel this day thy victorie:
                      For, if I imp my wing on thine,
                        Affliction shall advance the flight in me.
```

George Herbert (1693)

This poem is written in a symmetrical configuration, and as a result it looks like a pair of wings. It also symbolically shows the process of fall and rise of a human soul by creating an X shape. In the first stanza the physical appearance of the poem is reduced while the poet recalls the process of losing, and with the words “More poore” it reaches the least stage. Then it will start

\(^3\) This is an example of symmetry breaking. The intentional mismatch of one word prevents identification of two stanzas and saves the poem from pretentious perfection.
increasing the number of words, as the poem proceeds talking about the wish to rise. As Hollander (1975) analyses, this visual configuration has a strong metaphor of “what goes up will come down” “what becomes less will be more”. Spatial symmetry in this poem is metaphorically connected to the poem’s theme.

Although Herbert’s poem is a good example, spatial symmetry in written language poetry is a rare phenomenon (remember the time-bound, linear nature of spoken languages). In sign language poetry, on the contrary, the poets need to make the most of visual representation including spatial symmetry. Section 4 in this paper focuses on the symmetrical patterns in sign languages.

3. Symmetry in Sign Languages

3.1. Inherent symmetry in sign languages

Before discussing symmetry in poetic signing, it is necessary to refer to symmetry in sign languages in general. The classic notion of symmetry was first introduced in sign language research by Battison (1974), when he proposed two related constraints:

(1) Symmetry Condition
   (a) If both hands of a sign move independently during its articulation, then
   (b) Both hands must be specified for the same location, the same handshape, the same movement (whether performed simultaneously or in alternation), and the specification for orientation must be either symmetrical or identical.

(2) Dominance Condition
   (a) If the hands of a two-handed sign do not share the same specification for handshape (i.e. they are different), then
   (b) One hand must be passive while the active hand articulates the movement, and
   (c) The specification of the passive handshape is restricted to be one of a small set: A, S, B, 5, G, C and O.

Napoli and Wu (2003) have replaced these two conditions with more detailed accounts of two-handed signs in ASL. Using The American Sign Language Handshape Dictionary as a database, they categorised signs into different types. The categorisation is made according to the types of symmetry (reflection, reflection with inversion, rotation, translation, glide reflection) and to the different types of axis/planes (vertical midsaggital plane, vertical wall plane, horizontal plane). They found out that the majority of signs are based on reflection, and that the vertical midsaggital plane is the overwhelming majority among three principle planes.

Similar attempts were made for BSL in Sutton-Spence and Kaneko (to appear) using The Dictionary of British Sign Language / English. They found that two-thirds of two-handed signs are symmetric, at least partially (i.e. some part of signs, such as handshapes, locations, movements, show symmetrical distribution). They also found that there are far more examples of symmetrical
signs based on vertical plane (which corresponds to Napoli dnWu’s “vertical midsaggital plane”) than the other two planes.

![Percentage of symmetrical signs across different planes in ASL (left) and BSL (right)](image)

Figure 2: Percentages of symmetrical signs across different planes in ASL (left), based on Napoli and Wu (2003) and BSL (right), based on Sutton-Spence and Kaneko (to appear)

### 3.2. Three planes

Three principle planes for symmetrical signs result in left-right, front-back and up-down symmetry. Figure 3 shows examples from each plane.

![Examples of symmetric signs (left-right, up-down, front-back) in poetry](image)

Figure 3: Examples of symmetric signs (left-right, up-down, front-back) in poetry

The main reason why left-right symmetry is more common than the other two is a matter of physiology. Up-down symmetry involves locating signs at different altitudes, which is less easy than left-right arrangement. Front-back symmetry requires twisting the wrists/elbows/shoulders, which is physically very demanding.\(^4\)

Additionally, left-right distinction has a unique status because our body is symmetric in this orientation only.\(^5\) This, for example, leads to the fact that it functions less frequently as a basis for

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\(^4\) This is why signers often rotate a sign up to 45 degrees off the centre (as in figure 3).

\(^5\) While most people do not have any problem in distinguishing up and down and front and back (e.g. when being told to look “up”, we can do so instantly, without ever giving a thought to it), quite a few people have a difficulty in telling right and left immediately.
orientational metaphors than other two directions. Orientational metaphors are one kind of metaphor which “gives a concept a spatial orientation (Lakoff and Johnson 1980, 14). They are based on our experience with the orientation of the body. Since the up-down and front-back orientations are asymmetric in nature, it is easier to attribute two opposing concepts to those two directions than to left-right (Ohori 2002). “Up” is universally associated with positive concepts, and “down” with negative concepts (“He cheered me up” “Don’t let me down”). Front-back orientation is usually associated with time (“I look forward to seeing you.” “Looking back upon the past…”).

In contrast, we have a limited number of orientational metaphors in left-right, and moreover, the association in those left-right metaphors is often arbitrary. For example, “right” tends to mean positive in Western cultures (“right” means “correct” or “true”, while “left” can be a synonym of “clumsy”)6, but in East Asian cultures, it is sometimes opposite. In traditional political systems in China the minister at the highest position is called “Left-Minister”, and so-called “Right-Minister” is placed one rank below. In other words, attribution of good and bad to right and left is a by-product of cultures.

To put it in a different way, left-right is a neutral direction free from any strong, presupposed attribution of concepts. This means that poets can use this direction freely, and possibly attribute their own meaning to left and right.

### 3.3. Symmetry in Sign Language Poetry

As mentioned in the introduction, the primary purpose of symmetric signing is to create aesthetic effects. Therefore, we can assume that the number of symmetrical signs increases in poetic signing (which uses artistic language) compared with daily signing. Russo, Giuranna, and Pizzuto (2001) have pointed out that the proportion of two-handed signs is higher in poetry compared with everyday conversation. In their study, two-handed signs occupied 49% of poetic signing but only 21% of non-poetic signing (106). This shows that symmetric arrangement of two-handed signs is especially important in poetic signing.

As in spoken language poetry, sign language poetry has both temporal and spatial symmetry, although, unlike in spoken/written poetry, the latter becomes as common as the former.

Temporal symmetry in signed poems is represented by the rhythmic patterns in signing. Blondel and Miller (2001) describe the rhythmic repetition of long and short movements in nursery rhymes in LSF (French Sign Language) and show the symmetry across the middle stanza.

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6 The main logic for this is that most people are right-handed, and therefore something done by right hand is likely to be regarded as proper.
Sutton-Spence and Kaneko (to appear) provide examples of spatial symmetry. For instance, a BSL poem *Staircase* by Dorothy Miles makes considerable use of left and right symmetry. It describes the way a group of people who encounter a huge staircase manage to climb up to the top of it, being led by one man.\(^7\) When people gather and proceed along their way, Miles uses two-handed symmetric signs to show the progress. First, one person from each side moves ahead (an index finger extended), then two (index and middle fingers extended), and then many (3-4-5 handshapes). The increase in number is symmetrically represented by both hands. This spatial symmetry not only adds beauty to the singing, but also metaphorically represents “the togetherness and collective nature of the Deaf community” (Sutton-Spence and Kaneko, to appear).

4. Symmetry in Sign Language Haiku

For the remainder of this paper, I will focus on the symmetry in sign language “haiku” poems. Haiku originated in spoken/written Japanese, and is considered to be the shortest form of poetry in the world. Accordingly, sign language haiku can be defined as a very short piece of poetic signing\(^8\). Because of its concise nature, poetic devices in signed haiku are arranged very effectively and in an elaborated way, which provides useful observations when analysing its poetics.

4.1. Haiku

Haiku originated in medieval Japan. Traditional Japanese haiku consists of 17 syllables. The purpose of haiku is to create maximum effect based on minimum number of words, and the best way to achieve this is to present a simple and vivid image that triggers vast imagination in the reader’s mind. In this sense, a good haiku is analogous to a good photograph. Topics of haiku are often visual sketches of nature.

Since when Dorothy Miles first introduced the concept of haiku into sign language poetry in 1970s, haiku has become very popular among Deaf poets\(^9\). Many poets and researchers have agreed that sign language is “an ideal vehicle” (Sutton-Spence 2005: 163) for haiku, or vice versa. As Klima and Bellugi (1979) point out, “The particular compression and rich imaginary of haiku seem especially suited to sign language” (350).

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\(^7\) It represents a story of the first Deaf students who completed a British university course in sign language with the help of a Deaf tutor.

\(^8\) Although there are many other ways to describe haiku in sign languages.

\(^9\) There are haiku competitions organised in the US, Japan and in the UK.
4.2. Symmetry in haiku

Symmetry plays an important role in traditional haiku, both in form and in theme. Classic Japanese haiku poems consist of seventeen syllables, divided by 5-7-5 sections, which shows perfect symmetry. There are so-called “broken” haiku poems which have either one more or fewer syllable, but even those irregular poems prefer symmetric patterns such as 5-8-5 or 5-6-5 to patterns like 4-7-5, so that their irregularity does not stand out (Mukai 2000).

In terms of theme, haiku often presents a symmetrical sketch of a natural scene to create vivid impression. For example:

Nanohanaya tsukiwahigashini hiwanishini (Yosa Buson¹⁰)
Yellow flowers; Moon on the east; Sun on the west.

Akizorawo futatsuni tateri shiitaiju (Takahama Kyoshi)
Autumn sky; divided into two; by a big chinquapin tree.

A symmetrical sketch is an effective way to create vivid visual contrast that appeals to the readers’ mind. There are many examples of visual contrast in traditional haiku. Sign language haiku combines this tradition of “symmetrical sketch” in Japanese haiku with its own capability of symmetrical signing, and fully embraces the poetic effects of symmetry.

4.3. Case studies


There are many objects and natural phenomena in our world that show symmetrical patterns. As Weyl (1952) points out, one of the functions of symmetry is to reproduce the existing order in our world. Sign languages, being visual-spatial languages, are capable of faithfully reproducing such symmetrical order in the language. With the help of aesthetic symmetry, such simple reproduction of natural phenomena by itself can be a piece of poetic signing. This is especially important in sign language haiku, in which a simple description of nature is highly regarded.

The BSL haiku poem Eclipse, composed and performed by Linda Day, provides an illustration of a solar eclipse using left-right symmetrical signs, each of which represents the sun and the moon. The effect of symmetry in this poem is highlighted by the gradual approach of sun and moon, represented by identical (but reversed) movement of two hands toward the vertical

¹⁰ As convention, names of the Japanese haiku poets in this paper are written in Japanese name order (surname first).
midsaggital plane. The height of this movement is when the two circles overlap and become one (see Figure 4).

Day successfully “miniaturises” the phenomenon of solar eclipse into the signing space, while faithfully preserving the main characteristics (such as movements, locations and the shapes of the sun and the moon). There is a direct one-to-one mapping between the elements in the actual eclipse and those in signing (circular handshapes represent the shapes of actual planets, movements of hands are movements of the sun and the moon, the locations of two hands are the locations of two planets).

The simplicity and the vividness of symmetrical representations in this poem best fit the characteristics of haiku.


This poem is composed and performed by the Italian Deaf poet Rosaria Giuranna. It describes a process of two people coming together, holding each other, and being separated at the end. Giuranna in this poem makes considerable use of symmetry and asymmetry. First of all, she creates temporal symmetry in the structure of the poem. For example, she uses the same handshape, location, and (reversed) movement for signs at the beginning and the end of the poem (a closed fist with extended thumb, moving toward/away from the centre). Between these initial and final signs come signs with B-handshape (an open hand with fingers together), which are signed in a smaller scale at the centre of the signing space. This arrangement of signs creates a “sandwich” effect, which is a good example of temporal symmetry.

In terms of spatial symmetry, all signs are created based on perfect bilateral symmetry. Throughout the poem, both hands have the same handshape, movement, and location. This feature contributes to unification and aesthetic effect of this poem.

On the other hand, there are certain elements which are not symmetric in this poem. For example, although she uses the same signs at the beginning and the end of the poem, the speed of signing is completely different. While the initial movements are slow and gradual, the final
movement is abrupt and instantaneous. This might metaphorically represents the fact that we normally take some time to get to know other people whereas separation can come suddenly.

Another asymmetric feature is facial expression. Giuranna’s face changes according to the development of her poem, but the pattern is not symmetric. The initial neutral expression is followed by smile while two hands are held closely, and then by negative facial expressions when two hands move apart. The pattern does not follow the “sandwich arrangement” of the manual components, representing the irreversibility of a human encounter.

In this ten-second haiku poem, Giuranna manages to show the essence of human interaction. Her use of symmetry helps create depth in her performance.

![Figure 5: Symmetry in sequence from Giuranna’s LIS Haiku](image)

### 4.3.3. *Cornfield* by **Sam Sepah**

This is a haiku poem created by Sam Sepah in ASL. No title is given, but I call it *Cornfield* for convenience’s sake. The English translation of the poem is:

Playing hide-and-seek  
Chased into the cornfield  
Our first kiss¹¹

(translation by PEN International)

Unlike Giuranna’s poem above, there is no consistent use of symmetrical signs in this poem. However, the last two signs show good examples of front-back symmetrical signs and they add considerable poetic effect to the poem. The first sign iconically expresses two people’s encounter, as if they are looking at each other in the mirror. The second sign expresses the kissing of the two (Figure 6). The axis for these two signs is slightly oblique against the body.

¹¹ Used by permission of PEN-International, National Technical Institute for the Deaf, Rochester, NY. PEN-International is funded by a grant from The Nippon Foundation of Japan.
Up to this point, the poet uses numerous lexical signs in rather a busy manner (fast signing speed, involving various movements and perspective shifts). However, when these symmetrical signs are introduced, the poet reduces the speed of signing to attract attention. By doing so, the poet maximally highlights the beauty of the two symmetrical signs.

The kissing scene is the climax of this poem. The vividness of this scene is best represented by the use of front-back symmetry. Symmetry also highlights the mutuality of the kiss (not “I kissed her” or “she kissed me” but “we kissed”). It looks as if they are spontaneously pulled together with equal and gradual speed, which contributes to a heart-warming afterglow of the poem.

4.3.4. *Fish* by Jesus Marchan

The last example is another ASL haiku by Jesus Marchan, which I call *Fish*.

Fish swim eagerly
In a mad dash for the prize
Only to be hooked\(^2\)
(translation by PEN International)

Throughout the poem both hands are active in the signing space. Six out of ten segments involve bilateral symmetry. Considering that other four are instantaneous movements, symmetrical signing commands most of the poem. In most cases, the handshapes of the two hands are the same, and both hands move in perfect mirror-image across the vertical midsaggital plane. This continuation of symmetric signs adds an aesthetic sense to this poem.

However, symmetry in this poem is not just for the sake of beauty. It is deeply related to the theme of the poem, that is, the fish’s freedom and its loss. Jesus Marchan uses his two

\(^2\) Used by permission of PEN-International, National Technical Institute for the Deaf, Rochester, NY. PEN-International is funded by a grant from The Nippon Foundation of Japan.
hands (and the fact that we only have two hands) to show this theme. At the beginning, he establishes a link between “free swimming” and a symmetric figure-of-eight movement created by both hands (see Figure 7). In other words, in this particular poem the sign for swimming has to be two-handed. Throughout the first half of this poem, this two-handed signing associated with free swimming successfully continues.

![Figure 7: Two-handed sign FISH-SWIM](image)

Then, a “prize” (or a “hook” in reality) comes into the picture. In order to express this third element, the poet has to give up the perfect symmetry of two-handed signing. He uses his left hand to refer to the existence of the prize/hook (Figure 8), but by doing so, he destroys the balance of two-handed swimming which has been kept intact till that moment (the right hand remains inactive while the left hand is engaged in “hook” expression, which may symbolise the fact that one hand alone cannot express the act of swimming). The scene when prize/hook first comes into the poem is the scene when asymmetry is first introduced to the poem, and also, it is the scene of a warning toward the forthcoming loss of free swimming in this poem. In fact, the moment the fish reaches out to grab the prize (Figure 8), the balance is lost forever and there is no symmetry beyond this point. The last sign of this poem, a “flapping” movement signed only with right hand, is an attempt to re-create free swimming, which is extremely imperfect as two-handed symmetry is already lost.

This is not simply a poem about fish that is hooked by a trap. It tells us about the innocence of a free fish, which is only highlighted by its loss. The symmetry of two-handed swimming symbolises perfection, balance, and satisfaction of the fish as a free swimmer. The symmetry breaking in the end shows incompleteness, and sudden loss of freedom.

![Figure 8: Asymmetrical signs in Fish](image)
5. **Summary**

As I have described in this paper, symmetry is an important feature of sign language poetry, both as an aesthetic tool and for its symbolic function. Successful poems can connect the formal beauty of symmetrical elements with their theme. Sign languages, being visual-spatial languages, can apply the notion of symmetry more directly to the poetic language than spoken/written languages can. The elaborated use of symmetrical signs contributes to the overall effect of poetic signing.

**References**


1. Abstract

The objective of this article is to present aspects of the phonological acquisition of Brazilian Sign Language (LIBRAS), making use of principles from Dependence Phonology for the description of hand configuration (HC), location (L) and movement (M) acquisition.

It is presupposed that in the sign phonology acquisition, a child initially possesses a basic representational structure composed only of non-marked features, what constitutes the nucleus (head) in the representation of the Dependence Phonology. This basic representation involving only nuclear constitutive makes the initial phonological inventory be formed by the location and the hand configuration units. The movement is not considered primitive, but the result of the specification of locations, hand configurations and/or hand orientations.

In the phase of phonological acquisition, a child operates with basic nuclear representation units by mapping his/her whole production from such representation. As acquisition takes place, the other features are specified. The specification marked features appear gradually and are expressed in the dependent nodes (complements and specifiers).

In the present article, I present results obtained from a longitudinal investigation made with a deaf child, from 8 months (0;8) to 2 years and 6 months old (2;6), whose parents and sisters are deaf. All of them use LIBRAS.

2. Dependence Phonology in Sign Languages

Dependence Phonology supplies a basis for the analysis of the different aspects of the signs - location, movement and hand configurations – such as the model represented in (01) below for the phonological representation.

1 The present article presents the data findings from my doctorate thesis (Karnopp, 1999), which had already been partially published in the article “Directions in Sign Language Acquisition”, edited by Gary Morgan and Bencie Woll (2002).
The representation in (01) shows that location, hand configuration and movement are in a nucleus-dependent relation, more specifically, the location is the nucleus of the structure, while Movement and Hand Configurations are dependent.

The movement is analysed as the result of the specification of the two settings, in which the use of the two settings specifies the beginning and the end of the direction movement. This brings about arguments to justify the establishment of the two settings, being the directional movement just a consequence.

**(02) Representation of the Directional Movements**

In Figure (02), the letters “a” and “b” are specifications for initial and final locations. Straight, circle and arc correspond to the mode of how the movement can be made from the
specifications of the settings. For this reason the movement is considered as the specification of the different locations, in case of directional movements. In reference to the other types of movements, for instance, the internal movement of the hand, they may be reduced to changes in the opening of fingers or in hand orientation.

For the hand configuration representation, the present approach uses the model named "One over all and all over one", proposed by Brentari, Hulst, Kooij and Sandler (unpublished manuscript), from now on referred as BHKS. Another version of this model was further researched by Kooij (2002).

(03) Model for the representation of Hand Configuration (BHKS):

An important distinction of hand configuration features lies between feature for selection (choice and number) of fingers, which are used to execute the sign, and features for the configuration or specific position of fingers (type and degree of flexion, spreading or non-spreading, in relation to the thumb). In the model, finger selection and finger configuration are represented under the hand configuration node. Selected fingers are elements with nucleus property and finger configurations are elements with dependence properties (BHKS, p.1).
The uses of models (02) and (03) served as basis for the description of the phonological acquisition of LIBRAS.

3. Studies on the Phonological Acquisition of Brazilian Sign Language

Boyès-Braem (1973/1990), McIntire (1977), Siedlecki e Bonvillian (1993), Bonvillian e Siedlecky (1996, 1997), Marentette (1995) present some studies which describe and discuss the acquisition and development of the American Sign Language phonology. These studies were made with children users of ASL and they concentrated on some aspects of the phonological development, being hand configuration the aspect that received more attention.

Karnopp (1994) described in a transversal study of LIBRAS the acquisition of the hand configurations of four deaf children, whose parents were also deaf. The children’s ages ranged from 2;8 to 5;9. The present study reports the investigations made by Karnopp (1999).

4. Phonological Acquisition of Brazilian Sign Language – Methodological Aspects

Important information in relation to the methodology refers to the informant and to the linguistic production context. The results here presented consist of data obtained from the signs made by a deaf child whose name is Ana. She was born to deaf parents and has two deaf sisters. Ana's whole family make use of Brazilian Sign Language (LIBRAS), a fact that gives her input. The filming sessions started when Ana was eight months, covering the period between 8 months and 30 months, especially because this phase is very meaningful for sign acquisition and includes the appearance of the first productions. The data collecting sessions lasted around 30 minutes each and most of time were shot in Ana's parents' house. The goal was to film different situations of spontaneous everyday communication in which Ana was interacting with her parents and sisters and making use of toys, drawings, house objects, food, children's books and copybooks, and objects belonging to the informant or to the family. The data resulted in a series of filming sessions in places where Ana strolled.

The filming sessions sought to privilege Ana’s different routines in order to obtain data in reference to the vocabulary being used by her. All productions selected for the transcription, description and data analysis were produced in spontaneous situations. Those productions which were considered imitation were dismissed.
All the video tapes (in a total of 29 video tapes lasting from 30' to 40' each) were transcribed by the author of this research, interpreter of LIBRAS. Doubtful cases were discussed with the informant's parents.

Ana's productions were included in two distinct databases: one which comprehended only signs and the other which included manual actions. The database containing manual actions was named PRO-GESTOS (gestures production) and was used for the transcription of productions referring to the pre-linguistic period. On the other hand, the database including signs - abbreviated here as AQUI-LIBRAS (LIBRAS acquisition) - used the scheme of phonetic transcription (SignPhon, 1996)\(^2\) with the objective of detailing the linguistic production period and specifying the units constituting the signs.

The informal observation of the interaction between Ana and adults showed that a fundamental aspect is how the parents search for emphasising the importance of visual contact between the interlocutors. The parents use signs with special characteristics to attract Ana’s attention: for example, they overact facial expressions, repeat signs and make slower and wider movements. Ana seems to appreciate this kind of communication and stares at her parents’ faces.

The study identified social gestures, manual babbling and pointing as the first productions that precede sign articulation.

The follow-up on the acquisition and development of Ana’s sign language identified that she initially produced manual babbling, social gestures, such as sending kisses and signing good-bye, besides pointing to objects or people around her. Next, she started to produce one-sign utterances, and at age 1;6 she started to combine signs forming simple sentences. Table (01) shows information as to the number of signs produced and the increase.

<table>
<thead>
<tr>
<th>Age</th>
<th>Nr. of signs produced (types)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0;11</td>
<td>02</td>
</tr>
<tr>
<td>1;1</td>
<td>04</td>
</tr>
<tr>
<td>1;5</td>
<td>12</td>
</tr>
<tr>
<td>1;9</td>
<td>28</td>
</tr>
<tr>
<td>2;1</td>
<td>49</td>
</tr>
</tbody>
</table>

Thus, Ana produced 176 types of signs in 288 occurrences (tokens). The signs were produced in contexts of a sign utterance or contexts of one, two or more sign utterances. The findings indicated that from the 288 occurrences, 200 were taken from the production of utterances of two or more signs and 88 occurrences were taken from a one-sign utterance.

In order to identify the phonological acquisition of LIBRAS, Karnopp (1999) uses three empirical indications, which are:

- One approach was to determine the order of hand configuration, locations and movements which first appeared;
- The second consisted of calculating how often each unit appeared in the child’s sign lexicon;
- The third was to determine how accurately each of the different HC, M and L were produced, and whether there were any changes in production accuracy and complexity with the increasing of age or vocabulary size.

5. **Hand Configuration Acquisition**

Hand Configuration acquisition was analysed through the model ‘One over All and All over One’ (BHKS), previously referred to.

The results show that the Hand Configurations appearing more frequently in Ana’s system were also those that were produced earlier, that is, hand configurations that involved the selection of one or all the fingers without the specifications for finger configurations, for instance:

Table (02) shows the description of the acquisition of features at the initial position of the sign.

<table>
<thead>
<tr>
<th>Years; months</th>
<th>Hand configuration Type</th>
<th>What is acquired?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0;11</td>
<td></td>
<td>[Selected Finger: One/(All)]</td>
</tr>
</tbody>
</table>
Ana produced initially the opposition [one] and [all], in which only the nucleus node of the finger selected was activated. The phonological representation of these contrastive hand configurations involves the presence or the absence of [one]. Data from the ASL of hand configuration (Siedlecki and Bonvillian, 1997) also register the same type of opposition [one] and [all] in this initial period.

At age 1;1 the node finger configuration started to appear in the signs. A new feature adduction [adducted] was also added to the base form [all], besides the extending of the thumb. At age 1;5, the feature ‘opening’ appeared sub the Finger Configuration node. BHKS propose that the productions of the flexed forms result from the distinction applied to the opening node. Another feature of Ana’s development refers to the flex node of the joints. Ana presents the following development in relation to flexion:

<table>
<thead>
<tr>
<th>Age</th>
<th>Description</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1;1</td>
<td>[Adduction: adducted]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Thumb: selected]</td>
<td></td>
</tr>
<tr>
<td>1;5</td>
<td>[Aperture: closed] in [All]</td>
<td></td>
</tr>
<tr>
<td>1;7</td>
<td>[Aperture: open] in [All]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Aperture: closed] in [All]</td>
<td></td>
</tr>
<tr>
<td>2;0</td>
<td>[Flexion: flex; basis] in [One]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Flexion: flex; basis] in [All]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[Selected Finger: 1°] (Side: ulnar)</td>
<td></td>
</tr>
</tbody>
</table>
At the age of two, Ana began using the ulnar side of the hand, a feature which is linked the node of Selected Fingers. From there on, no new features were produced; thus, the Hand Configurations produced are clearly the combination of features which are already part of the phonological system, and are combinations resulting from nodes [adduction], [opening] and [selection of joints], in reference to Selected Fingers [All/One]. In other words, at the age of two, Ana produced all the nuclear and dependent features forecasted in the BHKS model, making the production of different hand configurations and of different signs possible, according to adult standards.

We can conclude from the description presented that the nucleus is acquired at the initial period, followed by the acquisition of Complements and Specifiers. Thus, the Complements cannot be acquired before the Nucleus. The Specifiers, in their turn, cannot be acquired before the Complements either. Thus, the components structure is construed from downwards to upwards in Ana’s acquisition:

1. Nucleus
2. Nucleus + Complement
3. Specifier + [Nucleus + Complement].

Reviewing the most frequent hand configurations types at the initial position of the signs in Ana’s repertoire, it is clear that the HC produced by Ana are inter-linguistically non-marked.

It is supposed that some hand configurations which were not produced during the data collection period were produced after the investigation period. Nevertheless, Ana’s system presented all the features forecast by BHKS’s model ‘One over All and All over One’.
6. Location Acquisition

The intention at this section is to describe the order of location appearance, occurrence frequency and the precision of Ana’s location production. In order to investigate such aspects, 176 types of signs, produced during the filming sessions, were selected in 288 occurrences. Considering the classification proposed in the literature, a location demonstrative was done in relation to the main area and in relation to the subspaces relative to the position in the sign structure; e.g., if the sign was produced at the nose, the area was recorded (body and the subspace – nose – of that sign).

According to the demonstration made, Ana presented indexes between 96% to 100% in the production of location in all sign positions.

The production of locations is grouped according to age and divided in main areas and subspaces. From the grouping, the feature of location acquisition was described.

<table>
<thead>
<tr>
<th>Age</th>
<th>Area</th>
<th>What is acquired?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0;11</td>
<td>Body Space</td>
<td>[nose], [mouth] [eye]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[peripheral], [ipsilateral], [high], [medium],</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[region of head], [above head region], [front side], [medium]</td>
</tr>
<tr>
<td>1;6</td>
<td>Body Space</td>
<td>[chin], [chick] [face]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[centre], [low], [backside]</td>
</tr>
<tr>
<td>2;1</td>
<td>Body Space</td>
<td>[lip], [fronthead], [neck], [head side]</td>
</tr>
<tr>
<td></td>
<td>Related to the body</td>
<td>[contralateral]</td>
</tr>
<tr>
<td></td>
<td>Non-dominant hand</td>
<td>[head x] [trunk x]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[hand palm]</td>
</tr>
</tbody>
</table>

The first locations were produced only in the body area and the neutral space. At 1;6 new features in the head area and the neutral space started to be produced. The locations related to the body or at the non-dominant hand were produced only at 2;1 years-old. The first sign related to the body were produced in a point near the head and also near the trunk. In the body, besides the
locations in the head area, locations started to be produced near the neck. In the neutral space, the production of locations at the contra-lateral side of the vertical plan occurred.

The results showed that in the acquisition of locations in LIBRAS there is a tuning between the three pieces of evidence used – the order of appearance, the frequency and the accuracy of production. The first locations produced were also those which presented the biggest number of occurrences and, in relation to accuracy, the results evidenced an invariable aspect: high precision at the correct production in all the environments (initial, final and in the non-dominant hand). At last, we can state that the locations in the main areas were produced (according to the frequency of occurrence) in the following sequence: in the neutral space (63%), in the body and related to the body (35%) and in the non-dominant hand (2%).

7. Movement Acquisition

The approach used in this article followed the proposal of the No-Movement Theory of Hulst (1993, 1995), Kooij (1997) and Bless, Crasborn, Hulst and Kooij (1996), which considers movement as a location change, an orientation or a hand configuration change. The transcription system proposed by these authors perceives movement as the result of the specification of two locations, e.g., two points in the body region or the neutral space. In a similar way, the movement can be the result of specifications of two (or more) hand configurations or orientations.

The movement which occurs from the specification of the locations is called movement of direction, and can be articulated in various ways: straight, circular, and iconic, among others. The movement which occurs from the shape specifications or hand orientations is named internal hand movement. In this sense, the types of changes at the hand configuration include the forms opening, closing, clawing, hinging, wiggling, waving, rubbing, scissoring. The movement resulting from the specification of the hand orientation includes changes in the hand palm orientation, and/or finger orientation.

The movement acquisition showed that Ana achieved moderate precision in the production of hand directional and internal movement, with the frequent use of a small group of possibilities. Ana did not show a strong separation between directional and internal movement; e.g., she replaced directional movement for internal one. Directional movements were also inserted in the place of internal movements. No structural principle which motivated such substitutions was observed. The three pieces of evidence used in the demonstrative data and in the movement acquisition setting phases suggest, however, that there is a gradation in relation to the complexity in the acquisition of
the movement manner, being the production of the initial movement of the straight type, resulting from specification of two different orientations or hand configurations.

8. Conclusion

Following recent work in the language acquisition area, the approach used in this research sought to describe the phonological acquisition of Brazilian Sign Language. In the hand actions description, we sought to investigate the productions which preceded the signs and, this way, social gestures, manual babbling and pointing were identified as Ana’s first hand productions.

Results also showed that the first signs were produced at the age of 11 months. The sequence presented in Ana’s linguistic production, during the period investigated, included announcements of a sign, of two signs (often a combination of sign and pointing) and simple sentences.

A comparison made between LIBRAS and ASL is related to the precision in the initial phonological production. In LIBRAS (Karnopp, 1999) and in ASL (Siedlecki e Bonvillian, 1993; Marentette, 1995), location was the first aspect to be produced in a precise way (having adult production as the basis); the movement was produced in a less precise way than locations; and hand configuration was the last aspect to be produced with precision. The observation of the phonological development showed that, with time, there was a greater variety of phoneme production and the articulation tended to be more precise.

Investigations in relation to the HS parameters recorded the following results:

(a) Ana produced 20 different types of HS which involved the combination of features under the Finger Selected node and/or Finger Configuration.

(b) Ana acquired at 30 months all the features forecast by BHKS’s model “One over all and all over one”. This means that the nuclear constitutive of the HC representation (Selected Fingers) are acquired in the initial period and that the dependent constitutive [Finger Configuration] are acquired afterwards and based on the first.

The description of location acquisition showed that, from 0;11 to 2;0 years old, the locations were produced in the body area (nose, mouth and eye) and in the neutral space. From 2;1 years old locations started to be produced in areas which presented relation with the body, and locations in the area of the non-dominant hand.

The locations which involved main locations and salient contrasts (in the neuter space and in the head region) were acquired initially. The typically acquired locations in later phases involved the non-dominant hand or areas which required more detailed distinctions in the articulation.
Hulst suggests that locations are produced with high precision because they are central constituents in the lexical organization of signs, and, therefore, information in relation to location may take on the main role in the child’s initial phonology.

The description of the movement acquisition showed that Ana achieved moderate precision in the production of the directional and internal movement of the hand, with the frequent use of a small group of possibilities. The demonstrative data suggest that in movement acquisition there is a gradation in relation to the complexity in the acquisition of the movement manner, even the internal movement of the hand, being the production of the internal movement of the hand of the straight kind, resulting from the specification of two different hand orientations or shapes.

Thus, concerning the phonological acquisition, the evidence – order, frequency and accuracy of formation aspects production – show that:

(a) As to the HC unit, the nucleus is Selected Fingers [one/all], and the dependent is Finger Configuration. The order of acquisition is Nucleus, Complements and Specifiers.
(b) As to the location parameter, the nucleus of representation is the main area and the dependent are the subspaces in which the signs are articulated.
(c) In the process of phonological acquisition, nuclear features were acquired in a precise and frequent way, and were those which appeared initially in the child’s production, being the dependent features, in some contexts, substituted and acquired after the production of nuclear features.

This way, Brazilian Sign Language acquisition data show that in the initial phase of the linguistic development, the child operates with a basic representation of nuclear constitutive, mapping all his/her production with that representation, and as acquisition takes place, input evidence, visual perception and motor development make the child specify the other features which were present in the initial representation. That specification happens gradually and is represented as a dependent constitutive.
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Sign Language Biological Motion Perception
Perception of sign language and human actions

Heather Patterson Knapp, Hansang Cho, and David P. Corina
University of Washington

Abstract
This study compares linguistic and non-linguistic biological motion perception in two populations: deaf signers of American Sign Language (ASL) and hearing, non-signing speakers of English. When observing point light displays of ASL signs and goal-directed, non-linguistic human actions embedded in visual noise, deaf signers were found to be equivalently sensitive to the presence of signs and actions, whereas hearing non-signers showed less sensitivity to the presence of signs, relative to actions. This difference is likely rooted in deaf signers’ lifelong experience with sign language motion. These data are discussed in relation to visual expertise, visual action perception, and properties of sign language motion.

Keywords: sign language, deafness, visual perception, motion perception, biological motion, human action, point light, linguistic, expertise

1. Perception of sign language and human actions
For Deaf individuals who use a visual-manual language as their primary form of communication, the successful perception of different types of human action is vital. Most routinely-encountered human actions are intransitive and non-communicative (e.g., slight postural adjustments, locomotion), many involve interactions with objects (e.g., turning on a lamp, lifting a pen to paper), and still others are conventionally, but not linguistically, communicative (e.g., shoulder shrugs, hand waving). A fourth type of biological motion is the abstract linguistic movement associated with signed languages of the Deaf. En route to understanding the communicative intent of a signed utterance, a signer must perceive that human action is occurring in her environment, distinguish sign actions from other kinds of human movements that are co-occurring, and map these sign language actions to linguistic action patterns stored in memory. It is largely unknown how the
perception, parsing, and mapping of linguistic movements proceed on a cognitive or neural level. In this paper we describe preliminary steps that we took to understand the first stages of sign perception. Our goal was to learn whether Deaf signers are sensitive to the mere presence of biological motions that appear in a cluttered visual scene, and whether their sensitivity varies as a function of the type of motion being perceived.

People require remarkably few cues to detect human movement. For example, it has long been known that small white lights placed externally on body joints or facial muscles of a person standing in a dark room appear to be a meaningless jumble of stationary dots until the person wearing them begins to move. Almost immediately, these context-free “point light” cues (as developed by Johansson, 1973, 1976) are sufficient to allow for the rapid identification of not only a particular type of human action (Johansson, 1973; Dittrich, 1993), but sometimes even the gender (Kozlowski & Cutting, 1977), individual identity (Cutting & Kozlowski, 1977), or emotional state (Atkinson, Dittrich, Gemmell, & Young, 2004; Dittrich, Troschianko, Lea, & Morgan, 1996; Pollick, Paterson, Bruderlin, & Sanford, 2001) of the point light actor (PLA). Additionally, it is known that deaf signers show sensitivity to linguistic properties of sign languages conveyed by PLA (Poizner, 1983; Poizner, Bellugi, & Lutes-Driscoll, 1981)\(^1\).

The ability to perceive particular human actions so readily may be a result of our extensive experience viewing and/or performing them. For example, upright point light walkers are recognized more frequently and accurately than upside-down walkers (Bertenthal & Pinto, 1994; Pavlova & Sokolov, 2000; Sumi, 1984), as are biologically possible vs. impossible gaits (Jacobs, Pinto, and Shiffrar, 2004). Similarly, the ability to identify individual point light walkers by their gait (Beardsworth & Buckner, 1981; Cutting & Kozlowski, 1977) is correlated with an observer’s experience with viewing a particular walker (Jacobs, Pinto, & Shiffrar, 2004). Within the domain of sign language perception, it is known that formational constraints that constitute one part of the grammatical foundation of signed languages (for reviews, see Emmorey, 2002; Klima & Bellugi, 1979), have consequences for linguistic point light biological motion processing. Specifically, movement dimensions underlying some morphologically-complex linguistic contrasts in ASL, such as repetition and cyclicity, are more salient to deaf signers than non-contrastive dimensions, such as direction (Poizner, 1983).

While greater visual sensitivity to motion as a function of action expertise has been demonstrated within action domains (e.g., locomotion), much less is known about the comparative saliency of human actions across domains, or of how action experience interacts with cross-domain

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\(^1\) It is important to note that without prior exposure to corresponding full-signal signs, the individual identities of point light signs are not readily apparent, even to experienced signers.
saliency. Our goal in the present study was to learn whether signers are more or less sensitive to sign language motion than to another common type of human movement: goal-directed actions performed on objects. In a Yes/No discrimination task, we presented signers with human point light movements—signs or non-linguistic actions situated within visual noise—and asked whether they detect human movement. We measured detection sensitivities across noise levels. In order to learn the extent to which any sensitivity differences are due to experience with these types of actions, we compare the performances of native deaf signers with that of hearing non-signers. Moreover, because it is possible that deaf signers and hearing non-signers, as populations, have differential visual motion processing abilities (see for example Bosworth & Dobkins, 2002; Loke & Song, 1991) we matched signers and non-signers for sensitivity to object-oriented actions prior to comparing their differential sensitivity to actions and signs.

Because we know of no other studies comparing sensitivity to human actions across biologically-plausible movement classes, we do not have specific predictions regarding the directionality of any differential processing of sign and non-linguistic action. However, given the great deal of exposure that signers get to this type of motion, we do hypothesize that linguistic motions will be at least as salient as non-linguistic human actions. Moreover, if experience is a primary driver of sensitivity effects, we expect that signers’ absolute ASL sensitivity will surpass that of non-signers.

2. Materials and methods

2.1. Participants

Participants were seven pre-lingually deaf Gallaudet University students who acquired ASL from birth as their native language, and continue to use it as their primary and preferred language (mean age 20.2 years, range 18 to 21 years, 5 female, 2 male), and seven hearing University of Washington students with no knowledge of a signed language (mean age 20.6 years, range 19 to 22, 6 female, 1 male). These 14 participants were chosen from a larger population of 22 participants (9 deaf and 13 hearing) with non-linguistic biological motion sensitivity scores of 1.0 or greater, and were selected for analysis because pair-wise, their d’ scores matched most closely (see Appendix 1 for the d’ scores for the matched deaf/hearing participant pairs). These participants’ non-linguistic biological motion sensitivity scores were representative of the populations from which they were

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2 Because we are interested only in perceptual differences and not in overt recognition, we do not ask participants to identify either the category or identity of the action shown to them.

3 Sensitivity to non-linguistic point light motion was assessed by calculating signal detection indices \[d' = z (hit rate) – z (false alarm rate)\], by participant, for the experimental trials in which non-linguistic human action was present (n = 70 trials per participant).
drawn (Mean d’ for selected deaf participants = 2.06, SD = .552, drawn from a larger group with Mean d’ of 1.92, SD = .583; Mean d’ for selected hearing participants = 2.04, SD = .46, drawn from a larger group with Mean d’ of 2.19, SD = .682). All University of Washington and Gallaudet University IRB guidelines were adhered to during testing.

2.2. Stimuli

**Stimuli were created by attaching a total of ten small, white “grain of wheat” lights to the head, torso, and upper limb joints (pairwise: shoulders, elbows, wrists, index fingers) of a deaf, fluent signer of ASL and videotaping him in a dark room while he signed single ASL signs and performed single, goal-directed, non-linguistic actions (Figure 1). Signs were 10 common ASL nouns, and non-linguistic movements were 10 common transitive, goal-directed actions (see Appendix 2 for a list of signs and actions produced by the signer). Objects were present during the production of non-linguistic actions to aid the actor in producing natural-looking movements, but were not illuminated and thus were not visible to the participants. Recordings were digitized using Media 100 (Version 5) digital video editing software and were combined with varying levels of white noise to create two-second video clips containing from 75 to 300 randomly-moving white dots. Random dots were generated from a grain of wheat light template using Microsoft DirectX, in conjunction with Visual C++. Dot sizes and speeds were chosen to subjectively match the size and speeds of the grain of wheat lights. The overall impression was of a field of smoothly, continuously moving lights that individually changed direction over time.

Procedure

2.3. Practice

Prior to testing, participants were familiarized with point light renderings of the action displays, half of which were signs and half of which were non-linguistic actions. They first viewed single trials of the PLA in the absence of noise, situated in three screen positions utilized during testing: left, right, and center. Once comfortable with the appearance and placement of biological motion stimuli, participants viewed the PLA in increasingly greater levels of white noise. They were given the opportunity to indicate on each practice trial whether they could discern the presence of the PLA.

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4 Each individual noise dot was approximately 11 x 11 pixels in size. Dots moved in one- or two-step increments in one of 16 directions per frame, at a displacement rate of 0 to 18 pixels/frame (at 30 frames/second). Dot position was thus correlated from frame to frame, and subjectively yielded an impression of local dot motion that was similar to the human figure. Dots moving off the screen were replaced, such that the number of random dots on the screen remained constant at any point in time.
Feedback was provided, and the practice continued until participants reported being comfortable with the procedure. This entailed the viewing of approximately 12 practice trials. At no point was any participant asked to categorize or identify the type of motion seen, nor did any participant indicate that he/she recognized a sign or action, either at a class or identity level.

2.4. Testing

During testing, all participants viewed 210 trials, ten at each noise level (n = 7) and stimulus type (n = 3: action, sign, and nothing) combination. Trials were randomized across noise level and stimulus type, then fixed. The human point light figure was present on 2/3 of the trials (1/3 each for signs and non-linguistic actions); noise-only was present on 1/3 of trials. When present, the PLA appeared equally often on either the right, the left, or in the center of the screen. Participants were instructed to watch each video clip for entire duration of the trial, and to indicate whether they observed “human motion” within the visual noise. They were asked to answer in the affirmative only if they were certain, and to do so by marking “yes” or “no” on a response sheet. Importantly, participants were not told that they might see different types of human motion (i.e., signs or non-linguistic actions), nor were they asked to identify the type of movement observed.

3. Results

To assess sensitivity to linguistic and non-linguistic point light biological motion as a function of noise level and hearing status, we calculated a signal detection sensitivity index \[d' = z (\text{hit rate}) - z (\text{false alarm rate})\] for each participant (n = 14) at each stimulus type (sign or mime) and noise level (75, 100, 125, 150, 200, 250, 300) combination, as suggested by Macmillan & Creelman (1991, p. 275). To assess differences in sensitivity between these groups, stimuli, and noise levels, we conducted a 2 (Group: deaf or hearing) x 2 (Stimulus type: sign or action) x 7 (Noise level: 75, 100, 125, 150, 200, 250, or 300) mixed-model repeated measures analysis of variance (ANOVA) on the means of these d’ scores.

We observed main effects of noise level and stimulus type, and an interaction between stimulus type and participant group. (1) Noise level: Participants’ sensitivity to both classes of point light biological motions decreased with increasing amounts of background white noise \[F(6, 72 = 17.69, MSe = .342, p < .0001)\]. (2) Stimulus type: Across groups, participants were more sensitive to non-linguistic actions than to sign \[F(1,12 = 11.01, MSe = .203, p = .006)\]. (3) Interactions: We observed an interaction between hearing status and stimulus type that bordered on statistical reliability \[F(1,12) = 4.04, MSe = .203, p = .068\]. Across noise levels, deaf signers
appear equally sensitive to ASL signs and transitive actions, whereas hearing non-signers appeared more sensitive to transitive actions than to ASL signs (Figures 2 and 3). Note that this pattern is consistent across six of seven noise levels\(^5\).

Figure 2 here

Figure 3 here

To further explore this interaction pattern between hearing status and stimulus type, and in light of our primary interest in signal processing differences between sign and non-linguistic actions in deaf vs. hearing, we conducted two planned comparison, paired-samples t-tests on the means of deaf signers’ and hearing non-signers’ action and sign scores (\(M_{\text{deaf ACTION}}\) vs. \(M_{\text{deaf SIGN}}\) and \(M_{\text{hearing ACTION}}\) vs. \(M_{\text{hearing SIGN}}\)). These tests confirmed that deaf signers and hearing non-signers showed different patterns of sensitivity to linguistic and non-linguistic point light biological motion. Specifically, deaf signers were equivalently sensitive to ASL signs and transitive actions [mean (Action – Sign) \(d'\) difference score = .085, SD = .214, \(t(6) = 1.055, p = .332\)], whereas hearing non-signers demonstrated a reduction in their sensitivity to linguistic movement, relative to non-linguistic actions [mean (Action – Sign) \(d'\) difference score = .3436, SD = .325, \(t(6) = 2.80, p = .031\)]. Additionally, a final paired samples t-test (\(M_{\text{deaf SIGN}}\) vs. \(M_{\text{hearing SIGN}}\)) confirmed our inference that deaf signers were more sensitive to ASL stimuli than were hearing non-signers [mean Deaf Sign Sensitivity - Hearing Sign Sensitivity \(d'\) difference score = .247, SD = .242, \(t(6) = 2.70, p = .036\)] (Figure 4).

Figure 4 here

4. Discussion

The goal of this study was to compare the relative visual discriminability of two types of socially-relevant human movement—sign language signs and object-oriented actions, among a population with extensive experience with both types of movement—deaf signers of ASL. Typically, humans have visual experience with relatively similar types and quantities of human actions, be they

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\(^5\) Only at noise level 150 does this pattern deviate. At this level, paradoxically, hearing non-signers appear more sensitive to signs than non-signs, and signers appear more sensitive to non-signs than signs. While this is puzzling, we can find no systematic experimental or analysis explanation that warrants exclusion of this noise level from further analysis. However, we do note that omitting the noise level from the omnibus ANOVA yields a significant hearing status by stimulus type interaction (\(p < 0.01\)), and decreases each already-significant paired comparison p-values (.031 and .039) to .009.
locomotive, gestural, or object-oriented movements. Native signers are additionally exposed from birth to a steady stream of actions from a fourth class: sign language signs—actions with which no other population can claim any significant experience. This study takes first steps to learn whether signers find sign language biological movement patterns to be as visually salient as other types of goal-directed human motion, treating the relative sensitivities of hearing non-signers as a comparison baseline.

We have two main findings. First, signers are equally facile at detecting the presence of ASL signs and object-oriented, non-linguistic actions embedded in visual noise. Second, non-signers are significantly less sensitive to the presence of ASL signs than to non-linguistic actions. We conceptualize these findings as an enhancement in the ability of deaf signers to perceive linguistic biological motion in noise, relative to the baseline evidenced by hearing non-signers. Interestingly, lifelong experience with ASL did not promote signers’ sensitivity to sign language motion above that of transitive, object-directed actions. Rather, it enabled sign perception to reach the same discrimination maximum as non-linguistic actions.

Signs are subject to a number of formational constraints that govern the instantiation of their movement, including the size and shape of signing space, the speed with which signs are articulated (Emmorey & Corina, 1990), and the relationship between movements of the two hands (Battison, 1978). It may be the case the conventionalized and circumscribed paths that are characteristic of these linguistic movements are less salient than other types of goal-directed human actions. Experience with this motion type, however, appears to offset the modest yet consistent perceptual disadvantage resulting from these signal differences.

Linguistically rule-governed movements may be tacitly more salient to signers because they are representative of movement patterns with which signers have significant experience, or because the constraints themselves can serve as familiarity indices to the visual system—a familiarity that stops short of aiding outright recognition but that manifests as heightened sensitivity, relative to the baseline of hearing non-signers. Importantly, participants in the present study were blind to the classes of motion that may have been present on any given trial, and indeed were unaware of the existence or identity of different types of movements seen throughout the study. It is therefore unlikely that either deaf or hearing participants engaged in any deliberate processing that aided their recognition of the presence of human actions in noise.

Converging evidence in favor of the hypothesis that sign language experience is a primary contributor to the heightened sensitivity of deaf signers to point light ASL signs is that enhanced

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6 To experimentally control for all physical differences between sign and action would be to remove the very signal properties that distinguish these two classes of movement, and would thus be counter-productive to our goals.
processing of familiar actions is not limited to signs. As discussed above, visual and motoric familiarity with the orientation of the action performed by a PLA has been shown to promote movement perception in hearing subjects with no sign language experience (e.g., Bertenthal & Pinto, 1994; Pavlova & Sokolov, 2000; Sumi, 1984), a finding that Shipley (2003) demonstrates to be rooted in familiarity with the orientation of the event itself (i.e., walking) rather than the object performing the event (i.e., the human body). Similarly, biologically possible movements are more readily perceived than impossible movements (Jacobs, Pinto, and Shiffrar, 2004).

Two major classes of action recognition theories have been proposed to account for humans’ tremendous sensitivity to a variety of classes of human movements: those that claim that this sensitivity is rooted predominantly in visual perceptual experience, and those that claim that it is rooted in a correspondence between humans’ visual systems and motor systems, such that actions are better recognized when we are familiar with the experience of producing them (for a review and a series of empirical studies teasing apart these proposals, see Jacobs, Pinto, and Shiffrar, 2004). These proposals are not mutually exclusive and are each consistent with the findings presented here. Certainly, deaf signers have extensive experience both viewing and performing sign language movements.

A related view in psycholinguistics is that the perception and production of spoken language gestures have common origins, such that the perception of speech is predicated on our own experiences with producing similar speech movements (Liberman, 1996). Similarly, evidence from the macaque neurophysiology literature suggests a tight coupling between the perception of goal-directed actions produced by others and the production of experience with similar actions made by others (e.g., Decety, 2002; Rizzolatti, Fadiga, Fogassi, & Gallese, 2002). It is probable that signers’ perception and recognition of sign language movements are mediated in part by highly-specialized extensions of these more fundamental system linking human action perception and production (see Corina & Knapp, in press, for a discussion of the overlap between networks mediating sign language perception and production, and action observation and execution).

5. Conclusion

In sum, this study of biological motion perception in deaf signers and hearing non-signers suggests that, when matched for non-linguistic biological motion sensitivity, deaf signers show equal abilities to discriminate sign and non-linguistic actions from visual noise, while hearing non-singers are significantly impaired with sign language movement sensitivity. The differential performance of hearing non-signers may reflect fundamental differences between movement attributes of
linguistic and non-linguistic classes of human motion, whereas the equivalent performance of deaf signers further speaks to the importance of having experience with a particular class of action in order to optimally perceive its production in others.

**References**


**Figure Captions**

Fig 1. Still video clips of a deaf signer producing signs and non-linguistic goal-directed actions in a dark room while wearing 10 grain-of-wheat lights on his forehead, upper body, and arm joints. Panel A: The signer producing the ASL sign NAME, in the absence of visual noise. Panels B, C: The same image embedded in 75 (Panel B) and 300 (Panel C) randomly moving “white noise” dots.

Fig 2. Mean sensitivity of deaf signers of ASL to point light actions and ASL signs.

Fig 3. Mean sensitivity of hearing non-signers to point light actions and ASL signs.

Fig 4. Mean sensitivity of deaf and hearing participants to non-linguistic and signing movements, collapsed across white noise levels.

Appendix 1. Participants were selected from a larger population because their sensitivity scores to non-linguistic biological motion were well-matched. Participant sensitivity scores were computed from all experimental trials in which non-linguistic human action was present (n = 70 trials per participant).

Appendix 2. American Sign Language signs and non-linguistic, object-directed actions produced by a deaf, signing actor. The first half of each of these are one-handed actions; the second half are two-handed actions. Non-linguistic actions were produced with the indicated object.

**Acknowledgements**

We thank research assistants Susan McBurney for assisting with sign and action selection, Nat Wilson for serving as our point light model, and Theron Parker and Melissa Thomas for assisting with data collection at Gallaudet University and the University of Washington, respectively. This project was sponsored by NIH/NIDCD F31 DC006796-01 to HPK and NIH/NIDCD R29-DC03099 to DPC.
The Danish Sign Language dictionary project aims at creating an electronic dictionary of the basic vocabulary of Danish Sign Language. One of many issues in compiling the dictionary has been to analyse the status of mouth patterns in Danish Sign Language and, consequently, to decide at which level mouth patterns should be described in the dictionary: That is either at the entry level or at the meaning level.

1. Mouth patterns in Danish Sign Language

Mouth patterns in Danish Sign Language comprise two different kinds of mouthings¹ (mouth patterns derived from spoken language) and two kinds of mouth gestures (mouth patterns with no relation to the surrounding spoken language).

1.1. Mouthings

1.1.1. Imitations of Danish equivalents of the sign

Some signs in Danish Sign Language can be or must be accompanied by one or more mouthings of the Danish equivalents of the sign:

The sign DRENG has two semantically related meanings: ‘boy’ and ‘son’

The manual part of DRENG has two possible mouth patterns: either /dreng/² ‘boy’ (figure 1) or /søn/ ‘son’ (figure 2).

¹ The issues of a clear terminology in the area of mouth patterns is still to be solved. In this paper we use the terminology chosen by Rachel Sutton-Spence and Penny Boyes Braem in The Hands and the Head of the Mouth (2001) p 2-3
² We use phonemic slashes around Danish phonemes that represent either a Danish word imitated in the mouthing or the sound that is imitated in the mouth gesture.
The mouth imitates the Danish equivalent of the sign that has the same semantic content. It is not a demand that the mouth exactly reflects the pronunciation of the equivalent.

1.1.2. Imitations of Danish words not equivalent to the sign

Some signs can or must be accompanied by a mouthing imitating a Danish word that is not (anymore) an equivalent to the sign:

The sign STJÆLE ‘steal’ (figure 3) has the mouthing /tyv/ that imitates the Danish word tyv ‘thief’, but the sign do not carry the meaning ‘thief’.

In a dictionary of Danish Sign Language from 1907³ the sign STJÆLE has two meanings: ‘steal’ and ‘thief’, and even though the sign has lost one of it’s meanings over the last 100 years, the mouthing imitating the lost meaning ‘thief’ must still accompany the sign.

³ Jørgensen, Johs. (ed.), De døvstummes Haandalfabet og 280 af de almindeligste Tegn [The Handalphabet of the Deaf and Dumband 280 of the most common sign]
1.2. Mouth gestures

1.2.1. Imitations of sounds that do not constitute Danish words

Some signs are accompanied by a mouth gesture which can be described as a sound, using the Danish phonetics, but which does not relate to any Danish word. The sign GAVN ‘great’, ‘advantage’ (figure 4) has a mouthing that can be described as an imitation of the sound sequence /tøp/, using Danish phonemes:

![Figure 4: GAVN/tøp/](image)

While producing the manual part of the sign GAVN, the mouth imitates the sound sequence /tøp/, which does not constitute a Danish word.

In our research we have found 35 different mouth patterns of this kind. They are listed in table 1. They are all described using Danish phonemes.

| /æds/ | /blabla/ | /if/ | /ord/ |
| /aj/ | /bo/ | /im/ | /paf/ |
| /ar/ | /bom/ | /jar/ | /søf/ |
| /årh/ | /bombom/ | /lala/ | /tata/ |
| /bæd/ | /bus/ | /m/ | /tøp/ |
| /bar/ | /do/ | /o/ | /væd/ |
| /bi/ | /faw/ | /øde/ | /vasvas/ |
| /bif/ | /fi/ | /øf/ | /y/ |
| /bip/ | /i/ | /oij/ |

Table 1: The inventory of mouth gestures that do not imitate Danish words, but can be described using Danish phonemes

4 ø is a Danish rounded front vowel that is the rounded counterpart to [e] in IPA’s alphabet
1.2.2. **Mouth patterns with no relation to Danish Language**

Finally signs can be accompanied by mouth patterns that can not be analyzed as imitating neither sounds nor words from Danish. They can not be described by Danish phonemes, but must have a description in prose of the exact movements made in the mouth area.

As producing the manual part of the sign EKSISTENS meaning ‘existence’, ’possession’ and ‘location’(figure 5), the mouth performs a quick side to side movement of the tongue.

![Figure 5: EKSISTENS](a quick side to side movement of the tongue)

In our research we have found 18 different mouth patterns of this kind. They are listed in table 2.

<table>
<thead>
<tr>
<th>&lt; bite one’s tongue &gt;</th>
<th>&lt; lick one’s lips &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; munch &gt;</td>
<td>&lt; pout &gt;</td>
</tr>
<tr>
<td>&lt; nothing &gt;</td>
<td>&lt; tongue expands the cheek &gt;</td>
</tr>
<tr>
<td>&lt; chattering teeth &gt;</td>
<td>&lt; tongue out &gt;</td>
</tr>
<tr>
<td>&lt; short puff of air &gt;</td>
<td>&lt; tip of tongue out &gt;</td>
</tr>
<tr>
<td>&lt; long puff of air &gt;</td>
<td>&lt; a quick back and forth movement of the tongue &gt;</td>
</tr>
<tr>
<td>&lt; puffy cheeks &gt;</td>
<td>&lt; a quick up and down movement of the tongue &gt;</td>
</tr>
<tr>
<td>&lt; puffy cheek &gt;</td>
<td>&lt; a quick side to side movement of the tongue &gt;</td>
</tr>
<tr>
<td>&lt; puffy lower jaw &gt;</td>
<td>&lt; vibrating lips &gt;</td>
</tr>
</tbody>
</table>

**Table 2: The inventory of mouth gestures that can not be described by Danish phonemes**

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5 We use brackets around descriptions of the mouth gesture that can not be described by Danish phonemes
2. Dealing with mouth patterns in the dictionary

Lemmatisation in the Danish Sign Language dictionary is based partly on meaning, partly on phonological shape:

- Semantically, we make a synchronous semantic analysis of the meanings covered by a sign, allowing only related meanings and transparent figurative uses to occur together in one entry.
- Phonologically, two forms that differ in their manual features are described as two entries, except for variants which we define as forms with identical semantic content with manual variation in no more than one of the categories number of hands, handshape, orientation, location, and movement (with the exception of repetition). Consequently, signs with the same meaning and with variation in two categories will be split into two entries and described as two synonymous signs.

Mouth patterns are an integral part of Danish Sign Language and must be described in a Danish Sign Language Dictionary. One possibility is to classify mouth patterns as part of the phonological description, located on the dictionary entry level, and allowing for variation within this category. Another possibility is to locate the mouth pattern description at the meaning level.

Some of the signs in Danish Sign Language has more than one possible mouth pattern that can be regarded as free variation that do not contribute to the meaning of the sign. The sign MASSER-AF meaning ‘many’ can be accompanied by four different mouth patterns: two mouthings: /mange/ ‘many’ (figure 6) and /masser/ ‘lots [of]’ (figure 7) and two mouth gestures: /i/ (figure 8) and <long puff of air> (figure 9).

![Figure 6: MASSER-AF/mange/](image6.png)  ![Figure 7: MASSER-AF/masser/](image7.png)
If mouth patterns in the dictionary were described as part of the phonological description, signs like MASSER-AF would according to our phonological principles for lemmatising have one entry with four variants – each with different mouth pattern but all with the same manual part of the sign. If mouth patterns were to be described at the meaning level, the sign would have one variant and one meaning with four possible mouth patterns.

The manual part of the sign HUS ‘house’ has many possible mouthings, all imitating Danish equivalents:
/hus/ ‘house’
/bolig/ ‘home’
/villa/ ‘villa’
/ejendom/ ‘property’
/hytte/ ‘cottage’
/hal/ ‘hall’
/klinik/ ‘clinic’

If mouth patterns were described as a part of the phonological description, signs like HUS would be split into seven different signs. If, however, mouth patterns were described at the meaning level, the sign HUS would be treated as one sign.

Some signs have different mouth patterns due to the fact that the two languages have different ways to separate concepts in real life. The sign HISTORIE (figure 10) means ‘real or made up story’. Danish has at least 20 different words for this meaning, all of them meaning ‘story’, but each individually or in synonym pairs covering a part of the concept, e.g.: vittighed and vits ‘joke’, novelle ‘short story’, roman ‘novel’, historie meaning both ‘history’ and ‘story’ etc.
Danish Sign Language has one sign covering the complete concept. There are – at least – eleven different mouth pattern for this sign, all mouthings of Danish words.

If mouth patterns were described as a part of the phonological description, signs like HISTORIE would be split into eleven different signs. If, however, mouth patterns were described at the meaning level, the sign HISTORIE would be treated as one sign.

Other signs in Danish Sign Language have different mouth patterns that contribute to the meaning of the sign. The sign OMTALE (figure 11-13) meaning both ‘slander’ and ‘subject of conversation’ can be accompanied by at least three mouth patterns, one mouthing: /omtale/ ‘subject of conversation’ (figure 11) and two mouth gestures: <long puff of air> (figure 12) and <tongue out> (figure 13). The meaning of the sign changes depending on the changes in the mouth pattern accompanying the sign. Thus, /omtale/ and <long puff of air> accompany the meaning ‘subject of conversation’, and <tongue out> accompany the meaning ‘slander’.
If mouth patterns were included as part of the phonological description, a sign like OMTALE would be split into two entries: OMTALE is polysemous according to our semantic principles for lemmatising, and the phonological principles only allow signs that differ in one phonological feature to be treated as two variants of the same sign if the two variants are identical in their semantic content. One of the two entries would have two variants, the other would have one variant. If mouth patterns were described at the meaning level, the sign OMTALE would formally have one articulation, as the variation is exclusively non-manual. Hence the sign OMTALE would be treated as one sign with two meanings, one having two possible mouth patterns, the other having one possible mouth pattern.

The Danish Sign Language dictionary project has established a group of deaf consultants – all native signers. The group consists of 0.5% of the deaf community in Denmark. The consultants consider both HISTORIE as one sign and OMTALE as one sign.

We have decided to locate the description of mouth patterns at the meaning level, thus obtaining the possibility of describing these without being forced to add new entries to the dictionary in cases like OMTALE and HISTORIE. Consequently, an entry in the Danish Sign Language dictionary is phonologically established solely by the headword’s manual expression, that is with no reference to oral (or other non-manual) features.

Some signs that have more than one Danish equivalent can not be accompanied by all the Danish equivalents. For example, the manual part of the sign BAGVED ‘behind [in schedule/ in sports etc.]’ may be translated into two Danish synonyms: bagefter or bagud, but the sign can only be accompanied by the mouthing /bagud/, not the mouthing */bagefter/. The dictionary aims to show which Danish words the individual signs can be accompanied by. Every Danish equivalent is marked in case the imitation of the equivalent is an acceptable mouthing accompanying the sign.
References:

Jørgensen, Johs. (ed.). *De døvstummes Haandalfabet og 280 af de almindeligste Tegn [The Handalphabet of the Deaf and Dumb and 280 of the most common sign]*. Copenhagen, 1907.

The Danish Sign Language Dictionary project
Centre for Sign Language and Sign Supported Communication - KC
Kastelsvej 60
2100 København Ø
Denmark

Jette Kristoffersen  email: jk@kc.dk
Janne Boye Niemelä  email: jbn@kc.dk
In this paper, I overview aspects of sign language acquisition studies conducted over the past twenty years, and speculate on the future of such studies. Rather than a chronological overview, I have organized the research into five themes, according to some of the goals of these works. These themes are as follows.

1) Exploring the parallels between sign and spoken language acquisition. In this category I include a variety of studies which show that sign language acquisition takes a similar path as spoken language acquisition, under comparable input conditions (i.e., children whose parents sign to them fluently from birth). Such studies serve to drive home the point that sign languages are fully natural languages and by implication, are deserving of all the rights associated with full natural languages.

2) Explaining the differences between sign and spoken language acquisition. In this category are studies which note potential differences in the path of acquisition of sign and spoken languages, and attempt to account for them, often by appealing to the modality. In some cases the differences are quite straightforwardly due to the modality (e.g., although sign phonology and spoken phonology have abstract principles in common, they are deeply rooted in modality differences); in others, a good argument has been made that ties the difference to a particular aspect of the modality.

3) A. Using sign language acquisition data to inform us about sign language grammar. B. Using sign language grammar to inform us about sign language acquisition. These two categories are grouped together to emphasize the importance of a strong, reciprocal relationship between studies of grammar and studies of acquisition. Studies in this category show how acquisition studies can bear on theoretical questions in grammatical analysis, and how grammatical developments can lead to new questions or reanalysis in acquisition studies. Such relationships between acquisition
and grammar are not unique to sign language studies, of course, but sign language researchers can and do profitably participate in these kinds of works.

4) Using sign language acquisition data to inform us about theories of language acquisition. Again, sign language research is not alone in pursuing the goal of developing and testing explicit theories of how language acquisition proceeds, but it has much to contribute to such goals. It is particularly important to include sign languages in the database of language acquisition facts which theories strive to explain, since any such theory would have as its goal providing an explanation for the ability of any child to learn the natural language she is exposed to.

5) Using sign language acquisition data to tell us about the nature of language. Sign languages and deaf communities allow us to understand in more detail the nature of language since, due to experiments of nature, they sometimes reveal what happens to language in extreme circumstances. Information about what emerges is of great significance to theories of language.

Of course, many studies fall into more than one of the categories above, and others may not have been specifically directed at any of these topics. However, I think it can be useful to take this type of view and examine the broader impacts of studies, whatever their original goals were. The overview provided here is not meant to be exhaustive, but selects examples of studies falling into each theme, to give the reader an idea of directions and possibilities. Additional research in all of these areas is eagerly anticipated.

1. Exploring the parallels between sign and spoken language acquisition

In this category I include research which aims to show that a particular sign language ‘is a language’ and is acquired on a par with spoken languages (see Lillo-Martin, 1999; Newport & Meier, 1985 for reviews of some of this research).

One clear example comes from the work of Laura Ann Petitto. Her body of research makes the strong claim that sign language is acquired in exactly the same way as oral language. For example, in one of her own overviews she claims, “Deaf children exposed to signed languages from birth acquire these languages on an identical maturational time course as hearing children acquire spoken languages” (Petitto, 2000).

Milestones claimed by Petitto to be ‘identical’ in signing and speaking children include babbling (7-12 months of age); the first word stage (11-14 months); and the first two-word stage (16-22 months).

Furthermore, Petitto says, “social and conversational patterns of language use ..., as well as the types of things that they ‘talk’ about ..., have demonstrated unequivocally that their language
acquisition follows the identical path seen in age-matched hearing children acquiring spoken language” (Petitto 2000).

Similar reports that the general path of language acquisition is similar for signed and spoken languages can be found in studies of sign languages other than ASL; for example, Italian Sign Language (Caselli & Volterra, 1990), Brazilian Sign Language (Quadros, 1997), and Sign Language of the Netherlands (Van den Bogaerde, 2000), among others.

Consider the case of babbling. Research on the babbling of hearing children shows that vocal babbling (repetitive, syllabic sounds such as ‘baba’) emerges around 6 to 8 months of age, and continues (with certain changes) until it disappears as words come in. Petitto & Marentette (1991) similarly observed that deaf children exposed to sign language produced ‘manual babbles’ during this same period. They found manual babble activities occurring as 32%-71% of the gestures produced by two deaf children studied at 10, 12, and 14 months of age. Petitto & Marentette argued that manual babbling is like vocal babbling in satisfying three conditions. First, the babbles employed phonetic units restricted to those used in signing; second, they showed syllabic organization; and third, they were used non-communicatively. Petitto (2000) concludes, “the discovery of babbling in another modality confirmed the hypothesis that babbling represents a distinct and critical stage in the ontogeny of human language.”

The similarities in babbling between children learning a sign language and children learning a spoken language were emphasized and expanded on in studies by Meier & Willerman (1995) and Cheek et al. (2001), although they propose that babbling in both modalities is a consequence of motor development rather than an expression specifically of the linguistic faculty. Like Petitto & Marentette, Meier & Willerman and Cheek et al. observed manual babbling in children exposed to sign language: they observed five deaf children at approximately 7, 10, and 13 months and reported manual babbling between 25% and 93% of all gestures produced. However, unlike Petitto & Marantette, who reported that manual babbling was much less frequent in the three hearing subjects they studied (about 20% of gestures), Meier & Willerman and Cheek et al. report that the five hearing children not exposed to sign language whom they studied produce manual babbles much like those of deaf children, at rates of 44% – 100% of all gestures.

Both of these studies find strong similarities between children developing sign language and children developing spoken language. Both also connect their findings to theoretical explanations which stress similarities in the development of sign and spoken languages, although their theories are different. Both are thus good examples of parallels between sign and spoken language acquisition.
Why is it important to demonstrate that deaf children with native signing input acquire sign languages along an ‘identical’ – or even parallel – time-course as that of children learning spoken languages? For Petitto, the implication of this finding is that the human propensity for language is not modality-dependent. Rather, the mechanisms that make language development possible apply equally well to a visual-gestural language as to an auditory-vocal language. As we seek to understand how language acquisition is possible, our theories might need to be changed to accommodate such modality-independence.

Such conclusions about the nature of the language-acquisition mechanisms would not be warranted if sign languages were considered anything less than full, natural human languages with the same biological foundations as well as similar social environments. Nowadays, well-informed linguists and psychologists do not question the status of sign languages. However, even still there are many people who are not well-informed on this subject and oftentimes they are in positions which allow them to make decisions regarding the welfare of (potential) sign language users. For this reason, the point cannot be stressed too much.

2. Explaining the differences between sign and spoken language acquisition

This category of research focuses on where sign language and oral language acquisition might be different, and attempts to explain this as, for example, effects of the modality. Such modality effects may include iconicity and motor/articulatory development, among others.

An example of research considering the role of modality in explaining differences between sign language and spoken language development looks at the appearance of first signs versus spoken words. Numerous authors have claimed that first signs appear before first words by as much as six months, and the current enthusiasm for ‘baby signing’ in the hearing population is based on this idea. Meier & Newport (1990), in a thorough review of the literature documenting acquisition milestones for sign versus speech, came to several important general conclusions about the similarities and differences. First, the ‘advantage’ for signs seems to be about 1.5 to 2.5 months (roughly age 8.5 months for first signs versus age 10-11 months for first words), and this difference is seen only with the earliest context-bound signs, not purely symbolic ones. Second, they argued that the sign advantage exists only for first words, not for first word combinations (early syntax). Finally, Meier & Newport offered a possible explanation for the sign advantage in terms of ‘peripheral’ mechanisms – those used in the production and/or perception of signs versus words. They provided reasons to think that it takes longer for speaking children to develop sufficient articulatory control to produce utterances which can be recognized as words than for signing
children to develop comparable control. Thus, the difference boils down to a disadvantage for spoken language at the earliest stages of lexical development.

Another body of research which examines effects of modality on sign language acquisition concerns early sign phonology. Researchers have studied which components of signs children are more or less accurate with, and found that in many cases children’s development can be explained by appealing to the development of motor and perceptual mechanisms. Both of these explanations emphasize the role that modality plays in sign language acquisition. It may well be that modality plays an especially important role in explaining patterns of phonological development.

For example, several researchers find more errors on handshape than location in early signs. Young children’s first signs tend to use a handshape with all fingers extended, whether spread or lax (5), or with the fingers all in a fist (A), or with just the index finger extended (1). These handshapes will often be substituted for others in target signs using more complex handshapes. A possible explanation offered for this pattern is that fine motor control needed for handshape develops later than gross motor control needed for location (Cheek et al., 2001; Conlin, Mirus, Mauk, & Meier, 2000; Marentette & Mayberry, 2000). On the flip side of the coin, researchers suggest that it may be easier for children to perceive differences in location as compared with different handshapes, also contributing to the earlier accuracy with the former.

Researchers have also noticed that children’s earliest signing often involves movement repetition (Meier, 2006). This can be directly related to repeated movements in motoric development such as the stereotypies of repeated kicking or arm waving. Meier (2006) also argues that children’s early non-target forms in two-handed signs may be explainable by reference to a phenomenon known as ‘sympathy’, whereby children have difficulty inhibiting the action of one hand when the other is active.

Meier (2006) argues that studying articulatory factors in the development of sign phonology is important for at least two reasons. First, knowing which effects come from articulation helps identify those which require other explanations. Second, he suggests that articulatory factors may promote particular kinds of linguistic organization – especially for children – which might lead us to think that these effects may reflect not only different levels of performance with grammar (for signing and speaking children), but also different competences.

Getting at where children’s developing ability to produce signs reflects performance or competence differences is difficult, but there are some cases for which an articulatory / perceptual explanation is probably unwarranted. For example, Conlin et al. (2000) and Marentette & Mayberry (2000) suggest that some place errors are not consistent with a motoric explanation, but rather indicate that the child has misrepresented the place value of certain signs. This suggestion
reinforces Meier’s comment that understanding articulatory factors helps to identify those aspects of development which require alternative explanations.

These examples have emphasized the modality-dependence of the proposed explanations of phonological development. However, it should be pointed out that articulatory factors may well explain some aspects of early phonological development in spoken languages as well (e.g., MacNeilage & Davis, 1990). ‘Modality’ effects are present in both modalities, then, and in this sense attending to modality is not only a way of explaining how sign language development and spoken language development are different, but again how they are alike.

3A. Using sign language acquisition data to inform us about sign language grammar

When competing grammatical models make different acquisition predictions, developmental data can be used to test the models. This is a principle of spoken language research as well as sign language research, although it has only been applied in sign language research relatively recently. Here I will discuss two examples, the first one only briefly.

Conlin et al. (2000) state, “Studies of early sign development .. may help us decide between competing models of the adult language” (p. 52). For example, they suggest that children’s early signs may help in the determination of canonical signs. It has long been recognized that the earliest-occurring handshapes are also the ‘unmarked’ ones in the adult language (Battison, 1978), so this promise has already been fulfilled in part. They also hope that analyses of children’s signing can help in the evaluation of models of adult grammar, in particular when certain models are better able to capture the generalizations about children’s productions. Karnopp (2002) takes such an approach in her investigation of the development of phonology in Brazilian Sign Language. She adopts the Dependency Model of van der Hulst (1993) and finds that it makes strong predictions about sign phonology acquisition which were borne out in the data she analyzed from one deaf signing child. She concludes that the sign language acquisition data she analyzed provide strong support for the theoretical model used.

A second example comes from the area of syntax. Lillo-Martin & Quadros (2005; 2006) argued that the acquisition of topic, focus, and WH-questions in ASL and LSB helps to reveal the correct analyses of these structures. We will start with a few examples.

In both ASL and LSB, certain signs can appear in a sentence twice, once in their usual position and again at the end of the sentence, to indicate emphasis on that sign. These constructions are often called ‘doubling’. Some examples are given in (1) (examples in this section are from Lillo-Martin & Quadros 2007).
(1) a. JOHN CAN READ CAN
   ‘John really CAN read.’
   b. MARY FINISH GO BRAZIL FINISH
   ‘Mary ALREADY went to Brazil.’
   c. I LOSE BOOK LOSE
   ‘I did LOSE the book indeed.’

Also in both of these languages, the same category of signs which can occur in doubling constructions can occur in the sentence-final position only. These sentences can be referred to as ‘final constructions.’ Examples are given in (2).

(2) a. JOHN READ CAN
   b. MARY GO SPAIN FINISH
   c. I BOOK LOSE

According to one type of grammatical analysis, doubling and final constructions are related. Both are used for emphatic focus, and according to these theories, they have related derivations (Nunes & Quadros, 2006, 2007; Petronio, 1993; Wilbur, 1997).

However, there is another kind of focus, known as new information focus (for short, ‘I-focus’). Unlike the emphatic focus, this places the focused material in the sentence-initial position (Lillo-Martin & Quadros, 2007; Neidle, 2002). Such new information focus is used, for example, in the context of answering a question, as in example (3). The unmarked word order (SVO) is also permitted in such contexts.

(3) S1: WHAT YOU READ?
   ‘What did you read?’
   ________ I-focus
S2: BOOK STOKOE  I READ
S2: I READ BOOK STOKOE
   ‘I read Stokoe’s book.’

According to the proposals of Lillo-Martin & Quadros, I-focus is derived syntactically through a completely different mechanism from that of emphatic focus. They predicted that if their
analyses are correct, children would acquire doubling and final constructions together, since these are both instances of emphatic focus, but these might be acquired independently from I-focus, since it is derived differently.

Lillo-Martin & Quadros (2005) tested their prediction by looking at the longitudinal spontaneous production data from two deaf children acquiring ASL as a native language (Aby, Sal), and two deaf children acquiring LSB as a native language (Ana, Leo). All four children have deaf, signing parents. They were videotaped regularly starting before the age of 2. Their utterances were examined to determine when they started productively using I-focus, doubling, and final constructions. The results of this study are summarized in Table 1.

Table 1.

Summary of Results – Lillo-Martin & Quadros (2005)

<table>
<thead>
<tr>
<th>Child</th>
<th>I-focus</th>
<th>Doubling</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aby</td>
<td>1;9</td>
<td>***</td>
<td>2;1</td>
</tr>
<tr>
<td>Sal</td>
<td>1;7</td>
<td>***</td>
<td>1;9</td>
</tr>
<tr>
<td>Ana</td>
<td>1;6</td>
<td>**</td>
<td>2;0</td>
</tr>
<tr>
<td>Leo</td>
<td>1;10</td>
<td>***</td>
<td>2;1</td>
</tr>
</tbody>
</table>

**p < .005 ***p < .001

It is clear that the children did acquire doubling and final constructions together, but these two constructions were acquired later than I-focus (highly significant by Binomial Exact Probability). These results can be taken to support theoretical analyses which relate doubling and final constructions in ASL and LSB over analyses which give them distinct derivations.

These two examples have shown areas in which data from sign language acquisition can bear on theoretical questions of grammatical analyses. For both sign and spoken languages, there are many cases in which different theoretical proposals do not obviously make different predictions for acquisition, so acquisition data may not bear on such issues. However, other cases lead to expectations of ordering, such that phenomena that are related in the adult grammar can be expected to be acquired together; or phenomena that are separated are expected to be acquired separately. In some cases, specific ordering predictions can be made, such as when a particular construction has others as prerequisites (for discussion of examples, see Snyder & Lillo-Martin, in press). In these
cases, language acquisition data can provide important support – or disconfirmation – of theoretical proposals.

3B. Using sign language grammar to inform us about sign language acquisition

Category 3A looks at ways in which acquisition studies can inform studies of grammar. The present category of studies goes in the opposite direction, using new developments in grammar to inform acquisition studies. These two categories are closely related, since both show the close relationship between acquisition studies and linguistic theory, and in fact there is often a spiral effect such that both fields benefit from and influence each other in the same domain.

An example of this category comes from studies of children’s development of word order. Coerts & Mills (1994) undertook a study of two deaf children’s development of the subject – object – verb word order in the Sign Language of the Netherlands (SLN), between the ages of about one-and-a-half years to two-and-a-half years. They found that children showed a great deal of variability in their ordering of subjects and verbs. This variability in the acquisition of word order was puzzling and left without a full explanation in the initial work.

Then Bos (1995) identified SLN as having a process known as Subject Pronoun Copy (SPC) (cf. Padden, 1988). According to SPC, the subject of a sentence can be repeated as a pronoun in the sentence-final position, as shown in (4)a. However, it is also possible for the sentence-initial subject to be unexpressed (this is a general process found in SLN as well as in other sign languages). When the sentence-initial subject is left unexpressed, but the sentence-final subject pronoun is present, the surface order is verb – subject, as in (4)b (examples from Coerts 2000).

(4)  
a. INDEX$_{beppie}$ FILM INDEX$_{beppie}$  
‘Beppie is filming’.

b. CRY INDEX$_{dolls}$  
‘The dolls are crying.’

Coerts (2000) then undertook to reanalyze the child data previously studied by Coerts & Mills. First, it was clear that the children knew that SLN permits null subjects, as they used them appropriately frequently. She then employed a fairly strict criterion for acquisition of the SPC process: the child must use a sentence-final subject pronoun in a sentence with an overt subject to show that they had acquired SPC. Once the children showed they had acquired SPC, at around two
years, any later instances of verb – subject order in which the post-verbal subject is a pronoun were considered instances of SPC.

Using this reanalysis, Coerts found that the majority of the previously ‘unexplained’ word order examples were in fact explainable, and children’s acquisition of word order was more in line with expectations. Coerts concludes:

“knowledge of the adult language steers the choice of analysis procedures used for acquisition data ... an analysis procedure that takes subject pronoun copy into account results in a much clearer picture with respect to the acquisition of subject and verb position”
(Coerts 2000)

A project by Chen Pichler (2001a; 2001b) resulted in similar findings for ASL, and her study goes beyond consideration of SPC alone to include other instances of word order changes allowed in the adult grammar. Although there had been early claims that children strictly followed the adult basic SVO word order, Schick (2002) found no evidence for this strategy in two-year-olds, concluding instead that children’s word order was ‘random’. Chen Pichler used a similar approach to Coerts’ and determined when children’s use of verb-subject order could be considered cases of SPC, and when their use of object-verb order could be considered as following from adult-like word-order changing operations (for example, object shift).

Chen Pichler established clear criteria for counting utterances as legal order changes. For example, post-verbal subjects must be pronouns to be considered SPC; pre-verbal objects occurring with verbs marked for aspect, spatial location, or handling classifier were considered instances of object shift. Using these criteria, Chen Pichler found that children’s word order use demonstrates regularity in following grammatical options much earlier than previously thought. Thus, taking into consideration such developments in the syntactic analyses leads to more reliable acquisition studies.

Both of these examples illustrate the importance of considering the target adult grammar when studying language development. The goal of studying language acquisition is to understand how children become adult-like in their knowledge of language. When children differ from adults, an explanation for this difference must be sought. But sometimes researchers examining child development overlook developments in the study of the adult grammar. The description of the language children are exposed to, and will ultimately be users of, changes as researchers gather more data and form hypotheses which point in new directions for further study. Language acquisition researchers can be frustrated by this moving target, but they can also benefit from it in improved analyses and hypotheses of their own.
4. Using Sign Language Acquisition Data to Inform us About Theories of Language Acquisition

In the previous section, we considered theories of adult grammar and their relationship to studies of language acquisition. Here, we turn to theories of the process of acquisition. Alternative theories of how language develops can be tested and refined using real-time acquisition data from sign languages just as they are tested using data from spoken languages. These theories are general theories about language acquisition, not particular to sign languages (and in general, not developed on the basis of sign language data).

As an example, consider the Verb Island Hypothesis of Tomasello (1992). According to this model of (general) language development, children go through an early period in which “verbs are individual ‘islands’ of organization in an otherwise unorganized grammatical system” (as summarized by Schick 2002). It predicts that certain patterns (such as word order or inflections) will be found with individual verbs, although there will not be evidence that a whole class of verbs behaves in the same way. This early period of verb islands would begin when children are starting to use two-word combinations, but generalizations would be apparent some months later (say, around the age of two years for most children).

In support of this proposal, Morgan & Woll (2002) conclude: “we found no evidence for the child’s exploitation of an abstract set of verb frames before 3;2. The child appeared to build argument structure afresh with each new verb and these verbs were uniquely tied to their communicative function.” Only later, they argue, do children build rules which hold over multiple verbs.

Schick (2002) also examined the verb island hypothesis in her study of early sign combinations. She found only limited evidence in support of the hypothesis, in that some of the children she studied showed consistent ordering patterns with some verbs. However, she found that in many cases, word order was quite varied even for individual verbs. This would appear to show neither verb islands, where individual verbs behave alike, nor evidence of word order rules which apply across the board to all different verbs.

In this context, we can return to the findings of Coerts (2000) and Chen Pichler (2001), reported in section 3B. These authors reported systematic use of word order by young signing children when grammatical alternations allowed by the adult grammar are also considered. According to their results, children’s signing is neither random nor organized into verb-specific islands. Rather, the rules which characterize the adult grammar are also found in this domain of
children’s language. Whether the data analyzed by Morgan and Woll (BSL) and by Schick (ASL) are amenable to the same conclusion remains to be seen.

Another example can be raised from Reilly’s study of the development of non-manual marking (as summarized in Reilly, 2006). Reilly and colleagues have been interested in children’s development of the use of linguistic non-manual markings versus often very similar affective and communicative facial expressions. Reilly sees this project as in part a test of the question of “the degree to which language is an innately specified independent cognitive function” because it assesses the separability of language from other cognitive functions. She suggests that an approach to language acquisition in which language is seen as a general cognitive system would predict that children would readily recruit their pre-linguistic affective and communicative abilities in the service of linguistic functions, and thus acquire non-manual markings together with their co-occurring manual components. On the other hand, “children would approach each linguistic structure and its morphology de novo” in a more modular approach.

This question is clearly addressed with data from the development of non-manual marking of negation. The negative non-manual marker used in adult ASL is essentially like the negative headshake used communicatively by very young children, whether exposed to sign language or not. Negation can be expressed in adult ASL by a negative sign co-occurring with this negative headshake, or even by the negative headshake alone, as in the examples in (5) (examples from Reilly 2006).

\[(5)\]

\[
\text{a. BOOK READ ME CAN’T} \\
\text{‘I can’t read the book.’} \\
\text{b. ME EAT ICE-CREAM} \\
\text{‘I don’t eat ice cream.’}
\]

Reilly and her colleagues found that deaf children acquiring sign languages, like hearing, non-signing children, produce communicative negative headshakes by about 12 months of age. The first negative signs, NO and DON’T-WANT, emerge at 18-20 months, followed by other negative signs up to age 3:6. For seven of the eight negative signs investigated, Reilly found that the manual sign first appears without the required co-occurring headshake. Several months later, the negative headshake is used together with the negative signs. This separation occurred despite the fact that the negative headshake was used pre-linguistically by these children to mean essentially the same thing.
Reilly concludes that children treat the negative headshake as it is used in ASL as a linguistic element which must be analyzed independently. This would not be expected under the theory of language as a more general cognitive system, but only by the modular approach.

The two theories under discussion in this section – the verb island hypothesis and the modularity of language with respect to other cognitive systems – can be further tested using data from sign language acquisition, as can other theories of language development. In some cases, sign languages provide a new form of data, unavailable using the study of spoken languages alone. The study of the non-manual marking of negation is one such case. In other cases, sign language provide needed breadth and diversity of languages brought to bear on a theoretical question.

5. Using sign language acquisition data to tell us about the nature of language

The study of sign languages and deaf communities can provide information about language development under extreme circumstances which are not found elsewhere. This is a unique contribution to our understanding of the nature of language and the mechanisms which make language acquisition possible. Researchers studying such circumstances have a very special role to play in advancing scientific knowledge.

Examples of such contributions come from the study of recently developed sign languages, late first language learners of sign languages, learners with degraded input, learners of invented sign systems, homesigners, etc. These studies tell us about the ranges of possible languages, the path and properties of language emergence, ‘resilient’ properties of language which appear in the absence of evidence, critical period effects in language acquisition, how the learner modifies the input she receives, etc. The range of outcomes from such studies is so broad and important that there is no way to give it justice here. However, I will give one example to whet the reader’s appetite; for a fuller meal please see the original works in this area.

Late first language learners are virtually unheard of in spoken language communities, but not so in signers. Since about 95% of deaf children have hearing parents (Mitchell & Karchmer, 2004), it is not surprising that the vast majority are not exposed to sign language from birth. Sometimes, parents decide to educate their children orally (without sign language); some of these children are later exposed to a sign language after having learned only a portion of spoken language (often, not enough to communicate effectively). In other cases, children experience late exposure to sign language simply because the resources for exposing the child earlier were not available to the family. For various reasons, children may be exposed to sign language only after the age of two
years, or five years, or twelve years, etc. It is not well understood exactly how such delayed linguistic exposure affects language development, but it is clear that there are such effects.

Morford & Mayberry (2000) provide an overview of some of the research investigating effects of delayed input on (first) language acquisition and processing. Most of this research has been conducted with adults whose exposure to sign language began at different times. By studying adults, researchers investigate the outcome of the language-development process, after years of experience have made the use of sign language a well-practiced, familiar skill.

Overall, studies with adults whose age of first exposure to ASL was approximately 4 to 16 years, as compared to native signers (those with exposure from birth), have consistently reported differences in both production and comprehension tests. Furthermore, studies looking at language processing have also found differences for different age-of-exposure groups. The degree of an effect is not uniform across different studies. For example, Newport (1990) found that later learners (those with exposure after age 12) scored lower than ‘early’ learners (those with exposure between 4 and 6), who in turn scored lower than native signers, on tests of ASL morphology production and comprehension. However, the three groups were not different on a test of basic word order. Similarly, Emmorey et al. (1995) found that late learners were different from native signers in a study of on-line processing of verb agreement, but not in aspect marking.

Mayberry et al. (2002) extended such findings by comparing late first-language learners of ASL with late second-language learners of ASL: late-deafened adults whose exposure to sign language began in the same period as the late first-language learners (9-13). The effects of late exposure were strongest for late first-language learners; late second-language learners performed close to natives.

These results reinforce the idea that early exposure to language is crucial for its normal acquisition. But what factor(s) will be most affected by delayed input when other factors are relatively spared? Newport (1990) hypothesizes that young children have the ability to detect patterns of the correct grain size for the development of complex morphology, while the greater cognitive capabilities of older children or adults actually interferes with this type of analysis, thus leading to the differences in performance on syntactic versus morphological tests she observed.

An alternative proposal is put forth by Morford & Mayberry (2000), who emphasize the differences in phonological processing skills for native or early learners versus late learners, and suggest that what is missing for late learners is what is learned by those with native exposure in the first year of life. In particular, a great deal of phonological development takes place during this period, and studies show infants’ sensitivities to phonological information from a very early age. What Morford & Mayberry propose is that “the true advantage of early exposure to language is the
development of the phonological system prior to the development of the lexical-semantic and morpho-syntactic systems”. Problems in phonological processing can have ‘cascading’ effects on other levels of language processing, showing up in the various areas of effects of language delay.

The hypothesis of Morford & Mayberry should be tested in additional studies of the effects of delayed language input. One important question is whether the hypothesized phonological processing deficit can fully account for the areas of impairment and preservation found in later learners. Are there specifically grammatical differences between early and later learners as well? Some evidence that there are such differences comes from a study of two children whose exposure to ASL began at the age of six. This study, by Berk (2003), finds that the later learners are particularly affected in their production of person-marking agreement on ASL verbs. Other verbal morphology, indicating location agreement, is not affected, although the form of such agreement is very similar to that of person-marking. A specifically grammatical deficit would seem to be implicated (possibly in addition to phonological processing difficulties).

The study of late learners has much to contribute to theories of language and language development. The effects of delayed input should not be random or general, but rather should fall along fault lines which the grammar makes available. Theories of why children are better language-learners than adults are must make reference to crucial aspects of the language-learning mechanism. Such theories have little data to go on outside of the realm of late first-language acquisition in deaf children, since second-language learning appears to have different constraints and consequences. Thus, more work in this area is clearly needed.

6. Research which cuts across themes

Many areas of sign language acquisition research touch on more than one of the themes above, although it has been possible to ‘force’ example studies into one or another category. One area of research which clearly touches on all of the themes is the acquisition of verb agreement, which has been a subject of attention for well over twenty years.

Meier (1982) examined the acquisition of verb agreement in ASL in comparison to the acquisition of verbal morphology in spoken languages. He posed the question whether agreement would be acquired differently in the two modalities, since the sign language agreement can be considered iconic (e.g., the agreeing verb I-GIVE-YOU may look something like a mime of the giving action). He argued that sign language agreement is acquired in a similar fashion as is complex, unstressed verb agreement in some spoken languages. In particular, he found that agreement is mastered only around age 3;0 (not early due to apparent iconicity). This mastery is
defined as correct use in obligatory contexts, an important consideration since not all verbs take agreement.

On the other hand, Morgan et al. (2006) argue that ‘spatial’ aspects of verb agreement in sign language make it unlike that in spoken languages, and they claim that typological and modality factors account for developmental patterns in the acquisition of British Sign Language (BSL). They argue that verbal morphology in sign languages has a high degree of simultaneity, making segmentation difficult for the young child. This contributes to the relatively late acquisition they observed in one deaf child who used agreement productively around 3;0.

However, changes in the classification of verbs into those which do or do not require agreement, and different proposals about how verb agreement should be analyzed, have led to a different picture of the nature of early verb agreement. Casey (2003) found early use of verb agreement in a group of ASL-acquiring children, although she identified errors of omission in obligatory contexts continuing to occur until age 3, even using new ideas about verb classification. Quadros & Lillo-Martin (2007) used additional recent developments in the analysis of verb agreement morphology to identify contexts for obligatory use, and found that errors of omission were extremely rare, for two children acquiring ASL and two children acquiring LSB. These studies are now working in the reciprocal direction, as Quadros & Lillo-Martin (in preparation) show that the acquisition data help to identify additional contexts of optionality which are confirmed in studies of adult signers.

As to the fourth theme, studies of verb agreement acquisition have been raised to address various theoretical questions. For example, Morgan & Woll (2002) discuss various approaches to the ‘mapping’ problem, that is, how children learn to ‘map’ various known conceptual conceptual representations onto linguistic structures they are acquiring. They use the acquisition of verb agreement as one source of data to address this problem, concluding that children must slowly develop more complex structures (e.g., those with a greater number of argument positions) after starting with simpler ones.

Finally, verb agreement has been studied in late learners, as it seems to be an area of special problems. Adult late learners (Newport 1990) and children with delayed exposure (Berk 2003) have been shown to err on verbal morphology, and they have processing difficulties in this domain (Emmorey et al. 1995). Verb agreement is also a subject of interest in studies of emerging languages (Aronoff, Padden, Meir, & Sandler, 2004; Senghas, 2000).

This one domain of research has been highly productive, with issues and concerns beyond those mentioned here. See also Meier (2002) for a critical review of many of these observations.
7. The future of sign language acquisition research

What does the future of sign language acquisition research look like? A possible future could be one in which studies of sign language acquisition fade away, due to lack of interest, or research only conducted by a few isolated researchers. Our hope, however, is that such studies expand, and that more and more hypothesis-driven research is conducted in this domain. It is important that more Deaf researchers are involved in this area of study, as their understanding of the language and its context is invaluable. This means that more opportunities for training and collaboration should be made available and encouraged.

It is hoped that future research will also enhance connections with the questions asked of spoken language acquisition. Theories of language, and of language acquisition, need to accommodate sign language data, so sign language research that informs and benefits from studies of spoken languages is desirable. Even more studies of an enhanced range of populations is encouraged – for example, cross-sign language comparisons, studies of the effects of differences in input quality and timing, etc. Such studies have so much to offer, both scientifically and practically.

Finally, all of these hopes for future research are based on the premise that Deaf children continue to be exposed to and acquire sign languages. This is the most important component of the future of sign language acquisition research.

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References


Variation in ASL: The Role of Grammatical Function

Ceil Lucas and Robert Bayley

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Research on spoken languages has shown that linguistic variables may be systematically conditioned by factors operating at different linguistic levels. For example, numerous studies have shown that the deletion of final /t/ and /d/ from English words such as mist is systematically conditioned by features of the preceding and following phonological environment (i.e., the preceding and following sounds), stress, and the grammatical class of the word containing the /t/ or /d/ (e.g., Guy 1980, 1991; Labov 1989; Patrick 1991; Roberts 1997). Final /t/ and /d/ are more likely to be deleted before consonants (e.g., the /t/ in mist, as in mist by the lake) than before vowels (e.g., mist over the water). They are also more likely to be deleted from uninflected words (monomorphemes) (e.g., in the past, than from past-tense forms and past participles (e.g., he passed by) in which -ed is pronounced as /t/. Other linguistic variables are also constrained by both phonological and grammatical factors. Houston (1991), for example, has shown that the ING variable in British English is systematically conditioned by grammatical function, with the apical variant (e.g., workin’) associated with verbal categories and the velar variant (e.g., ceiling) with nominal categories. Labov’s (1989) study of the acquisition of patterns of variability by

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Ceil Lucas is a sociolinguist who has taught in the Department of Linguistics at Gallaudet University since 1982. Robert Bayley is Professor of Linguistics at the University of California, Davis. This research was supported by National Science Foundation Grants SBR 9310116 and SBR 9709522. Both authors contributed equally to this article. Clayton Valli, Alison Jacoby, Mary Rose, Leslie Saline, Susan Schatz, Ruth Reed, and Alyssa Wulf assisted with data collection, transcription, and coding. We are grateful to Robert Walker for the drawings and to MJ Bienvenu for serving as the model. Special thanks to the many Deaf individuals who generously shared with us the richness of their language and experience.
children shows a similar grammatical effect for members of the Cameron family in King of Prussia, Pennsylvania.

The fact that many linguistic variables are constrained by factors operating at different linguistic levels is a commonplace for students of spoken languages. However, phonological variation in ASL and other signed languages has generally been accounted for by positing phonological constraints alone (i.e., features of the preceding and following signs), without reference to the role of grammatical and functional factors (for a full review, see Lucas, Bayley, and Valli 2001).

Until very recently, the program of research on ASL has been to demonstrate that ASL, and by analogy other sign languages, are true languages. This work has proceeded by demonstrating that the structure of ASL parallels that of spoken languages and that its phonology and syntax are subject to the same kinds of processes that operate in spoken languages. In the process, this work has not investigated the possibility that factors other than phonological ones may be operating. For example, Battison, Markowicz, and Woodward (1975) examined variable thumb extension in signs such as FUNNY, BLACK, BORING, and CUTE. Of the six factors that they claim conditioned the variation, five concern formational (phonological) features of the signs themselves. Woodward and DeSantis [Woodward, J. W., and S. DeSantis. 1977. Two to One It Happens: Dynamic Phonology in Two Sign Languages. Sign Language Studies 7: 329-88.] (1977) examined two-handed signs that can become one handed, such as CAT, CHINESE, COW, and FAMOUS. They have also proposed that the variation they observed was conditioned by phonological features of the signs themselves (e.g., the movement and location of the sign). Liddell and Johnson explain variation in two forms of the sign DEAF (ear to chin and chin to ear) as a process governed solely by phonological constraints: “A number of signs exchange an initial sequence of segments with a sequence of final segments in certain contexts that appear to be purely phonological. The sign DEAF is typical of such metathesizing signs” (1989, 244).

Liddell has continued to uphold the explanation expressed in the 1989 article. In Grammar, Gesture, and Meaning in American Sign Language (2003), he refers to Lucas’s (1995) pilot study of variation in the form of DEAF, which found that only grammatical function, not the features of the preceding and following signs, had a significant effect on signers’ choice between citation (ear-to-chin) and noncitation (chin-to-ear or contact-cheek) forms of DEAF. He then describes two tokens of DEAF used in the same sentence to illustrate the role of the preceding and following signs in conditioning variation. He acknowledges that the example does not show
“statistical significance,” but he nevertheless comments, “Clearly preceding and following signs are the significant factor in these examples” (2003, 319).²

Liddell and Johnson also comment on the variable lowering of signs (e.g., KNOW) that are produced at the level of the forehead in citation form (+cf), the standard form that appears in dictionaries and is taught in ASL classes: “[T]he phonological processes that originally must have moved them are still active in contemporary ASL. The rules which account for [these signs] appear to be variably selected in casual signing, and like vowel reduction rules in spoken languages, have the effect of neutralizing contrasts of location” (1989, 253). They also attribute variation in signs produced with a 1 handshape (index finger extended, all other fingers and thumb closed) to phonological processes, without consideration of factors at other linguistic levels: “There are numerous instances of assimilation in ASL. For example, the hand configuration of the sign ME (= PRO.1) typically assimilates to that of a contiguous predicate in the same clause. . . . The extent to which signs other than ME assimilate to the hand configuration of another sign, although not yet thoroughly investigated, appeared to be considerably limited. . . . For most signers it appears to be variable, probably controlled by formality and fast-signing constraints” (ibid., 250–52).

In this article, we test the claim that phonological variation in ASL may be accounted for primarily by the influence of the surrounding phonological environment. We report on a series of multivariate analyses of approximately ninety-four hundred tokens distributed among three phonological variables, extracted from videotaped conversations and sociolinguistic interviews with a well-stratified sample of 207 signers from seven sites across the United States. We first illustrate the linguistic variables and outline the model of ASL phonology that informs our analysis. We then discuss the methods, including data collection, reduction, and coding. Finally, we present our results and discuss their implications for our understanding of variation in spoken and sign languages.

1. The Variables

We examine the linguistic factors that constrain variation in the form of three variables: the sign DEAF, the location of a class of signs represented by the verb KNOW, and signs made with a 1 handshape.
2. The Sign DEAF

DEAF has main three variants, illustrated in figures 1a, 1b, and 1c. In citation form, DEAF is signed from ear to cheek. DEAF may also be signed from cheek to ear or reduced to a contact on the cheek. We refer to these alternatives as noncitation forms (–cf).

3. Signs with Downward Movement

The second variable consists of a class of signs represented by the verb KNOW, which shares features of location and hand placement. Signs of this class are produced at the forehead or temple. In addition to KNOW, other signs include verbs of thinking and perception (e.g., BELIEVE, DECIDE, FORGET, REMEMBER, SUPPOSE, SUSPECT, SEE, THINK) as well as a variety of adjectives (e.g., DIZZY, FEDERAL, WEIRD), nouns (e.g., DEER, FATHER, HORSE), prepositions (e.g., FOR), and interrogatives (e.g., WHY). (In signs such as BELIEVE, DECIDE, and REMEMBER, the focus here is on the initial location of the handshape—the forehead in citation form and lower in variable forms.) Figure 2a is an illustration of KNOW and FOR in their citation forms. Variants of these signs are produced at locations below the forehead or temple. Figure 2b shows KNOW and FOR as they are sometimes produced, just above or below the jaw.

4. Signs with a 1 Handshape

Many signs of all grammatical classes are produced with a 1 handshape. Figure 3a shows the citation form of ONE, with the thumb and all of the fingers except the index finger closed. Signs produced with a 1 handshape, however, exhibit a wide range of variation (e.g., thumb open, all fingers open). Here we consider the two most common noncitation forms. The first one, the L handshape variant, differs from the citation form in that the thumb is open (figure 3b). In the second noncitation form, the open-hand variant (figure 3c), both the thumb and the fingers are open.

5. ASL Segmental Phonology

The fundamental perspective on the structure of signs has changed dramatically since the early studies of variation in ASL (see, e.g., Battison, Markowicz, and Woodward 1975; Woodward 1973a, 1973b, 1976). Stokoe’s (1960) perspective, which shaped sign language studies from 1960 until the 1980s, holds that signs are composed of three basic parts or parameters (the
location at which the sign is produced, the handshape, and the movement of the sign) and that, unlike the sequentially produced segments of spoken languages, these components are produced simultaneously. Although Stokoe and others recognized that sequential events occur within signs, they regarded these events as phonologically unimportant. As Liddell and Johnson observe, “the claim that signs are simultaneous bundles of primes is not a claim that there are no sequential events within signs. It is a claim that within signs sequential organization is phonologically unimportant. Thus, while Stokoe and more recent workers recognize sequence within signs, they typically hold it to be phonologically unimportant” (1989, 196–97). More recent models, however, do attribute phonological significance to sequential events. These appear far more suitable for the study of variation than earlier simultaneous models because they render more explicit aspects of the sign that are subject to variation.

In Liddell and Johnson’s (ibid.) model, which we adopt here, signs are viewed as composed of sequentially produced hold and movement segments somewhat analogous to the consonants and vowels of spoken languages. Each segment is an articulatory bundle that includes the features of handshape, location, palm orientation, and nonmanual signals (facial expressions). For example, the citation form of DEAF consists of a sequence of a hold segment, a movement segment, and a hold segment (HMH). Figure 4 is a simplified representation of DEAF in this framework.

While we recognize that there is considerable debate regarding the nature of these segments (see, e.g., Coulter 1992; Perlmutter 1992; Sandler 1992; Uyechi 1994; Brentari 1998), we regard the Liddell and Johnson framework as the most suitable for the study of variation. As Liddell (1992) has demonstrated, it allows not only for the efficient description of any individual sign but also for an accurate account of phonological processes such as assimilation, metathesis, epenthesis, and segment deletion—processes that are central to variation in both spoken and sign languages.

6. Methods

6.1. Communities

To obtain a representative sample of variation in ASL, we collected data in seven sites: Staunton, Virginia; Frederick, Maryland; Boston, Massachusetts; Olathe, Kansas/Kansas City, Missouri; New Orleans, Louisiana; Fremont, California; and Bellingham, Washington. All of these sites
have thriving communities of ASL users. In addition, Staunton, Frederick, Boston, Fremont, and Olathe have residential schools for deaf children and long-established Deaf communities. We chose these sites because we consider them representative of the major areas of the country — the Northeast, East, South, Midwest, West, and Northwest. In the late summer and early fall of 1994, we tested and refined the data collection methodology in Frederick and Staunton before implementing it at the other sites. Data were collected in Boston in January 1995, in Kansas City and Olathe in May 1995, in Fremont and Bellingham in June 1995, and in New Orleans in September 1995.

7. Participants
Participants included 207 African American and white working and middle-class men and women in three age groups: 15–25, 26–54, and 55 and up. All had either acquired ASL natively in the home or learned to sign from their peers in residential schools before the age of 5 or 6 (see Lucas, Bayley, and Valli [2001] for detailed information about the participants).

8. Data Collection
The approach to the participants was guided by the work of Labov (1984) and Milroy (1987). Groups of from two to seven signers were assembled in each area by a contact person, a Deaf person living in the vicinity with a good knowledge of the community. At the four sites where we interviewed both white and African American signers, we had two contact people, one for each community. It was their responsibility to identify fluent lifelong ASL users who had lived in the community for at least ten years.

Data collection was divided into three parts. The first part of each videotaped session consisted of approximately one hour of free conversation among the members of each group, without the researchers present. After this period of free conversation, two participants were selected from the group and interviewed in depth by the Deaf researchers about their backgrounds, social networks, and patterns of language use. Sessions concluded with the showing of a set of thirty-four pictures to elicit signs for the objects or actions represented in them (see Lucas, Bayley, and Valli 2001 for the findings on lexical variation).

It has been demonstrated that ASL signers tend to be very sensitive to the audiological and ethnic status of an interviewer (i.e., hearing or deaf, white or African American [Lucas and Valli...
This sensitivity may be manifested by rapid switching from ASL to Signed English or contact signing in the presence of a hearing person (ibid.). To ensure the consistent elicitation of ASL rather than Signed English or contact signing, the participants were interviewed only by Deaf researchers. In addition, all of the African American participants were interviewed by a Deaf African American research assistant. White researchers were not present during the African American group sessions and interviews. These procedures were followed for sixty-two groups. Data were collected at community centers, at schools for deaf children, in private homes, and, for three groups, at a public park.

9. Data Reduction and Coding

As data were being collected, a cataloguing system and a computer database were developed to provide easy access to the data and to store a wide variety of information about the videotapes. The database includes details as to when and where each group was interviewed as well as information about the people who appear in each tape (names, ages, educational backgrounds, occupations, patterns of language use), details about phonological, lexical, morphological, and syntactic variation, and observations about other linguistic features of ASL not necessarily related to variation.

10. DEAF

To allow for a comparison of variation across modalities, for all three variables we coded a range of linguistic factors, most which are well known in studies of spoken language variation. For DEAF, we coded all 1,618 tokens in the data for the grammatical function of the sign and the location of the preceding and following segments. In addition, because our data included both informal conversations and extended narratives, we coded for discourse genre. The factors are shown here:

1. Grammatical function of DEAF: noun (e.g., DEAF UNDERSTAND [“Deaf people understand”]); adjective (e.g., DEAF CAT); predicate adjective (e.g., PRO.1 DEAF [“I am deaf”]); compound (e.g., DEAF^WORLD, DEAF^CULTURE)

2. Location of the preceding segment: high (at ear or above), middle (between ear and chin), low (chin or below), pause

3. Location of the following segment: high, middle, low, pause
11. Location of Signs Represented by KNOW

In the examination of the downward movement of signs like KNOW, approximately fifteen tokens were sampled from each signer, resulting in a total of 2,862 tokens. These were coded for the following linguistic factors: grammatical function, preceding phonological environment, following phonological environment, and discourse genre. The coding scheme was designed to determine whether the location of the target sign would be influenced by the location of the preceding or following segment. We also wanted to establish whether variability in the target sign would be influenced by the preceding or following segment contacting the body or face.

We also coded for whether the signers’ elbows or forearms were resting on a chair or table while they were producing the target sign. This phenomenon, known as “impeded signing,” is somewhat comparable to hearing people’s speaking with food in their mouth. The difference is that impeded signing, which does not carry social stigma, is more common. We predicted that signers who rested their elbows on a table would produce the signs below the temple. However, although the results from the initial analysis bear out our prediction, the 268 tokens of impeded signing (less than 10 percent of the total) were eliminated from the final analysis reported here because such signing shows the influence of a constraint that is subject to neither linguistic nor social analysis. The linguistic factors that were coded are the following:

1. Grammatical function: noun (e.g., BOY, FATHER); adjective (e.g., BLACK, DIZZY); verb (e.g., KNOW, UNDERSTAND); preposition (e.g., FOR); interrogative (e.g., WHY)

2. Preceding sign: sign, pause (with no preceding segment, the target is the first sign)

3. Location of preceding segment: at level of signer’s head; at level of signer’s body (the neck or below); not applicable (the target is preceded by a pause)

4. Contact of preceding segment with the body: contact with the head or face; no contact with the head or face; contact with the body (i.e., lower than the chin); no contact with the body; at the level of the signer’s body (the neck or below) and the dominant hand contacts the base hand (2-hand contact); not applicable since the target is preceded by a pause

5. Following sign: sign, pause (with no following segment, the target is the last sign before a pause)
6. Location of following segment: same codes as for the location of the preceding segment, applied to the segment following the target sign

7. Contact of the following segment with the body: same codes as for contact of the preceding segment, applied to the segment following the target sign

8. Genre of text in which location sign occurs: conversation, narrative

12. Signs Made with a 1 Handshape

For signs made with a 1 handshape, which are very common, we sampled at least 25 tokens per signer, resulting in more than 5,000 tokens, all extracted from the spontaneous conversation portion of each videotaped session. The tokens were divided between lexical 1 handshape signs, \(wh\)-signs, grammatical function signs, and pronouns. For each example, the features of the variant were described, and the syntactic context in which the variable occurred was recorded.

We coded for three linguistic constraints: (1) the grammatical category; (2) the preceding phonological environment; and (3) the following phonological environment. We discuss each of these in some detail. In addition, as with DEAF and the location of signs such as KNOW, we coded for a fourth linguistic constraint, the genre of the text in which the token occurred, defined as either a conversational turn or a narrative.

The grammatical category of the sign in which the handshape in question occurred was coded as follows:

- PRO.1 (“I”)
- PRO.2 (“you”)
- PRO.3 (“he,” “she,” “it”)
- \(wh\)-word (e.g., WHERE, WHEN)
- grammatical function word (e.g., FOR)
- adverb (e.g., REALLY)
- verb (e.g., GO, CANCEL)
- adjective (e.g., BLACK, LONG)
- noun (e.g., WEEK, MONTH)
Classifier predicates were not included in the analysis because the 1 handshapes in these signs are separate morphemes with independent meaning, unlike the lexical signs and pronouns in which the handshape has no independent meaning.\(^2\)

The coding system for phonological factors was designed to test the hypothesis that variation in signs made with a 1 handshape is subject to assimilation, the process by which signs come to resemble the surrounding signs. For example, the 1 handshape in PRO.1 ("I") may become an open 8 handshape in the phrase PRO.1 PREFER ("I prefer"). In our coding, we assumed that only the handshape features of the preceding or following segments would have an effect on the variable features of the handshape of the target sign. Therefore, rather than coding for preceding location, orientation, and handshape, we limited our definition of the preceding and following environments to the preceding and following handshapes.

The first step in coding for features of the phonological environment was to code for whether the variable was preceded or followed by a segment or a pause. We then coded the preceding and following segments for relevant features of the thumb, index finger, and fingers 2, 3, and 4. Features were selected because the variable as defined here does not constitute a whole linguistic unit or segment but a cluster of features that defines only the handshape. In the same way, the handshape of the segments preceding or following the 1 handshape sign is simply a bundle of features. Each of these elements of the handshape could be categorized as having one of two binary features: open or closed, in the case of the thumb or fingers, and straight or hooked, in the case of the index finger. Our analysis treated each of the elements of the handshape of the preceding or following environment in a separate factor group. Table 1 shows how we coded for the features of the preceding and following segments in three binary factor groups.

13. Social Factors

In addition to these linguistic factor groups, all of the variables were coded for a range of nonlinguistic factors: geographic region, age, gender, ethnicity, social class, and language background. (See Lucas, Bayley, and Valli [2001] for a full discussion of the results for these factors.)

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1. Some of the target signs are two-handed signs (e.g., WEEK) and our focus is on the dominant hand.
14. Analysis

Data were analyzed with Rand and Sankoff’s (1991) Macintosh version of VARBRUL (Rousseau and Sankoff 1978; Sankoff 1988), a specialized application of logistic regression that has long been used in studies of spoken language variation (see, e.g., Guy 1980, 1991; Houston 1991; Labov 1989). The purpose of a VARBRUL, or variable rule, analysis is to quantify and test the significance of the multiple factors that may potentially affect language users’ choices of variable linguistic forms (Bayley 2002). In variable rule analysis, a value, or VARBRUL weight, between 0 and .5 indicates that the factor in question disfavors the variant that has been selected as the application value, or the variant that counts as an application of the “rule” being investigated. A value or weight between .5 and 1.0 favors application of the rule. However, VARBRUL weights, loosely termed “probabilities,” need to be interpreted in relation to the input probability or the overall likelihood of the use of a particular variant, regardless of the influence of any individual factor in the environment. For example, in table 3, we see that following signs produced lower than the citation form of DEAF favor the contact-cheek variant of DEAF, with a weight of .579, even though the contact-cheek variant is used only 25 percent of the time in this environment. Note, though, that the overall use of the contact-cheek variant is only 20 percent.

15. Results

The results of the multivariate analyses indicate that, for each of the variables, grammatical function is the most important linguistic constraint in the choice between citation and noncitation forms. In comparison, phonological factors play a relatively minor role. In this section we present the results for the linguistic factors for each of the three variables. We then focus on the relationship between the grammatical and the phonological constraints.

16. DEAF

For DEAF, noncitation forms were far more common than citation forms. Of the 1,618 tokens of DEAF analyzed in this study, only 500, or 31 percent, were in citation form. Of the noncitation forms, 889 tokens, or 55 percent, were chin-to-ear, and 229, or 14 percent, were contact-cheek. The analysis of variation in the form of DEAF is based on a two-stage model of rule ordering. In the first stage, the citation form (+cf, ear-to-chin) may undergo metathesis to chin-to-ear; that is,
the order of the parts of the sign—in this case the location—may be reversed. In the second stage, forms that have undergone metathesis may undergo a further process of reduction—from chin-to-ear to contact-cheek. That metathesis precedes the process of reduction is seen in the fact that compounds such as DEAF\(^{\text{WAY}}\) or DEAF\(^{\text{CULTURE}}\) begin with the contact-cheek form of DEAF. If metathesis had not occurred, we would expect the sign to begin at the ear location, as we explain later. Results for the analyses of DEAF are shown in tables 2 and 3.\(^7\)

Grammatical function and discourse genre proved to be the only significant linguistic factors in the choice between the citation and the noncitation forms of DEAF. Compounds favored a noncitation form; nouns and adjectives, the great majority of the tokens, constituted the nearly neutral reference point; and predicate adjectives disfavored a noncitation form. These results confirm Lucas’s (1995) pilot study, which shows that the choice between citation and noncitation forms of DEAF is conditioned by the grammatical function of the sign rather than by the features of the preceding or following signs.

As noted earlier, the second analysis involved a choice between the chin-to-ear variant and the contact-cheek variant, with citation forms (ear-to-chin) excluded. In this analysis, grammatical function again proved to be the first-order linguistic constraint. As table 3 shows, compounds strongly favor the reduced form of contact-cheek, nouns are neutral, and adjectives and predicates disfavor the reduced form. However, unlike the first analysis between citation and noncitation forms, the second analysis, which included only the two noncitation variants, did select a significant phonological constraint. The location of the following sign significantly affected signers’ choice between the chin-to-ear and the contact-cheek variants. When the following sign was between the ear and the chin (middle) or null (a pause), contact-cheek was disfavored. When the following sign was at the ear or above or at the level of the chin or below, contact-cheek was favored. These results may best be explained by the need to maintain a distinction between DEAF and the following sign. Thus, the contact-cheek variant may be freely used if the location of the following sign is at the ear or above or at the chin or below (i.e., if the location of the following sign is somewhere other than at the cheek).

16.1. Location of Signs Represented by KNOW

Multivariate analysis of 2,594 tokens shows that variation in the location of the class of signs represented by KNOW is systematic and constrained by factors operating at different linguistic levels. The noncitation forms of these signs, produced lower on the face or head than the citation
form, are slightly more common than the citation forms. Noncitation forms account for 53 percent of the tokens, and citation forms 47 percent. The following discussion sets out our findings of significant contributions of the linguistic factor groups.

As in the case of DEAF, we assumed that the citation form was the underlying form of the signs that make up this class. Among the linguistic factors, grammatical function, preceding location, and following contact proved significant at the .05 level. Table 4 shows the VARBRUL weights for the significant linguistic factor groups, with –cf defined as the application value. The table also includes the input probability and the overall totals.

As the spread in factor values suggests, grammatical function again proved to be the first-order constraint. Within the grammatical function factor group, prepositions and other grammatical function words are most likely to be produced at a location lower than the temple \( (p = .581) \). Nouns and verbs, which compose the great majority of tokens, form the nearly neutral reference point \( (p = .486) \), whereas adjectives favor the citation form \( (p = .316) \). The result for adjectives, however, should be treated with caution since the data contain only fifty-seven adjective tokens. We have no tokens for this factor from approximately 75 percent of the signers in the study.

With respect to the phonological factors, contact and location behaved somewhat differently from what we had expected. We coded for location and contact of the immediately preceding and following segments because we hypothesized that features in these environments would play a role in conditioning variation. Indeed, this proved to be the case, although to a limited extent. The results show that, among the phonological factor groups, only the location of the preceding sign and the contact of the following sign with the body, head, or base hand proved to have statistically significant effects. The other four factor groups—whether the preceding and following segments were part of a sign or a pause, whether the preceding segment contacted the body or the head, and the location of the following sign—all failed to reach significance.

The results for the location of the preceding sign suggest that assimilation is at work. If the preceding segment is produced on the head, the target sign is less likely to be produced in its noncitation location \( (p = .452) \). Preceding signs produced at the level of the body represent the neutral reference point \( (p = .503) \).

The feature \([+/- \text{ contact}]\) also influences the lowering of signs such as KNOW. A \([+\text{contact}]\) following segment disfavors –cf \( (p = .466) \). As with the location of the preceding
sign, the influence is in the direction of the citation form, whereas the factor we expected would account for the signs being produced lower (i.e., [–contact]) favors –cf only slightly ($p = .525$).

17. Signs Made with the 1 Handshape

In this section we report on separate VARBRUL analyses, with each of the three main variants of 1 handshape signs defined as the application value. These three variants compose 95 percent of the 5,195 tokens analyzed. Their relevant features are the following:

- +cf: citation form (index finger extended, thumb and fingers 2, 3, and 4 closed)
- L handshape: thumb extended, that is, different from the citation form with respect to a single feature
- open hand: thumb and fingers 2, 3, and 4 extended (the fingers other than the index finger), that is, the most phonetically distinct from the citation form

As with DEAF and the lowering of signs represented by KNOW, the noncitation forms occur more frequently than the citation forms of these signs. Moreover, variation is not limited to the first-person singular pronoun. Rather, it also occurs in other pronouns and lexical signs.

The overall results indicate that, among the linguistic factor groups, grammatical category, the preceding thumb, fingers, and index, and the following thumb and fingers all constrained the signers’ choices of one or another 1 handshape variant. Discourse type (narrative, conversation) and the position of the index finger in the following segment failed to reach significance in any of the statistical analyses. The choice of a 1 handshape variant was also not significantly affected by the presence or absence of a preceding segment. Signers were just as likely to use one of the noncitation forms if the target sign preceded or followed a pause.

As in the cases of DEAF and the lowering of signs such as KNOW, phonological constraints did not exert the strongest influence on the choice of a variant. Rather, the grammatical category proved to be the first-order linguistic constraint in two of the three VARBRUL analyses, with +cf and the open-hand variant defined as the application value. Grammatical category also significantly constrained signers’ choice of the L handshape variant. Results for the linguistic factors are shown in tables 5 and 6.

These results show that when +cf is selected as the application value, nouns and adjectives ($p = .838$), verbs and adverbs ($p = .727$), grammatical function signs ($p = .708$), wh-signs ($p = .647$), and PRO.3 ($p = .583$) favor the citation form. PRO.2 and PRO.1 ($p = .482, .223$) are more likely to be realized as some other handshape.
For the L handshape variant, the situation is nearly the reverse. Signers are more likely to choose this variant for wh-signs ($p = .581$) and PRO.2 and PRO.3 ($p = .568$), which do not differ significantly from one another, than for verbs and adverbs ($p = .474$) or nouns and adjectives ($p = .351$). For this variant, grammatical function signs ($p = .492$) and PRO.1 ($p = .515$) are relatively neutral in their effect.

Turning to the open-hand variant, we again see a pattern that is nearly the reverse of the pattern for +cf. Nouns and adjectives ($p = .219$), verbs and adverbs ($p = .275$), wh-signs ($p = .270$), and grammatical function signs ($p = .306$) all strongly disfavor the open-hand variant. PRO.3 ($p = .439$) also disfavors the choice of this variant, while PRO.2 ($p = .505$) is neutral. In contrast, PRO.1 ($p = .761$) strongly favors the open-hand variant, the form that differs most from the citation form.

The features of the surrounding handshapes also constrain variation in L handshape signs. A closed thumb in the preceding segment favors +cf ($p = .635$), as does a closed thumb in the following segment ($p = .628$). Similarly, closed fingers in the preceding segment ($p = .551$) and in the following segment also favor +cf ($p = .532$). A hooked index finger in the preceding sign slightly disfavors +cf ($p = .468$). These results suggest that assimilation is at work in handshape variation. As table 6 shows, the results of the analyses with the L handshape and open hand defined as the application values confirm this. Note also that the preceding and following thumb and fingers are clearly the most important features involved. In contrast to whether the preceding index finger was hooked or straight, which was significant only in the analysis with +cf defined as the application value, the positions of the preceding and following thumb and fingers were significant in all three analyses.

18. Discussion

18.1. Constraint Ranking

The core of our analysis of each variable involved identifying the linguistic factors that govern the observed variation. Following the model provided by studies of spoken language variation and heeding earlier claims about variation in sign languages, we hypothesized that features of the immediately preceding and following phonological environment would play key roles. For example, we hypothesized that the location of the preceding and following signs would be important for understanding the variation in DEAF and in the lowering of signs such as KNOW.
We also hypothesized that the handshape of the preceding and following signs would affect the variation of signs formed with a 1 handshape. We therefore included factor groups consisting of the features of the preceding and following segments.

However, Lucas’s earlier analysis of DEAF (1995), albeit with a relatively small number of tokens, had alerted us to the possible role played by grammatical function in explaining the variation. With those results in mind, in this study we included a factor group for the relevant grammatical categories of each variable along with the phonological and social factor groups. For DEAF, the grammatical categories included predicate adjective, noun, adjective, and adjective in a compound. For the analysis of the downward movement of signs represented by KNOW, they included prepositions and interrogatives, nouns, verbs, and adjectives, and for 1 handshape signs, they included pronouns and lexical signs, the latter divided into nouns, adjectives, verbs, adverbs, and grammatical function signs. Table 7 summarizes the ranking of the linguistic constraints for the variables and shows that grammatical function is the most powerful factor for all three. This is a very surprising finding, with substantial implications. We first discuss its importance in terms of each variable and then offer a more global explanation that unifies all three variables.

In the case of DEAF, we suggest that the role of grammatical constraints in the choice between a citation and a noncitation form represent a synchronic reflex of a change in progress in which compounds are the most favorable environment for innovative forms, followed by nouns and adjectives, and finally predicates. The specific order of events involved in the change is as follows. The citation form of DEAFis ear-to-chin. This form is attested early in the nineteenth century in the dictionary of French Sign Language prepared by Sicard (1808), a form that most probably was brought to America by Clerc in 1817. The sign undergoes the natural process of metathesis, whereby the initial location of the sign becomes not the ear but the chin or near it. In fact, we have a record of the metathesized form of DEAF in Veditz’s 1913 lecture on the preservation of ASL. This chin-to-ear form of the sign participates in the compounding process, resulting in ASL compound signs such as DEAF^WAY, DEAF^PEOPLE, and DEAF^WORLD. We know this because all of the compound signs with DEAF begin at a point on the cheek near the mouth. The first rule of compounding in ASL requires the first sign in a compound to retain its initial contact hold (i.e., a hold segment that has contact with the face or body) (Liddell 1984). Were the ear-to-chin form of DEAFthe first sign in compounds, we would expect compounds with DEAF to begin at the ear, but this never happens. They all begin low on
the cheek. This first contact hold is the contact-cheek form of DEAF that we see in our data and that occurs most frequently, but not exclusively, with compound signs. We also see both the chin-to-ear and contact-cheek forms occurring with predicates, nouns, and adjectives. As the results of the VARBRUL analysis demonstrate, then, when the citation (ear-to-chin) and noncitation forms (chin-to-ear and contact-cheek) of DEAF are compared, grammatical category accounts for the variation.

As we have seen, however, these findings do not mean that phonological factors never play a role. When we compare the noncitation forms to each other, the grammatical category is still the most important factor, but the location of the following sign also has a significant effect, and we have evidence of assimilation: Following locations lower than the usual location for the contact-cheek form favor this form, while a following location at the contact-cheek location (as in YESTERDAY or GIRL) and a following pause both disfavor the contact-cheek form and favor the chin-to-ear form. Following locations higher than the usual contact-cheek location also favor the contact-cheek form, but only 51 tokens are in that position, compared to 756 tokens where the following sign is lower than the contact-cheek location.

In the case of the lowering of signs such as KNOW, as with DEAF, grammatical function is again the most important factor. Specifically, prepositions and interrogatives are most likely to be produced at a location below the temple. Nouns and verbs represent the neutral reference point. Adjectives favor the citation form. And, as reported earlier, the phonological factors of the location of the preceding sign and body contact in a following sign proved significant. Thus, the features of the preceding and the following signs do affect location variation, but their role is not as strong as the one played by the grammatical category to which the sign belongs.

The results for variation in 1 handshape signs again show the major role of grammatical constraints. Grammatical function is the first-order linguistic constraint on two of the three main variants, +cf and the open-hand variant, and a significant constraint on the third, the L handshape. The 1 handshape findings suggest that conditioning at the level of discourse structure and information packaging may be more important for phonological variation in sign languages than previously thought. That is, there appears to be an inverse relationship between the “distance” of a form from the signing subject, that is, whether the referent is present in the immediate context, and the extent to which a handshape may diverge from the citation form.

We can view the three variants examined here as points on a continuum of distance from the citation form: the citation form itself, a form in which only the thumb is extended, and a class
of forms in which other fingers are also selected and extended. The most salient referent in the
discourse, the signer, is more likely to be referred to with a pronoun whose form may vary
maximally from the citation form. The addressee, also salient in the discourse setting, is more
likely to be referred to with a pronominal form that diverges from the citation form only in
features of the thumb. Third-person referents, those not present in the setting, are the most likely
among the pronouns to be the citation forms. In ASL pronouns, the indexical category is carried
by the tips of the fingers, regardless of the handshape used. In nonindexical lexical signs,
however, the whole handshape carries part of the semantic load. The handshapes in these classes
are the most likely to be the citation form. Lexical signs may be produced as the L handshape
variant, in which the thumb is also extended, but they are less likely to take a handshape that is
farther away from the citation form than are pronouns, as this could convey either a different
meaning or no meaning at all.

The analyses of the three variables show that we cannot assume that only features of the
preceding and/or following signs constrain phonological variation in sign languages. Indeed, the
results of the multivariate analyses presented here indicate that is not the case. Moreover, just as
in the study of variation in spoken languages, studies of variation in sign languages must be
based on large amounts of data collected from representative samples of the language
community (cf. Cameron 1996). With all three phonological variables examined here, we have
seen that, while it might seem reasonable to assume that the most important factors governing
variation have to do with features of the preceding and following segments, this assumption is
not always reliable. When examined in light of the actual language produced by real people, the
claims and assumptions about all three variables cannot be supported.

The influence on variation of factors other than features of the preceding and following
signs discussed here has also been found in other studies of ASL. In a small-scale study, Hoopes
(1998), for example, looked at signs such as THINK, WONDER, and TOLERATE, all signed in
citation form with the pinky closed but variably produced with the pinky extended. Again, we
might suspect pinky extension to be governed by the handshape of the preceding or following
sign, but this turned out to not be the case. Rather, pinky extension tended to occur with lexemes
used repeatedly within a discourse topic, before pauses, and with lexemes lengthened to almost
twice their usual duration. These findings suggest that pinky extension is itself a prosodic feature
of ASL that adds emphasis or focus to the sign with which it co-occurs. It is analogous to stress
in spoken language as indicated by a stronger signal as a result of greater articulatory effort.
Thus, in Hoopes’s study we do see the possible influence of a phonological factor, stress, as well as a discourse factor, repetition. The phonological factor, however, is unrelated to the features of the preceding or following signs.10

In another study, Mulrooney (2002) investigated variation in fingerspelling with the goal of determining what governs the production of noncitation forms of the individual signs that make up a fingerspelled word. Again, one might expect the immediate phonological environment to play some role, specifically the handshape of the immediately preceding or immediately following sign. However, neither of these turned out to have a significant effect. The immediately preceding and following locations had modest influence, but once again, the strongest role was played by the function of the fingerspelled word in which the target form occurred, with proper nouns favoring citation forms, common nouns being neutral, and verbs favoring noncitation forms.

The influence of grammatical function on phonological variation has also been observed in Australian Sign Language (Auslan). Schembri and Johnston (2004) have reported on an ongoing study of the lowering of a class of signs in Auslan similar to the class of signs represented by KNOW discussed earlier. In Auslan, signs in this class include nouns (e.g., NAME), verbs (e.g., KNOW), and adjectives (e.g., YELLOW). A multivariate analysis of 1,096 tokens collected from a representative sample of the Deaf communities in Perth and Sydney shows that grammatical function significantly constrains signers’ choice between a citation and a noncitation (lowered) form of signs in this class. Adjectives were most likely to be realized as +cf (p = .74), followed by nouns (p = .61) and verbs (p = .44).

Schembri and Johnston (ibid.) also found evidence of assimilation. Auslan signers’ choices between +cf and –cf were significantly constrained by the location of the preceding and following signs. Preceding and following signs produced at the level of the head favored +cf. Preceding and following signs produced and the level of the body slightly disfavored the +cf form, and a preceding or following pause disfavored +cf. However, at least in the combined results for two of the five cities that will eventually be included in the full study, Schembri and Johnston found that the location of the preceding and following signs did not exert as strong an influence on a signer’s choice between a +cf and –cf variant as did the grammatical function of the target sign.

In a larger study of location variation in Auslan, Schembri, Johnston, and Goswell (2006), drawing on Bybee’s (2002) recent work on the role of frequency in phonological change in
spoken languages, tested the effect of frequency as well as the factors examined in Schembri and Johnston (2004). They also added data from signers in three additional cities, Adelaide, Brisbane, and Melbourne. These most recent results show that grammatical function and frequency interact, a finding that might tend to call into question the role of grammatical function in their preliminary results. High frequency verbs, which comprise the majority of the 2,446 tokens in the Auslan corpus, are more likely to be realized as –cf than low frequency verbs, adjectives, or nouns, whether high or low frequency. Schembri, Johnston, and Goswell (in press) also point out that the frequency of lexical items in signed languages is not as well established as it is in spoken languages. Resources comparable to Kucera and Francis’s (1967) frequency list for written English or the British National Corpus for spoken and written English (Leech, Rayhson, and Wilson 2001) do not yet exist for any signed language. Therefore, sign language researchers must rely on much smaller corpora if they wish to test the effects of frequency on variation or acquisition. On the basis of their own corpus, Schembri, Johnston, and Goswell classify ten signs as frequent: THINK, KNOW, NOT-KNOW, MOTHER, NAME, REMEMBER, FORGET, UNDERSTAND, CONSIDER/WONDER, WORRY. These signs account for 80 percent of the tokens in their study. They note that most of these signs are also among the top 200 signs in the Wellington corpus of New Zealand Sign Language (McKee and Kennedy 1999), a language that is closely related to Auslan.

We suggest that Schembri, Johnston, and Goswell’s (2006) most recent results for the lowering of signs produced at the forehead are not incompatible with the results presented in this study for several reasons. First, grammatical function is implicated in the results presented in Schembri, Johnston, and Goswell because only frequent verbs favor a –cf variant. Frequent nouns do not. Rather, frequent nouns pattern with infrequent verbs, nouns, and adjectives. Second, Schembri, Johnston, and Goswell examine only one variable. Our study deals with three variables and grammatical function has an important role in variation in all three as well as in Mulrooney (2002) discussed earlier. Third, one of the variables examined in this study, DEAF, is a single sign. In the case of DEAF, the question of frequency is not relevant. And, grammatical function is clearly the first-order constraint on variation in the form of DEAF. This is not to deny the possibility that frequency may condition phonological variation in ASL. However, until we have a corpus of ASL that is comparable to the corpora developed for many spoken languages, we will not have adequate means to test whether frequency has an effect on variation independent of grammatical function—or of any other factors for that matter—or whether, as
appears to be the case for one variable in Auslan, frequency and grammatical function also interact in ASL.

To summarize, empirical research has consistently shown that grammatical function has an important role—most often the most important role—in conditioning phonological variation in sign languages. We see the major role of grammatical function not only in the three phonological variables discussed in this article but also in the results of studies such as those by Mulrooney (2002) and Schembri, Johnston, and Goswell (in press). We suggest that these empirical results may help us sort out the types of constraints that may be unique to sign languages (e.g., indexicality) and those that are common to all languages, whether spoken or signed.

19. Modality Differences and Phonological Variation

We have strong evidence that grammatical and prosodic constraints have a more important role than the features of the preceding and following signs in conditioning phonological variation in ASL. The challenge is to understand why this is so. The first answer is simply that, as in spoken languages, phonological variation in ASL is not constrained only by phonological factors, at least if these are restricted to the features of the preceding and following signs. The focus heretofore may have been on features of the preceding and following signs, but large data-based quantitative studies such as ours clearly show that grammatical factors must also be considered.

A second answer concerns differences between spoken and sign languages. Having established that sign languages are indeed languages, research on all aspects of sign language structure has begun to reveal some fundamental and most likely modality-related differences between spoken and sign languages. Of most relevance to the present study are the basic differences in how morphology functions and how they manifest themselves in variation. In many of the spoken languages in which phonological variation has been extensively explored, morphology is a “boundary phenomenon.” That is, meaningful segments are added to the beginning or the end of other units in the language in the form of plural markers, person and tense markers, derivational affixes, and so forth. These units are essentially added to an existing phonological environment. It stands to reason that when variation occurs, a good place to look for the cause of this variation is the immediate environment to which the units have been added (i.e., the preceding or following segments). In fact, many studies of spoken language variation have demonstrated the key role of the immediate phonological environment in governing variation.
However, morphology in sign languages is by and large not a boundary phenomenon, at least not to as great an extent. There exist very few affixes. Morphological distinctions are accomplished by altering one or more features in the articulatory bundle that makes up a hold or a movement segment or by altering the movement path of the sign. For example, segments are not usually added to other segments to provide information about person or aspect. Rather, the location feature of a segment (e.g., near or away from the signer) indicates person, and movement between locations indicates the subject and object of the verb in question. Similarly, a particular movement path indicates continuative or inceptive aspect. As Emmorey states with specific regard to aspect marking in ASL:

In many spoken languages, morphologically complex words are formed by adding prefixes or suffixes to a word stem. In ASL and other signed languages, complex forms are most often created by nesting a sign stem within dynamic movement contours and planes in space. . . . ASL has many verbal inflections that convey temporal information about the action denoted by the verb, for example, whether the action was habitual, iterative, continual. Generally, these distinctions are marked by different movement patterns overlaid onto a sign stem. This type of morphological encoding contrasts with the primarily linear affixation found in spoken languages. For spoken languages, simultaneous affixation processes such as templatic morphology (e.g., in Semitic languages), infixation, or reduplication are relatively rare. Signed languages, by contrast, prefer nonconcatenative processes such as reduplication; and prefixation and suffixation are rare. Sign languages’ preference for simultaneously producing affixes and stems may have its origins in the visual-manual modality (1999, 173).

The results of our analyses indicate that these fundamental differences manifest themselves in the variable components of the language. That is, the immediate phonological environment turns out not to play the major role in governing phonological variables, in part because the variables themselves are not affixes. The grammatical category to which the variable in question belongs is consistently the first-order linguistic constraint.

This finding has important implications for our understanding of variation in spoken and sign languages. As the modality differences between spoken and signed languages manifest themselves in the basic phonological, morphological, and syntactic components of the language, so they also seem to appear in the patterns of linguistic variation. As phonological and morphological processes go, so apparently goes variation.
The question now arises as to the parallels between ASL and spoken languages (e.g., Chinese) that, like ASL, do not use affixes to any great extent. The gist of the question is whether the variation in these spoken languages resembles that in ASL, specifically with respect to the prominent role of grammatical factors in governing the variation. As of this writing, the question is difficult to answer. Although numerous studies of Chinese dialects exist, relatively few employ variationist methods. Only one study, Bourgerie’s (1990) dissertation on sociolinguistic variation in Hong Kong Cantonese, considers the effect of grammatical class on phonological variation.

Bourgerie (ibid.) examined three sociolinguistic variables: initial n-/l-, initial ng-/o-, and initial k-/h- in third-person pronouns. Although his main focus was on the social dimensions of variation, he found that two of the three phonological variables were constrained by grammatical class. For the ng-/o- variable, adverbs and nonstative verbs were significantly more likely to be realized by the innovative initial, while stative verbs were much less likely to be realized in the innovative form. Grammatical class was also significant for the n-/l- variable. More than 80 percent of the tokens of verbs and adverbs were realized with the [l-] initial, compared to only 40 percent of demonstratives and particles (ibid., 137–38). Bourgerie’s results for grammatical class suggest that differences in modality alone may not fully account for the difference in the strength of grammatical constraints on phonological variation in spoken and sign languages.

However, in the absence of a substantial number of studies of sociolinguistic variation in Chinese and other languages that have no or only minimal inflectional morphology, we cannot rule out modality differences as a contributing factor to the patterns reported here. At this point, the role of grammatical factors in conditioning phonological variation in ASL seems to be best described as a matter of degree. There clearly are grammatical constraints on spoken language phonological variation, and features of preceding and following signs obviously influence variation in sign languages.

What we are suggesting, based on the results of our analyses, is that the difference in modality may account for a difference in the relative importance of the constraints. In the phonological variation observed thus far in sign languages, grammatical constraints are consistently more important than phonological ones. Ironically, it may be the visual nature of sign languages that reinforces the impressions and hypotheses that phonological variation in sign languages is governed by constraints having to do with the features of the preceding and/or following segments. That is, we can actually see the lower and higher locations that precede and
follow DEAF and signs such as KNOW; we can see the handshapes that precede and follow 1 handshape signs. Being able to see the phonological environment surrounding the variation easily leads to hypotheses about this environment accounting fully for the variation. But these hypotheses are simply not supported by our data.

20. Conclusion

This study, based on data from more than two hundred ASL signers across the United States, has shown that the variation found in three phonological variables is systematic. For all three variables—the sign DEAF, the downward movement of signs such as KNOW, and signs made with the 1 handshape—multivariate analysis shows that the grammatical category to which the sign belongs is the most important linguistic constraint. Features of the surrounding signs also significantly constrain signers’ choices among some variants. Thus, the analyses of the location of signs such as KNOW and 1 handshape signs indicate that assimilation is at work. Nevertheless, the influence of phonological factors is consistently less important than grammatical class. The pattern observed across all three phonological variables, as well as in studies such as Mulrooney (2002) and Schembri and Johnston (2004), may help us sort out the types of constraints (e.g., indexicality) that are unique to signed languages and those that are common to all languages, whether spoken or signed. Finally, the results reported here, we suggest, provide evidence that hypotheses about factors that constrain variation in signed languages, like hypotheses about variation in spoken languages, must be tested not through a few examples but in large-scale studies of the actual language used by broadly representative samples of the Deaf community.

Notes

1. In accordance with convention, English glosses of ASL signs are written in small capitals.

2. Liddell’s statement reflects a misunderstanding of the goals of empirical sociolinguistics. An individual example can tell us only what might be possible for a particular signer in a particular context. It cannot be used to dispute the results of a quantitative study of data collected in the language community. That can be accomplished only by carrying out a study of the same or a similar community and finding different results. Moreover, empirical sociolinguists do not claim certainty, nor do we claim to know which factors are associated with variation before we have investigated an adequate sample of data from users of the language.
Rather, in the case of DEAF, for example, the normal criterion for statistical significance ($p < .05$) means that there is only one chance in twenty that grammatical function is not associated with a signer’s choice of a form of DEAF. Of course, the larger and more representative the sample of the language community, the more confident we can be of our results. For that reason, we sought to confirm or disconfirm the results of Lucas (1995) by carrying out a much larger study of signers across the United States, reported in Bayley, Lucas, and Rose (2000) and Lucas, Bayley, and Valli (2001). Liddell (2003), however, comments only on the results of the pilot study reported in Lucas (1995) rather than the results of the much larger national study.

3. Note that Liddell and Johnson’s (1989) transcription of the sign is MHMMH as opposed to HMH. These differences in transcription simply reflect different levels of detail and do not affect the fundamental issue of treating signs as sequential.

4. Olathe is in Kansas, near Kansas City. The white signers from this region all resided in Olathe, while the African American signers resided in Kansas City, Missouri. Two other sites included signers from neighboring areas. The Fremont location included some signers from San José, and the Boston site included young signers at the Learning Center for Deaf Children in Framingham, Massachusetts.

5. It may be argued that DEAF as used in compounds such as DEAF^WORLD and DEAF^CULTURE is also an adjective. However, terms such as these, which are particularly salient in the Deaf community, have come to be regarded by ASL natives as single lexical items, much as English “breakfast.”

6. Some signers were minor participants in the group conversations or were positioned out of camera range. In such cases, it was not possible to code fifteen tokens.

7. In table 3 and elsewhere we have combined factors within groups that did not differ significantly from one another in cases there was linguistic justification for doing so.

8. A step-up/step-down analysis confirms this interpretation of the spread in factor values. This type of analysis involves performing a run with only one factor group and then adding each of the other factor groups to the analysis, one at a time, until all of the factor groups are included. When the full model with all of the factor groups is reached, VARBRUL then removes one factor group at a time until only one remains. During each individual run, the factor weights and the log-likelihood are calculated. At the end of the analysis, the program outputs a file with the details of each run and an indication of both the best stepping-up run and the best stepping-down
run, which include only the significant factor groups, with $\alpha = .05$. For details of this and other features of VARBRUL analysis, see Young and Bayley (1996).

9. Even though the features of the preceding and following environment proved not to be significant in Lucas’s pilot study, we included them in this study because we suspected that some of the features would prove significant, given the much larger number of tokens we were working with. As the results show, this turned out to be the case.

10. It is possible that stress may also be implicated in the predicate adjective effect for DEAF. That is, predicate adjectives may favor +cf because they are frequently stressed. However, we are not in a position to evaluate this possibility at this time because, although we coded the data for a large number of factors, we did not code for stress.

11. Morford and Macfarlane (2003), for example, in a recent study of frequency characteristics in ASL, base their conclusions on a corpus of 4,111 signs produced by only 27 signers.

References


Veditz, G. 1913. Preservation of Sign Language. Veditz Collection, Gallaudet University Archives. Film.


Table 1. Variable 1 Handshape: Relevant Features of the Preceding and Following Segments

<table>
<thead>
<tr>
<th></th>
<th>Thumb</th>
<th>Fingers</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preceding segment</td>
<td>open/closed</td>
<td>open/closed</td>
<td>straight/hooked</td>
</tr>
<tr>
<td>Following segment</td>
<td>open/closed</td>
<td>open/closed</td>
<td>straight/hooked</td>
</tr>
</tbody>
</table>

Table 2. Variation in the Form of DEAF: +cf vs. –cf (Application Value: –cf)

<table>
<thead>
<tr>
<th>Factor group</th>
<th>Factor</th>
<th>Weight</th>
<th>Percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammatical function</td>
<td>Noun, adjective</td>
<td>.515</td>
<td>71</td>
<td>1063</td>
</tr>
<tr>
<td></td>
<td>Predicate</td>
<td>.370</td>
<td>58</td>
<td>361</td>
</tr>
<tr>
<td></td>
<td>Compound</td>
<td>.660</td>
<td>81</td>
<td>194</td>
</tr>
<tr>
<td>Discourse genre</td>
<td>Conversation</td>
<td>.489</td>
<td>69</td>
<td>1489</td>
</tr>
<tr>
<td></td>
<td>Narrative</td>
<td>.628</td>
<td>74</td>
<td>129</td>
</tr>
<tr>
<td>Total</td>
<td>Input</td>
<td>.743</td>
<td>69</td>
<td>1618</td>
</tr>
</tbody>
</table>

\(\chi^2/cell = 1.2952\), all factor groups significant at \(p < .05\); the application value is the form of sign which the algorithm is directed to focus on: in this case, the –cf, noncitation form.

Table 3. Variation in the Form of DEAF: Chin-to-Ear vs. Contact-Cheek (Application Value: Contact-Cheek)

<table>
<thead>
<tr>
<th>Factor group</th>
<th>Factor</th>
<th>Weight</th>
<th>Percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammatical function</td>
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<td>17</td>
<td>411</td>
</tr>
<tr>
<td></td>
<td>Adjective</td>
<td>.403</td>
<td>10</td>
<td>191</td>
</tr>
<tr>
<td></td>
<td>Predicate adjective</td>
<td>.338</td>
<td>12</td>
<td>299</td>
</tr>
<tr>
<td></td>
<td>Compound</td>
<td>.850</td>
<td>56</td>
<td>151</td>
</tr>
<tr>
<td>Following sign</td>
<td>Low</td>
<td>.579</td>
<td>25</td>
<td>756</td>
</tr>
</tbody>
</table>

288
<table>
<thead>
<tr>
<th>Factor group</th>
<th>Factor</th>
<th>Weight</th>
<th>Percentage</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammatical function</td>
<td>Preposition, interrogative</td>
<td>.581</td>
<td>59</td>
<td>485</td>
</tr>
<tr>
<td></td>
<td>Noun, verb</td>
<td>.486</td>
<td>52</td>
<td>2052</td>
</tr>
<tr>
<td></td>
<td>Adjective</td>
<td>.316</td>
<td>35</td>
<td>57</td>
</tr>
<tr>
<td>Preceding location</td>
<td>Body</td>
<td>.503</td>
<td>53</td>
<td>1648</td>
</tr>
<tr>
<td></td>
<td>Head</td>
<td>.452</td>
<td>48</td>
<td>614</td>
</tr>
<tr>
<td>Following contact</td>
<td>No contact</td>
<td>.525</td>
<td>55</td>
<td>1323</td>
</tr>
<tr>
<td></td>
<td>Contact</td>
<td>.466</td>
<td>48</td>
<td>991</td>
</tr>
<tr>
<td>Input</td>
<td>Total</td>
<td>.518</td>
<td>53</td>
<td>2594</td>
</tr>
</tbody>
</table>

Note: χ²/cell = 1.1702; all factor groups are significant at p < .05; results for preceding location and following contact do not include pauses, which were tested in separate factor groups that proved not to be significant.

Table 5. Variation in 1 Handshape Signs by Grammatical Category

<table>
<thead>
<tr>
<th>Factor</th>
<th>+cf, One Hand</th>
<th>–cf, L Handshape</th>
<th>–cf, Open Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noun, adjective</td>
<td>.838</td>
<td>.351</td>
<td>.219</td>
</tr>
<tr>
<td>Verb, adverb</td>
<td>.727</td>
<td>.474</td>
<td>.275</td>
</tr>
</tbody>
</table>

Note: χ²/cell = 1.0294; all factor groups are significant at p < .05.
### Table 6. Variation in Handshape Signs by Features of the Preceding and Following Segments

<table>
<thead>
<tr>
<th>Factor group</th>
<th>+cf</th>
<th>–cf, L Handshape</th>
<th>–cf, Open Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preceding thumb</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>.635</td>
<td>.390</td>
<td>.440</td>
</tr>
<tr>
<td>Open</td>
<td>.426</td>
<td>.560</td>
<td>.532</td>
</tr>
<tr>
<td><strong>Preceding fingers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>.551</td>
<td>.573</td>
<td>.385</td>
</tr>
<tr>
<td>Open</td>
<td>.463</td>
<td>.446</td>
<td>.585</td>
</tr>
<tr>
<td><strong>Preceding index</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight</td>
<td>.512</td>
<td>ns</td>
<td>Ns</td>
</tr>
<tr>
<td>Hooked</td>
<td>.468</td>
<td>ns</td>
<td>Ns</td>
</tr>
<tr>
<td><strong>Following thumb</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>.628</td>
<td>.389</td>
<td>.429</td>
</tr>
<tr>
<td>Open</td>
<td>.419</td>
<td>.570</td>
<td>.545</td>
</tr>
<tr>
<td><strong>Following fingers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>.532</td>
<td>.597</td>
<td>.375</td>
</tr>
<tr>
<td>Open</td>
<td>.477</td>
<td>.431</td>
<td>.590</td>
</tr>
</tbody>
</table>

Note: 1,021 tokens were preceded by a pause, which was coded as not applicable for features of the preceding segment; 617 tokens were followed by a pause, which was coded as not applicable for features of the following segment.
**Table 7. Summary of Linguistic Constraints on Phonological Variation in ASL**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Analysis</th>
<th>Constraint Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEAF</td>
<td>+cf vs. –cf</td>
<td>Grammatical function &gt; discourse genre</td>
</tr>
<tr>
<td></td>
<td>Chin-to-ear vs. contact-cheek</td>
<td>Grammatical function &gt; location of following segment (assimilation)</td>
</tr>
<tr>
<td>Location of KNOW, etc.</td>
<td>+cf vs. –cf</td>
<td>Grammatical function &gt; contact with body of following sign &gt; location of preceding sign</td>
</tr>
<tr>
<td>1 handshape</td>
<td>+cf vs. –cf</td>
<td>Grammatical function &gt; features of preceding and following handshapes (assimilation)</td>
</tr>
<tr>
<td>L handshape vs. all others</td>
<td>Features of preceding and following handshapes (assimilation) &gt; grammatical function</td>
<td></td>
</tr>
<tr>
<td>Open hand vs. all others</td>
<td>Grammatical function &gt; features of preceding and following handshapes (assimilation)</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1a. DEAF, variant 1: ear-to-chin**
Figure 1b. DEAF, variant 2: chin-to-ear

Figure 1c. DEAF, variant 3: contact-cheek in the compound DEAF CULTURE
Figure 2a. KNOW and FOR, citation form

Figure 2b. KNOW and FOR, noncitation form

Figure 3a. ONE, citation form Figure the L

3b. 1 handshape: handshape variant

Figure 3c. 1 handshape: the open-hand variant
Figure 4
DEAF, citation form

Handshape: 1 1
Location: Palm in Palm in
Orientation: M

<table>
<thead>
<tr>
<th></th>
<th>Location</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Handshape</td>
<td>Palm in</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>Palm in</td>
</tr>
</tbody>
</table>
This paper reports on a study of sociolinguistic variation in lexical numerals in New Zealand Sign Language (NZSL). The aim was to determine how social factors of age, region and gender condition signers’ choice of variants for numerals 1 to 20. The numeral study was conducted as a pilot for the larger ‘Sociolinguistic Variation in NZSL’ project,\(^1\) a quantitative investigation (in progress) of the correlation between variable linguistic structures and social characteristics of Deaf NZSL users. The larger project is modelled closely on the methodology of two preceding studies of sociolinguistic variation in ASL (Lucas, Bayley & Valli 2001) and in Auslan (Schembri & Johnston 2004), with the aim of enabling cross-linguistic comparison that will potentially illuminate whether similar factors and processes condition variation across signed (and spoken) languages.

Numeral signs were selected for a pilot study, as they are anecdotally known to be a variable part of the NZSL lexicon. The importation of Auslan number signs via Australasian Signed English from 1979, and indeed the general increase in signing from this date, allowed us to hypothesise that age would be a clear predictor of variation in numeral usage. The study of numeral signs also allowed us to pilot the methodology for analysis of lexical variation in the larger project using non-sensitive and easily obtainable data. Findings of the numeral study may have applied relevance to teachers and interpreters of NZSL who frequently make choices between available variants.

Relatively few empirical studies have noted lexical variation in the number systems of signed languages. Some researchers have investigated psycholinguistic aspects of number use, such as Fuentes and Tolchinsky’s (2004) study of Deaf children’s accuracy in transcoding written numbers into Catalan Sign Language (LSC), in the hope this would provide further insight into the structure of LSC. Their study included a preliminary description of the LSC number system based on data collected from three members of the Deaf community who were also teachers, LSC course content,\(^1\)  

\(^1\) [http://www.vuw.ac.nz/lals/research/deafstudies/DSRU site/NZSL variation/variation project.aspx](http://www.vuw.ac.nz/lals/research/deafstudies/DSRU site/NZSL variation/variation project.aspx)
and observations at a Deaf association (2004:95). The authors acknowledge that such a small dataset does not account for variation in areas where LSC is used outside of Barcelona, and could even represent more academic variants, because their informants were teachers: “…we might have obtained somewhat different results from a larger quantity of occasional observations or by an augmentation of the number of different informants” (2004:114).

An experimental study by Leybaert and Van Cutsem (2002) compared knowledge of number sequence (abstract counting, object counting and creation of number sets) in young deaf and hearing children in Belgium, in order to investigate the effects of language modality and linguistic structure on development of number skills. The study notes that Belgian French Sign Language has a base five structure: between 1-5, the number of extended fingers literally represents numerosity, while signs for numbers 6-9, represent the visible number of digits plus 5 (also true in NZSL). Accordingly, Leybaert and Van Cutsem comment that BFSL numbers are intrinsically less arbitrary and more morphologically structured than spoken French numbers, but there is no mention of variant forms within the number lexicon.

Examining ASL numerals as evidence of historical creolisation processes, Fischer (1996) argues that they are a hybrid of old American and LSF number signs, which in turn derive from the number gestures used in the hearing cultures of their respective countries. She proposes that historically, ASL relexified LSF numbers to incorporate American gestures (for numbers 1-5), except for 3, which retains the French gesture, borrowed via LSF. Fischer describes sub-lexical variants in the morphology of some number forms (eg, the movement of ‘teen’ numbers in ASL), but does not observe any other lexical variants for numerals within ASL or LSF.

In comparison to older and more documented languages such as ASL or LSF, the contemporary numeral lexicon in NZSL appears relatively unstable, with several variants for a single number co-existing in common usage. Our quantitatively designed study aims to explain patterns in that variation, which may in turn contribute to understanding the origin of numeral signs in NZSL and processes of lexical change more generally in the NZSL community.

1. The NZSL community

With a national population of approximately four million, the (Deaf) NZSL community is estimated to be between 4,500 and 7,700 (Dugdale, 2000; Statistics New Zealand, 2001). There are two large Deaf communities with thriving Deaf clubs in Auckland and Christchurch, and sizeable Deaf communities in Palmerston North, Wellington (in the central region), and Hawkes Bay (in the East).
From 1880 - 1942, there was one school for the deaf in Christchurch (in the South Island) which all deaf children were required to attend. Two schools were later established in the North Island – one in Auckland in 1942 and a Catholic school in Wellington in 1944. All schools were co-ed, and enrolled both Maori (indigenous) and Pakeha (white) children. Deaf education in NZ used strictly oralist methods until 1979, when Total Communication (TC) was introduced. The manual component of TC was Australasian Signed English, a sign system based largely on native sign vocabulary from the state of Victoria in Australia, supplemented by contrived signs (Collins-Ahlgren, 1986). A proportion of the Auslan vocabulary overlapped with signs already in use in NZ, but many traditional NZ signs were supplanted the new TC lexicon (including whole sets of signs such as colours, numbers, days of the week, kinship terms). An Auslan vocabulary base was adopted for use in education because it was widely believed at the time that there was no adequately ‘systematic’ sign language in use by the NZ Deaf community, as a result of their oralist educational history. This was an inaccurate perception, but a scholarly linguistic description of NZSL was not available until the late 1980s (Collins-Ahlgren, 1989). Although its status has risen greatly since then, (including recognition as an official language in 2006), NZSL is still relatively under-described, particularly in sociolinguistic terms.

NZSL is historically part of the British Sign Language family, and has been empirically shown to be closely related to contemporary Auslan and BSL (Johnston 2000; McKee and Kennedy 2000), languages from which signs continue to be freely borrowed. NZSL can be described as a young language in a small community that has no established tradition of Deaf teachers or use of NZSL in education or public media. Although NZSL has now gained acceptance in the educational domain, the majority of deaf students have been mainstreamed since the 1980s, with negative ramifications for the transmission of NZSL between generations. Enrolment at the two remaining Deaf Education Centres (formerly schools for the deaf) has dwindled to between 30 - 60 students in either centre. Professional interpreters were first trained in 1985, and NZSL has been taught in community education settings by Deaf tutors since the early 1990s. These sociohistorical factors contribute to variation within the NZSL community, which has not yet been empirically studied beyond the descriptive documentation of variants in *A Dictionary of New Zealand Sign Language* (Kennedy et al, 1997).

2. **Participants and data for the research**

Participants in the study comprised 109 Deaf people from around New Zealand. Four were students in a university Deaf Studies class and all others were recruited at one of three large Deaf events: a
Deaf school reunion, a Deaf youth camp, and at a Deaf club. All participants had acquired NZSL before the age of 12 years, and the majority before the age of seven.

Social variables for analysis were age group, region and gender. Demographic data gained in a short interview with each participant enabled us to code for these factors. Table 1 shows a breakdown of participant characteristics.

**TABLE 1: Participant characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender totals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>49</td>
<td>45</td>
</tr>
<tr>
<td>Male</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>109</td>
<td>100</td>
</tr>
<tr>
<td><strong>Age group totals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-29</td>
<td>34</td>
<td>31.2</td>
</tr>
<tr>
<td>30-44</td>
<td>30</td>
<td>27.5</td>
</tr>
<tr>
<td>45+</td>
<td>45</td>
<td>41.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>109</td>
<td>100</td>
</tr>
<tr>
<td><strong>Region totals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South</td>
<td>64</td>
<td>58.7</td>
</tr>
<tr>
<td>North</td>
<td>45</td>
<td>41.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>109</td>
<td>100</td>
</tr>
</tbody>
</table>

Although a representative sample of the community was sought, the cells for each social category are not completely balanced as recruitment of participants was opportunistic, depending on attendance at Deaf events, rather than following a strictly planned sample.

Eight participants were excluded from analysis due to late NZSL acquisition or extended residence overseas which would potentially influence their vocabulary.

### 3. Data collection

Data were collected by a Deaf researcher, who is an immigrant member of the NZSL community. Signs were video-recorded in brief, individual elicitation sessions, in an area that was semi-private
from the main event. First, participants were asked some background questions to allow coding of social variables, and to ensure the participants met the criteria of lifetime (native or near-native) users of NZSL. The questions were:

- Where do you live and for how long have you lived there?
- What school/s did you attend, and at what age?
- (If not early Deaf school attendance) At what age did you acquire NZSL?
- What is your age now?

Participants were asked to produce numbers 1 to 20 counted in sequence, followed by signing individual numbers in response to flash cards that were presented in a consistent, but non-sequential order. Only data from the non-sequential task was analysed to avoid the possible effects of sign choice on production of a conventional sequence.

Because of the potentially large number of variants we needed to analyse, it was not a goal of this investigation to compare numerals produced in sequential and non-sequential conditions. In hindsight, we believe it would have been methodologically stronger not to have included the initial counting task, as this could have primed participants to produce numeral signs that are not necessarily consistent with forms they would spontaneously produce at random, or embedded in natural discourse. Interestingly though, some signers did produce forms that differed between the sequential and non-sequential conditions, suggesting that this effect was minimal for those signers. We should also note that it is possible that producing number signs in response to seeing written Arabic numerals might elicit different forms than those produced when enumerating or counting items presented visually.

4. Analysis

The three age groupings shown in Table 1 were based on changes in school policy with respect to sign language use, as follows: 15-29 years, 30-44 years, and 45+ years. Participants in the 15-29 group have potentially (though not uniformly) been exposed to the use of NZSL in education from 1993 onwards. Participants in the 30-44 age group would have been exposed to Australasian Signed English introduced from 1979. Finally, people in the 45+ group were mainly educated in residential schools or deaf units using purely oral methods. In fact, there are observable differences between the signing of 45 year olds and that of 65 year olds; for example, the oldest signers use more mouthing as a primary means of reference, a more restricted sign vocabulary, and little or no use of a conventional manual alphabet. However, we could not identify a definite historical point of change that would justify creating a further age band for the oldest generation.
Region categories were based on three historical Deaf school regions, which maintain large Deaf communities: Auckland (North), Palmerston North/Wellington (Central), and Christchurch (South). Participants were assigned to a region according to where they had predominantly lived for the preceding ten years. Participant 93, for example, was born and grew up in Wellington, but had lived in Auckland for the past ten years, leading us to decide that he should be coded as North region. Participants who reported living continuously in a smaller centre were categorised in the closest of the three major regional centres. Exceptions to this were made for individuals who had spent most of their formative and adult years in the location of another large Deaf community, and moved relatively recently to a smaller town without a Deaf community, in which case we coded them to their original region of NZSL exposure.

It is difficult to isolate the effects of a Deaf individual’s place of schooling and their current regional identity on their adult language use. We chose not to use place of school attendance as a variable of analysis, as it was not possible to account for it in a consistent manner. This is because the majority of NZSL users below the age of 45 have attended a combination of two or three school settings including deaf school, deaf unit, and mainstream, and sometimes in different geographical locations. Current long-term place of residence (10+ years) was therefore selected as the basis for assigning regional identity, even though it is an ethnographically crude measure in the context of the NZSL community where school origin could be argued to have equal bearing on language use.

We first coded and analysed the data in relation to three regions - North, Central, South. The results showed no significant difference between Central and South signers, so these categories were subsequently collapsed into a single region, South. Ethnographically, this is a valid decision, as the Central region is within the enrolment zone for the southern deaf school in Christchurch. The deaf school in the central region was a Catholic school which closed in the early 1980s, which a relatively small proportion of older signers had attended.

Following numerical coding of the data for social categories and variants produced by each participant, data was exported to SPSS and analysed using logistic regression, following the backwards stepwise method to model the effect of the independent social variables (age, gender, and region) on the dependent variable (occurrences of the variant forms of each number).

Varbrul, a statistical package designed for determining the relative strength of independent variables in predicting variation in language use (Paolillo, 2002), was used on subsets of the data to identify the relative weighting of social factors in sign choice.
5. Findings

Ten out of the twenty numerals showed a high level of consistency in the forms that signers produced, and were therefore not suitable candidates for further quantitative analysis of variation. Table 2 lists these in order of their uniformity in the dataset.

<table>
<thead>
<tr>
<th>Numeral</th>
<th>Degree of consistency in forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 4, 5</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>99%</td>
</tr>
<tr>
<td>14, 16</td>
<td>93.6%</td>
</tr>
<tr>
<td>15</td>
<td>92.7%</td>
</tr>
<tr>
<td>7</td>
<td>90%</td>
</tr>
<tr>
<td>17</td>
<td>87.3%</td>
</tr>
</tbody>
</table>

From the ten numerals that did reveal variation (3 and 13, 8 and 18, 9 and 19, 10, 11, 12, 20), this paper will report on findings about four examples in order to illustrate the effects of different social factors on variation in numeral signs.

6. Number Eight: Age Effect

Eight was the first number we examined in detail as a test case (see Major 2005). We selected eight for close analysis because it has an unusually high number of co-existing variants. Four main variants were identified in the data, as shown in Table 3.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
</table>
| Forms A and D also have two and one-handed sub-variants, respectively, but it was decided not to treat these as distinct forms. A fifth variant recorded was a ‘tracing’ form in which the index finger
writes’ the numeral 8 in the air. This technique is often used by elderly signers (who experienced the strictest form of oralism) to represent letters and numbers; however the tracing form did not occur frequently enough in the dataset (for any of the numbers) to warrant inclusion in quantitative analysis.

The most frequent forms for 8 were A and B, together accounting for 101 out of 109 cases in the data. Descriptive statistics indicated that C and D did not occur frequently enough to meet assumptions for parametric testing and were thus eliminated from analysis. The data for forms A (n=77) and B (n=24) were analysed using logistic regression in SPSS. Having reduced the nominal categories of the dependent variable to two, binary logistic regression modelling was carried out.

Results showed that in the case of number 8, neither region nor gender are statistically significant predictors of which variant is used (i.e., they did not have a p value at or below 0.05). Age, however, was found to have a significant effect on the selection of variant. This effect was apparent whether age was considered in age groupings, or by individuals’ actual age in years. Using a logistic regression model with centered-age as the sole covariate, it was possible to explore how selection between the A and B forms was influenced by departures from the mean age.

We found that the probability of using the A form increases with rising age. Inversely, the probability of using the alternative variant B decreases with rising age. For example, signers at the mean age of 39 years have only a 12% (0.117) probability of using the A variant, while the probability of signers below this age using it decreases exponentially. Descriptive statistics showed that the ‘A’ variant was not used at all by participants under the age of 30. Signers at the mean age of 39 years had an 88% (0.883) probability of using the B form, and the probability of its use increases exponentially for each year of decreasing age. Descriptive statistics showed that B was used by all of the participants aged under 30, but was used by only 18% of those aged over 65.

On this basis, A can be called the ‘old sign’, and B the ‘new sign’, with clear evidence of a change towards B, which is apparently complete in the youngest generation.

The A form (like D) is used variably with or without a base ‘5’ weak hand by older signers. This example, and a similar form for number 9 (see form C, table 4), suggests that a two-handed system for numerals above five is being replaced by the one-handed Auslan forms introduced via TC. This may reflect a pattern of change towards the reduction (or in this case replacement) of more phonologically elaborate forms.

7. Homonyms for 3 and 8

Our data show that some signers use A (as in table 3) to mean 3, and some use it to mean 8. (The more common form for 3 in NZSL is the ASL ‘W’ handshape, while the more common form for 8 is B, in table
3.) 19% of participants used form A for 3, and 22% of signers used it for 8. Using a manual homonym for 3 and 8 is especially common in signers aged 45+ in the South region, who use mouthing to disambiguate meaning. We did not track in this data whether the same individuals used this form to mean both 3 and 8, but from observation we know that for many older individuals, the numeric meaning of a 3-digit handshape (3 or 13 or 8 or 18) depends on mouthing. The ‘W’ handshape (a one-handed version of D as table 3), is also used interchangeably by some signers for both 3 and 8.

This example points to the integral role of mouthing in numeric reference and in the lexicon more generally in NZSL, especially among older signers. The fact that fewer younger signers favour potentially ambiguous forms for 3 and 8 suggests a shift away from reliance on the mouth to specify meaning, towards a preference for distinctive manual forms.

8. Number 9: an unclear case

Three main variants were found for number nine, as illustrated in table 4.

Because of the zero cells (eg, no North, young signers and no South, young or middle aged signers using the C variant), C was removed from the analysis, and logistic regression done on variants A and B. No significant difference were found. However the descriptive data suggest emergent patterns related to age and region factors.

**TABLE 4: Number 9 variants distributed by region**

<table>
<thead>
<tr>
<th>Region</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>21 (46.6%)</td>
<td>18 (40%)</td>
<td>6 (13.4%)</td>
<td>45 (41.28%)</td>
</tr>
<tr>
<td>South</td>
<td>41 (64%)</td>
<td>3 (5%)</td>
<td>17 (26.5%)</td>
<td>64 (58.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>62 (56.9%)</td>
<td>21 (19.26%)</td>
<td>23 (21.1%)</td>
<td>109</td>
</tr>
</tbody>
</table>
Table 5 shows that it is mainly the younger age groups who favour the innovative A form, suggesting a possible change in progress towards this form. While other Auslan number signs have been widely adopted (such as 6, 7, and 8,) the Auslan (B) form for nine is difficult for some signers to articulate - requiring the pinky finger to be folded towards the palm. This is a possible reason that the A variant is strongly competing with it.

Although variant C - the oldest form – is overall used slightly more than variant B, its distribution by age suggests that is likely to soon disappear, as it is used by none of the youngest age group in either region, and by almost none of the middle age group.
### TABLE 6: Number 9 variants distributed by region and gender

<table>
<thead>
<tr>
<th>Region</th>
<th>Gender</th>
<th>Variant A</th>
<th>Variant B</th>
<th>Variant C</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>Female</td>
<td>9</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>12</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>North Total</td>
<td></td>
<td>45</td>
<td>21 (47%)</td>
<td>18 (40%)</td>
</tr>
<tr>
<td>South</td>
<td>Female</td>
<td>12</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>29</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>South Total</td>
<td></td>
<td>64</td>
<td>41 (64%)</td>
<td>3</td>
</tr>
</tbody>
</table>

Results showed no statistically significant effect for gender on number 9, although the frequency data show some tendencies. In the North, variants are quite evenly distributed across both genders, while in the South, there is a strong male preference for form A, with zero use of form B by men. As noted above, articulatory considerations could be a factor also related to gender, as the B form requires finer digital dexterity to produce than forms A and C. In a similar vein, we found that in the case of number 10, males clearly disfavoured a form with a flicking motion of the middle finger off the thumb, which is a rather delicate or marked handshape and movement, and preferred a variant with a less complex open 5 handshape.

### 9. Number 11: age and gender effect

Although six variants were recorded for number eleven, only the two main variants had sufficient tokens to analyse. Form A (in table 7), or index shake was introduced via TC in 1979, while form B (in which the two fingers move downwards) is an older sign. Overall, form B is more prevalent, accounting for 60% of tokens, while A accounts for 32%. The remaining 8% of tokens were made up by the other variants.

The logistic regression analysis showed significant main factor effects for age and gender. Confirmatory chi-square analysis showed a main effect for age, with index shake (A) more likely in the youngest group, and two fingers (B form) more likely in the middle group. The chi-square for
gender approached significance, and when region was held constant, males across age groups used B more than females.

TABLE 7: Number 11 variants distributed by age, gender and region

<table>
<thead>
<tr>
<th>Age group</th>
<th>A (n = 35)</th>
<th>B (n = 65)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-29</td>
<td>18</td>
<td>16</td>
<td>34</td>
</tr>
<tr>
<td>30-44</td>
<td>6</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>45+</td>
<td>11</td>
<td>26</td>
<td>37</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>20</td>
<td>23</td>
<td>43</td>
</tr>
<tr>
<td>Male</td>
<td>15</td>
<td>42</td>
<td>57</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North</td>
<td>27</td>
<td>16</td>
<td>43</td>
</tr>
<tr>
<td>South</td>
<td>8</td>
<td>49</td>
<td>57</td>
</tr>
</tbody>
</table>

(9 of the 109 cases (8%) in the data were comprised of other variants. Of these 9 ‘other’ tokens, 7 were produced by South signers).

While logistic regression did not reveal a significant effect for region, there was a strong trend (p=.068) for regional variation, as shown in table 7. The frequency data show that North signers favour A (the newer form) space signers favour B (the older form), showing some regional effect on this number. Taken alone, this may suggest that South signers are more conservative, but the interaction between age and region as discussed next for number 12 show that this may not be the whole picture.

10. **Number 12: Region, Age and Gender effects**

Results of logistic regression analysis for number twelve showed a significant interaction between region and age in signers’ choice of variant; frequencies are shown in table 8. Form A is an apparently recent innovation, while form B was introduced via TC. (Another traditional variant
exists, formed by the first two fingers closing onto the thumb, but this occurred too infrequently in the data to analyse.

A closer look at the frequencies reveals the relationship between region and age group. A clear regional contrast is seen in the age group 15-29 years: none of the youngest signers in the South use B, while this form is favoured by the same age group in the North. It is puzzling to see that 29% of the oldest (45+) group in South favour the B form, which was introduced via Signed English into the school system, well beyond their era of schooling.

A regional contrast is also evident in the middle age group 30-44 years: 67% of North signers favour B, but only 5% of the same age group in the South. The 12 sign is thus a possible lexical marker of South vs North identity, at least in signers under 45 years old. The regional split within these two age groups accounts for the region by age interaction.

### TABLE 8: Number 12 variants distributed by region and age

<table>
<thead>
<tr>
<th>Region</th>
<th>Age group</th>
<th>A</th>
<th>B</th>
<th>Other variants</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>15-29</td>
<td>7</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>30-44</td>
<td>6</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>45+</td>
<td>6</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>North Totals</td>
<td>N = 44</td>
<td>19 (43%)</td>
<td>20 (46%)</td>
<td>5 (11%)</td>
</tr>
<tr>
<td>South</td>
<td>15-29</td>
<td>13</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>30-44</td>
<td>17</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>45+</td>
<td>4</td>
<td>19</td>
<td>8</td>
</tr>
<tr>
<td>South Totals</td>
<td>N = 64</td>
<td>34 (52%)</td>
<td>22 (34%)</td>
<td>8 (13%)</td>
</tr>
</tbody>
</table>
### TABLE 9: Number 12 variants distributed by region and gender

<table>
<thead>
<tr>
<th>Region</th>
<th>Gender</th>
<th>Variant A</th>
<th>Variant B</th>
<th>Other variants</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>Female</td>
<td>6</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>13</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>North Total</td>
<td></td>
<td>19 (42%)</td>
<td>20 (44%)</td>
<td>6 (13%)</td>
</tr>
<tr>
<td>South</td>
<td>Female</td>
<td>14</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>20</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>South Total</td>
<td></td>
<td>34 (53%)</td>
<td>22 (34%)</td>
<td>8 (13%)</td>
</tr>
</tbody>
</table>

Analysis of number 12 also shows a statistically significant interaction between region and gender. Table 8 shows that within the North region, men and women use forms A and B in almost exactly opposite proportions, with women favouring the newer sign (B). In the South, both men and women favour form A although a gender difference is apparent in the proportions – men being more evenly split between A and B. Comparison between regions shows that North women favour form B, while South women favour A, again in nearly opposite proportions. Overall, A is strongly favoured in the South, while B is slightly favoured in the North, and more so by women. This is similar to results for numbers 9 and 11 which show South, male signers to disfavour the newer Auslan form.

### 11. Overall effects of social factors on numeral variation

To gain an overall picture of how the social variables condition variation in numeral forms generally, we combined all tokens produced for the ten numbers that varied.\(^2\) We then collapsed the variants (the dependent variable) into two categories: ‘frequent’ and ‘non-frequent’ forms. All forms that were the most common sign produced by participants were coded as ‘frequent’, and all other forms as ‘non-frequent’.

---

\(^2\) We thank Adam Schembri for this suggestion and advice with this analysis.
For this overall analysis, we re-grouped participants into four age group categories to test our observation that there was a difference in the lexical choices of signers over the age of 65 years; thus the third age group was sub-divided into 45-64, and 65+ years. Also we decided to use the three original regions for this analysis to see if more regions may have an impact on factor weight for using non-frequent numeral forms.

Varbrul was used to analyze the effect of social variables on the probability of using a non-frequent form. In Varbrul, factor weights over .5 indicate an increased likelihood to favour the application value while those below .5 indicate an increased likelihood to disfavour it. In this analysis, we selected ‘non-frequent forms’ as the application value.

TABLE 10: Overall likelihood of using non-frequent numeral forms

<table>
<thead>
<tr>
<th>Factor Group</th>
<th>Factor</th>
<th>Varbrul Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td>15-29</td>
<td>.308</td>
</tr>
<tr>
<td></td>
<td>30-44</td>
<td>.397</td>
</tr>
<tr>
<td></td>
<td>45-64</td>
<td>.685</td>
</tr>
<tr>
<td></td>
<td>65+</td>
<td>.863</td>
</tr>
<tr>
<td>Region</td>
<td>North</td>
<td>.564</td>
</tr>
<tr>
<td></td>
<td>Central</td>
<td>.395</td>
</tr>
<tr>
<td></td>
<td>South</td>
<td>.477</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>.491</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>.512</td>
</tr>
</tbody>
</table>

Age and region are significant at p<.01

Results in table 10 show that age has the most marked effect on signers’ use of frequent vs non-frequent forms. The younger two age groups tend to favour frequent (arguably more ‘standard’) forms while the two older age groups are more likely to use a variety of non-frequent forms. The Varbrul weightings for age group show a clear age progression from the youngest to oldest age group with regard to use of non-frequent forms: the youngest signers are the least likely to produce
these, and the oldest signers are the most likely to produce them. For most but not all of the numerals, the ‘frequent’ forms are those introduced via Australasian Signed English.

With respect to region, northern signers are slightly more likely to favour non-frequent forms than central and South. Men are somewhat more likely than women to favour non-frequent and older forms, although gender appears to have the weakest effect of the three social factors.

12. Conclusions

Analysis of variation in this subset of the NZSL lexicon confirms that lexical choice correlates with social characteristics. As we hypothesized, age proved to have the strongest effect on lexical variants used, followed by region and gender, in that order. The data provides evidence of diachronic change between age cohorts and increasing standardisation within the numeral lexicon. Differences in signs favoured by the youngest and oldest age groups could be interpreted to mean that the set of NZSL numerals (particularly above five) has been partly relexified, mostly by Auslan forms introduced via Signed English replacing older variants. Adoption of the new forms has spread across generations of the community. For some numbers, such as eight, the change appears to be complete, in that none of the youngest age group use older variants. In other cases, variants co-exist or may indicate a change in progress, sometimes towards a variant other than a Signed English form (such as the crossed fingers for twelve, which is a local innovation).

Performing alternative statistical analyses which treat age as a categorical variable (in pre-determined groupings) or as a continuous variable, (as we did for the number eight), is useful in allowing the data to determine where the relevant boundaries for generations of the language community may be drawn. While it is desirable to compare findings across languages (in our case with similar studies of ASL and Auslan), adopting the criteria for social categories used in overseas studies such age-groupings or maximum age of sign language acquisition is potentially arbitrary and methodologically invalid, unless justified by the ethnographic and historical particularities of each language community.

Clear evidence for increasing standardisation is seen in the finding that all 15-29 year old participants produced the same forms for numerals between 1 to 20, except for numbers 9, 11, 12, and 19. Apart from 9, 19 and 12, the number signs they consistently favour are Auslan forms introduced via Australasian Signed English. Older signers exhibit more in-group variation (more often using infrequent variants) which reflects the fact that they were never exposed to a conventional signed number lexicon during their formal education - a context in which numerals and number concepts are explicitly learned. These findings confirm the powerful standardizing
impact of introducing signing into deaf education. However, it is likely that a discrete lexical set such as numerals is more immediately affected by school language use than might be the case for the lexicon as a whole – since numbers are highly likely to be taught as a conventionalised sequence or set of vocabulary that is extensively rehearsed and utilised in mathematical operations in the classroom. We will explore this possible effect further in a forthcoming analysis of data for 80 lexical items of NZSL, some of which belong to semantic sets (such as colours and days of the week), and others which are unrelated everyday concepts.

Since all social variables were found to correlate significantly with lexical variation, this pilot study suggests that a larger investigation of sociolinguistic variation NZSL using quantitative methods will be fruitful.

**References**


**Acknowledgements**

We are indebted to several colleagues who provided advice particularly with the statistical analysis of data reported in this paper: John Haywood, Robert Bayley, Rebecca Adams. Special thanks to Adam Schembri for support with analysis of data, and for advice on the larger variation project of which this study is a pilot.

**Author contact:** david.mckee@vuw.ac.nz  
http://www.vuw.ac.nz/lals/research/deafstudies/DSRU
An innovative proposal of a Phonological Coefficient of Gesture-Sign Proximity to analyse gestures production in Brazilian Sign Language.

Mecca, F.F.D.N; Lichtig, I.

Summary

Recent studies have been enhancing the investigation of deaf children’s linguistic development, in order to obtain useful information to improve intervention programs. The aim of this study was to investigate gesture production during vocabulary naming in deaf children. Two children aged 7 and 11 years old respectively, with profound deafness, born to deaf parents participated in this study. The children communicated through Brazilian Sign Language (Libras) and by the oral modality of Brazilian Portuguese Language (OMBPL). Children were requested to identify, by signing, 118 pictures that comprised a vocabulary test. A speech and hearing therapist assessed each child individually. All the pictures identified with gestures were carefully separated from those correctly named in Libras, and were investigated further. For this purpose, a proposal of an innovative instrument, denominated phonological coefficient of gesture-sign proximity $\left| \text{cpf} \right|$ was developed. This instrument aims to establish the proximity-relationship between gestures used by the child and the regular signs used by fluent signers in Libras. The $\left| \text{cpf} \right|$ classified the gestures used by the children in four different categories, according to the presence of the phonological aspects presented in Libras, such as: hands and arms articulation, palm orientation, place of the articulation, movement and facial expression (Quadros and Karnopp, 2003). The four categories in which the gestures were distributed included: No gesture-sign phonological proximity ($\left| \text{cpf} \right| = 0$); low gesture-sign phonological proximity ($\left| \text{cpf} \right| \leq 2$); moderate gesture-sign phonological proximity ($\left| \text{cpf} \right| > 2 \leq 4$) and high gesture-sign phonological proximity ($\left| \text{cpf} \right| = 5$). Analysing the 54 gestures produced by the children, the majority (61%) was classified either as: no gesture-sign phonological proximity ($\left| \text{cpf} \right| = 0$) or as a low gesture-sign phonological proximity ($\left| \text{cpf} \right| \leq 2$; 22.2%). A small number of the produced gestures were classified as moderate gesture-sign phonological proximity ($\left| \text{cpf} \right| > 2 \leq 4$; 4.3%) or high gesture-sign phonological proximity ($\left| \text{cpf} \right| = 5$). Considering each child, the older one (7 years old) used more gestures with sign-phonological proximity ($\left| \text{cpf} \right| > 2$...
≤4; 33,4% and \(|\text{cpf}|=5; 6,7\%) than the younger child (\(|\text{cpf}|>2 ≤4; 7,7\%\) and \(|\text{cpf}|=5; 0\%).

The present study showed that, by using the \(|\text{cpf}|\), it was possible to verify an important phonological difference among the gestures used by the children.

1. Introduction

Studies about sign language acquisition and development by deaf children born to deaf parents show parallel milestones in their development as hearing children do (Marschark, 1993; Paul, 2001).

In the pre-lingual phase, deaf babies born to deaf parents who are exposed to sign language, present manual babbling (Quadros, 1997, Woll, 1998). Deaf parents respond to this babbling as if it is intentional, attributing a meaning and consequently contributing for Sign Language acquisition (Gallaway & Woll, 1994, Woll, 1998).

The transition moment from the pre-lingual to the linguistic phase is yet very discussed due to the difficulty in differentiating sign (from sign language) and gestures used by children when acquiring sign language (Woll, 1998). In general, studies indicate its occurrence between six and eight months of age (Karnopp, 1994; Petito, 1987).

According to Quadros (1997) and Woll (1998), the first sign combinations occur around two years of age. Words become grammatically more structured, however differently from adults.

The multiple combination stage and the vocabulary expansion begin around two and a half to three years of age. In this period deaf children use pronouns only to refer to present people and/or objects. It is only from three years old onwards that deaf children start to use the pronominal system to represent absent objects and people assystematically, either in Brazilian Sign Language (Libras) or in British Sign Language (Quadros, 1997; Woll, 1998).

Around the age of three and a half years, signs become more complex and deaf children start to understand verbal flexion, although inconsistently. Between ages five to six years, these children start to use verbal concordance consistently, and pronouns more appropriately. Around seven years, the child masters verbal concordance and referential pronouns completely (Quadros, 1997).

Woll (1998) reports that at eight years of age, the deaf child is able to use classifiers (plural and gender) and verbs with mastery, although presenting errors in complex forms. It is only between nine and ten years that the child starts to use classifiers and verbs correctly, mastering the syntax of sign language.
Mother/ father – child interactions experiences interfere in the acquisition, organization and development of lexical information and may differentiate, deaf and hearing children’s vocabulary in different degrees. The greater the privation of sensory experiences (ex. ; the role of hearing in world understanding), and social-linguistic experiences, less vocabulary differentiation will occur. (McAnally, Rose & Quigley, 1994).

In this context it is incontestable the difference between deaf children’s vocabulary acquisition, who grow up in native linguistic environments, and those who are born and live with their hearing families (Kyle, 1990; Marschark, et al. 1997; Marschark, 1997; Paul, 2001).


According to Woll (1998), a 15 months old hearing child presents an average vocabulary of 10 words, and at 20 months, 50 words. Deaf children born to deaf parents, users of ASL present an equivalent vocabulary at those same ages.

Some studies suggest that the iconicity of sign languages is a facilitator for their acquisition (McAnally, Rose & Quigley, 1994; Marschark, 1997).

It is important to stress that gestures and signs of sign languages are substantially different. Despite the iconicity of certain gestures and signs, a sign differs from a gesture substantially, by presenting a particular phonology of its representation (Quadros & Karnopp, 2004). It is assumed that in the sign language acquisition process, gestures approximate to signs once they approximate to the phonological patterns that define them. The greater the presence of phonological aspects that compose and define a sign in a gesture performance, the greater is its proximity to this sign. According to Quadros and Karnopp (2004), “the primary articulators of sign languages are the hands that move in a space in front of the body and articulate signs in certain locations of this space... the Brazilian sign language is basically produced by hands, although face and body movements also have roles. Its main phonological parameters are location, movement and hands configuration (p.51)... non-manual expressions (facial, eyes, head or trunk movements) have two roles in sign languages: syntactic build up markers and differentiation of lexical items” (p.60).

Capovilla and Raphael (2001) describe each of these phonological parameters in details:

---

1 Kyle (1990), defines iconicity as those signs which their visual representation means the referent. An example of iconicity in Libras is the sign of smoking. The sign is performed by the right hand in V shape, palm towards inside, touching the mouth, moving forward twice, quickly (Capovilla e Raphael, 2001).
1. Hands articulation:

- Right and/or left hand: in numbers (1 to 9), in letters (A to Z), open, curved, closed, horizontal or vertical;
- Right and/or left fingers: open, crossed, curved, distended, bent, interlaced, detached index finger, detached index fingers, distended indicator, distended indicators; slightly bent, parallel, detached thumb, detached thumbs, distended thumb, tips united, separated, loose or united;
- Relation between hands and/or fingers: on the right and in front, on the right and below, on the right and above, on the left and in front, on the left and below, on the left and above, on the left and behind, below, below and on the right, below and on the left, above and in front, above and behind, crossed, in front of, from side to side or near to;
- Touching hands: between fingers, by the base of the palms, by the lateral of fingers, by the palms, bye fingers’ palms, by fingers’ tips, by nails, by fingers, by the back of the hands, by the back of fingers or by the wrists.

2. Arms articulation

- Right and/or left arm: distended horizontal, bent horizontal, distended vertical or bent vertical.

3. Palms orientation

- Right and/or left hand: palm to palm, to the right, to the left, down, up, to inside, to the front, to opposite sides or to the back.

4. Articulation place in signing space:

- Above, below, over, under, beside, on the left, on the right, towards front, in front of, behind or touching the following body parts:
- Abdomen, forearm or forearms, stomach, mouth, cheek or cheeks, arm or arms, head, waist, body, back, elbow or elbows, thigh or thighs, fingers, teeth, fold of arm or arms, back of hand or back of hands, lip or lips, laterals of the head, lateral of the body, tongue, nose, eye or eyes, shoulder or shoulders, ear or ears, palm or palms, inner part of the arm or inner part of both arms, upper part of the arm or upper part of both arms, chest neck, tip of the tongue, hip or hips, chin and face.
5. Movement (fingers, hands, arms, tongue)

- Hands and arms: shaking, in curves, in spiral, waving, to the right, to the left, downward, upward, to the inside, to the front, backward, trembling or zigzag.
- Finger or fingers: shaking or oscillating.
- Tongue or tip of the tongue: passing.
- Fold hand(s) by wrist(s): downward, upward, to the inside (or back), to the right, to the left or forward.
- Turn hand(s) by the wrist: downward, upward, to the inside (or to the back), to the right, to the left or forward.
- Turn palm(s): downward, upward, to the inside (or back), to the right, to the left or forward.
- In horizontal circles: to the right, to the left, backward (or to the inside), forward, to the left and forward, to the left and backward (or to the inside), backward (or inside) and to the left, backward (or inside) and to the right, to the right and forward, to the right and backward (or to the inside), forward and to the left, forward and to the right.
- In vertical circles: to the right, to the left, downward, upward, forward, backward (or inside), to the left and downward, to the left and upward, downward and to the right, downward and to the left, downward and backward, upward and to the right, upward and to the left, upward and forward, upward and backward (or inside), to the right and backward, to the right and upward, forward and downward, forward and upward, backward (or inside) and downward, or backward and upward.
- In arches: to the right, to the left, downward, upward, forward, backward (or inside), to the left and downward, to the left and upward, downward and to the right, downward and to the left, downward and backward, upward and to the right, upward and to the left, upward and forward, upward and backward (or inside), to the right and downward, to the right and upward, forward and downward, forward and upward, backward (or inside) and downward, or upward and backward.
- Diagonally: to the right, to the left, downward, upward, forward, backward (or inside), to the left and downward, to the left and upward, downward and to the right, downward and to the left, downward and forward, downward and backward, upward and to the right, upward and to the left, upward and forward, upward and backward (or inside), to the right and downward, to the right and upward, forward and downward, forward and upward, backward (or inside) and downward, or upward and backward.
• Intensity of movement: speed and/or frequency: alternated or alienate alternated, with strength, twice, slow, slowly fast, fast or several times.

6. Facial Expression)

• Happy, joy, open mouth, semi-open mouth, inflated cheeks, sucked cheeks, contracted with anger, closed teeth, protuberant lips, tongue out, showing the tip of the tongue, showing teeth, eyes wide open, closed eyes, semi-closed eyes, arched eyebrows, smile, smiling, wrinkled forehead, sad or sadness” (Capovilla e Rafael, 2001, p.48-50).

Children users of ASL do not present differences in their acquisition of arbitrary or iconic signs according to Woll (1998). Furthermore, the author points out that what is iconic for an adult may not be iconic for a child.

Considering what was exposed above, the aim of this study was to ascertain the relation between gestures and signs performed by deaf children using a tool specifically designed for this purpose.

2. Method

2.1. Subjects

Two deaf children born to hearing parents were selected for this investigation randomly.

Subject 1 was 7 years old and subject 2 was 11 years old.

Both communicated in Brazilian Sign Language (Libras) and in the oral modality of Brazilian Portuguese Language (OMBPL).

Materials and procedures

Children were requested to identify, by signing one hundred and eighteen (118) colored pictures corresponding to target words for the investigation of deaf children’s vocabulary. Those pictures were taken from Fernandes’s study (2002), and constituted a specific material for vocabulary investigation comprising nine conceptual fields proposed by Befi-Lopes (2000, 2004). These pictures were registered in a power point file, recorded in a recordable compact disk (CD-R Sony 700 MB) and showed to the subjects in the monitor of a Toshiba Satellite notebook, model 28055201.

Subjects were videotaped while naming in Libras the 118 pictures. A speech therapist assessed each child individually. All the pictures identified as gestures were separated from those named in Libras correctly. Fifty four (54) namings performed by these children through gestures were selected and analyzed.
Due to the iconicity of some signs of Libras, some responses samples were randomly checked by the speech therapist and a Libras interpreter in order to verify whether the procedure for classifying the responses (gestures) was reliable. The agreement between the two judges on classifying the responses as gestures or signs was above 95%.

All children’s responses classified as substitution process of verbal for non verbal semiotics, were separated in a specific protocol. Each word was analyzed individually. In order to determine the phonological proximity between the gesture produced by the child, with the proper sign in Libras, the **Phonological Coefficient of Gesture-Sign Proximity** $|\text{cpf}|$ (coefficiente de proximidade fonológica), designed specially for this research and based on studies by Quadros & Karnopp, (2004) and Barbosa (2005)$^2$ was used.

For determining the $|\text{cpf}|$, six categories that determine the phonological description of a sign (Quadros & Karnopp, 2003), defined in the Brazilian sign language dictionary by Capovilla & Rafael (2001) were considered: hands articulation, arms articulation, palms orientation, location of articulation, movements and facial expression.

After the detailed observation of the gesture produced by the child to designate the target word, this gesture was described. Each category of the phonological description of a sign present during the performance of the gesture scored 1 point, and the maximum score was 6 points (6 points corresponding to a sign and not to a gesture). The phonological coefficient of gesture-sign proximity $|\text{cpf}|$ between 0 and 5 allowed measuring the degree of proximity between a gesture and a sign in Libras. It was considered that: (a) the closer to 6 points, the greater the phonological proximity degree between the gesture and the sign; (b) the closer to 0 (zero), the lower the phonological proximity degree between the gesture and the sign. The following classification was used to determine the proximity degree:

If $|\text{cpf}| = 0$, means absence of phonological proximity between the gesture and a sign in Libras;

If $|\text{cpf}|$ between 1 and 2, means a weak phonological proximity between the gesture and the sign in Libras;

If $|\text{cpf}|$ between 3 and 4, means a moderate phonological proximity between the gesture and the sign in Libras;

If $|\text{cpf}| = 5$, means a strong phonological proximity between the gesture and the sign in Libras;

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$^2$ Barbosa, F. (LIF- Audição e Surdez do Departamento de Fisioterapia, Fonoaudiologia e Terapia Ocupacional da FM-USP. Índice de proximidade de uso de língua. (Apresentado ao 6º. Colóquio do LIF(audição e surdez); 2005; São Paulo, SP)
3. Results

Table 1 presents a synthesis of the results of both subjects (subject 1 and subject 2).

Of the 54 gestures used by the two subjects to name the pictures, the majority (61,1%) did not have phonological proximity ($|\text{cpf}| = 0$) or had weak phonological proximity with signs from Libras ($|\text{cpf}|$ between 1 and 2; 22,2%). A small amount of gestures showed moderate ($|\text{cpf}|$ between 3 and 4; 4,3%) or strong ($|\text{cpf}| = 5$; 1,4%) phonological proximity with signs from Libras.

Analyzing separately the semiotic verbal substitution for non-verbal semiotic process used by the two subjects, it was verified that subject 2 presented 46,6% of gestures without phonological proximity correlation ($|\text{cpf}| = 0$); 53,4 of them presented phonological correlation with signs in Libras, of which 13,3% presented a weak correlation ($|\text{cpf}|$ between 1 and 2); 33,4% moderate correlation ($|\text{cpf}|$ between 3 and 4) and 6,7% strong correlation ($|\text{cpf}| = 5$).

A different result was observed in subject 1: 66,6% of gestures used by this subject did not show phonological correlation with signs in Libras ($|\text{cpf}| = 0$). Some gestures showed weak phonological correlation with signs in Libras ($|\text{cpf}|$ between 1 and 2 = 44,4%). Only 7,7% indicated moderate phonological correlation with signs from Libras ($|\text{cpf}|$ between 3 and 4). It was not observed a strong $|\text{cpf}|$ in the gestures used by this subject.

<table>
<thead>
<tr>
<th>Table 1: Distribution of the Phonological Coefficient of Gesture-Sign Proximity of both subjects.</th>
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<tr>
<td><strong>Phonological Coefficient of Gesture-Sign Proximity (Libras)</strong></td>
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4. Discussion

As previously observed, the percentage of substitution and/or complementation of verbal for non-verbal semiotics was high for both subjects. This fact points out the quantity of gestures used by deaf children, independently of their age. The occurrence of a great percentage of gestures in the vocabulary investigation tasks of deaf children was found in different studies. Kyle (1990) and
Woll (1998) discuss that one of the greatest difficulties in assessing deaf children lexical performance relates to the iconicity of sign language with the gestures of another language. Undoubtedly, some Libras signs are iconic to some gestures of the Oral Brazilian Portuguese Language, however as pointed out by Woll (1998), whatever is iconic for an adult may not be iconic for a child.

The results obtained in this study pointed that although there is a great percentage of substitution and/or complementation of verbal for non-verbal semiotics, not all non-verbal substitutions presented the same characteristics. By using the Phonological Coefficient of Gesture-Sign Proximity it was possible to verify distinctions between their complexities. Gestures used by the younger child (7 years old) presented less phonological parameters than those presented by the older child (11 years old). That means that there is a greater linguistic component in the performance of gestures by the older child, which could be considered an indication of sign language lexical development. According to Quadros and Karnopp (2004), gestures approximate to signs once they get closer to the phonological pattern that defines them.

It wasn’t the purpose of this study to investigate gestures in the lexical development of deaf children. Data reported here, however, indicate that gestures used by deaf children tend to be linguistically different from each other and may be considered as characteristics that preview the acquisition of usual verbal designation. In order to assess deaf children’s vocabulary accurately information regarding the use of gestures as part of the lexical development process should be considered.

5. Conclusion

When investigating the typology of substitution of verbal for non-verbal semiotics, it was verified that gestures used by the younger child (7 years old) showed less phonological characteristics than those used by the older one (11 years old). These results show that there were more phonological parameters, and consequently more linguistic components, in the gestures used by the older child. This data was ascertained by the use of the Phonological Coefficient of Gesture-Sign Proximity (Libras) \[ |cpf| \].
References


Modality and Language Acquisition: Resources & Constraints in Early Sign Learning

Richard P. Meier
Department of Linguistics
The University of Texas at Austin

Signed and spoken languages share many fundamental properties. Signed and spoken languages have learned, “conventional” vocabularies. Languages in both modalities share the property of having words/signs that are built of meaningless phonological units; thus, signed and spoken languages exhibit duality of patterning. Signed and spoken languages share mechanisms for building new vocabulary through compounding and derivational morphology. And signed and spoken languages exhibit similar rules for combining words or signs to form sentences.

Signed and spoken languages also exhibit interesting differences in how they are produced and perceived. Whereas the manual articulators move in a transparent, three-dimensional space, the speech articulators are largely hidden from view. For this reason, speech reading (“lip reading”) does not yield sufficient information for a deaf child to understand speech. In speech as in sign, there are a variety of articulators. But, unlike the oral articulators, the manual articulators are paired. The signer must coordinate the action of the two hands. These differing articulatory properties may explain, in part, why speech has a limited capacity for iconicity, whereas sign has a much greater capacity for iconic representation. In particular, the movement of the two arms in a transparent space may allow signed languages to represent the shapes of objects and their movement trajectories.

The differing articulatory and perceptual characteristics of the visual-gestural and oral-aural modalities raise the possibility that the two language modalities may place

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1 This research is supported in part by NSF grant #BCS-0447018 to Catharine H. Echols (PI) and RPM (co-PI). Please direct correspondence to Richard P. Meier, Department of Linguistics, The University of Texas at Austin, 1 University Station B5100, Austin, TX 78712 USA or to rmeier@mail.utexas.edu. I thank Chris Moreland for serving as the model in Figure 3 and Claude Mauk for preparing that photograph.
different constraints on the language learner and may offer different resources to that learner. The question then for this paper is this: how is the learning of words and signs affected by these differing constraints and resources? I’ll discuss three arenas of early sign learning in which we might detect the effects of modality-specific constraints upon the child and of modality-specific resources afforded the child. Those three studies will examine: 1) properties of child-directed signing, 2) the interaction of iconicity and infant sign production, and 3) motoric constraints upon infant sign production.

Child-Directed Signing

Consider the problem of how signs and their referents are presented to children. In particular, let’s consider the problem of object labels (common nouns). Spoken labels and their referents are generally presented in distinct sensory modalities; auditorally-presented labels are paired with visually-perceived referents. The speaking child may attend simultaneously to the label and its referent, without shifting gaze from the referent. In contrast, a signed label and its referent are generally available to the child through a single sensory channel (vision). In signed language, labels and their referents must compete for the child’s limited visual attention. Children often must shift their regard from the referent to the label. In learning spoken languages, parental attempts to redirect a child’s attention to a new referent are costly for word learning (Tomasello & Farrar, 1986). We might wonder whether, by comparison to speech, sign learning is impeded by the fact that the child must learn to shift his attention from object to label.

One issue in early sign development is therefore this: how do signing parents make signed labels visible to their infants? More generally, do signing parents accommodate the visual demands upon their infants? Surprisingly there is some suggestion in the literature that one way in which signing parents accommodate their infants is by producing fewer utterances than do the hearing parents of hearing children. For example, Spencer and Harris (2006) have reported a lower quantity of input from deaf mothers to deaf infants than from hearing mothers to hearing infants. Why? Spencer and Harris suggest that “the lower rate of signed communications seems to be another natural consequence of deaf mothers’ sensitivity to their children’s immature patterns of visual attention. Mothers almost never sign when they know their young child is not
attending…” (p. 81). In other words, deaf mothers don’t sign when their children aren’t looking.

Yet despite possible differences in the quantity of input available to children, signed and spoken languages are acquired on very similar developmental schedules (Newport & Meier, 1985). Signing and speaking children display similar developmental milestones at similar ages. There is no evidence at any point in child development that the acquisition of sign is delayed. To the extent that there are any differences in sign versus speech milestones, those differences may disfavor speech (Anderson & Reilly, 2002). Specifically, there have been claims that continue to be quite controversial of a delay for first words (Meier & Newport, 1990; and, for a critique, Volterra & Iverson, 1995). In sum, despite possible differences in the quantity of sign input available to signing children, the acquisition of sign is robust.

Perhaps therefore it’s the quality of input—not sheer quantity—that matters. In particular, the child-directed signing of deaf mothers may be carefully tuned to the child’s attentional capacities (Spencer & Harris, 2006). One way in which in which mothers can accommodate their children is by altering the form of their signs in order to ensure that those signs are within the child’s visual field. Ginger Pizer and I (Pizer & Meier, this vol.) have been analyzing the child-directed signing that deaf mothers address to their deaf children. One way in which a mother may accommodate her child is by leaning into the child’s visual field. For example, Katie (13 months old) and her mother were looking at a picture book; both were seated on the floor, with the mother on her daughter’s left and somewhat behind her. Katie’s mother leaned over to label the picture of a duck in the book that Katie was examining:

M’s gaze: book Katie book Katie
M’s posture: leans in
RH: Point [held on book] DUCK\textsuperscript{3x} Point [on book] DUCK\textsuperscript{4x}.
LH: DUCK\textsuperscript{4x}
K’s gaze: to book……………..to Mom…….to book……Mom

There is much to observe in this brief interaction: 1) With the first token of DUCK (a one-handed sign articulated at the mouth that suggests the opening and closing of a duck’s bill), the mother leaned in so that it was possible for her daughter to see a sign
such as DUCK that is articulated on the face. She continued to lean in for the remainder of
the interaction. 2) The first token of DUCK was produced with the left hand, so that the
mother could maintain the right-handed pointing gesture to the picture of the duck. Thus
the mother simultaneously indexed and labeled the referent. 3) The first and third tokens
of DUCK may have been over-repeated by the mother; both had four movement cycles, in
contrast to the two or three cycles that would be common in adult-directed signing. By
repeating the sign, the mother may have extended its duration so that it might be seen by
her child; nonetheless Katie did not turn to view her mother’s signing until the next token
of DUCK. 4) During this episode, Katie twice shifted her attention from the book to her
mother. Had she not shifted her regard, she would not have seen her mother’s signed
label.

By leaning in towards her daughter, Katie’s mom altered her production of a span
of four signs. Other properties of child-directed signing are more selective in affecting the
articulation of just single signs. For example, in one interaction, Noel (17 months) was
seated on her mother’s lap. In this conversation, the mother was labeling the colors of
four blocks that were arrayed on the floor in front of them. The color signs BLUE,
YELLOW, and GREEN are articulated in neutral space; see Figure 1. Consequently, the
mother could readily sign those signs in front of the child and know that they would be
fully visible to her daughter. But what about the sign ORANGE? This sign has a repeated,
hand-internal closing movement that is articulated at the mouth. If the mother had
produced this sign at her own mouth, it would not have been visible to her daughter.
Instead, she produced the sign on her daughter’s mouth, thus ensuring that the child
received visual and tactile information about the form of this sign.
In our analyses of child-directed signing, Ginger Pizer and I (Pizer & Meier, this vol.) have examined longitudinally-collected samples of the signing of three mother-child dyads. In all cases, the mother and child are deaf and use ASL as their primary language. Samples from 9, 13, 18, and 24 months have been examined. Depending on the sample, 30-60% of the mothers’ signs were altered, whether through repetition of the sign’s movement, displacement of the sign in space, signing on the child, lengthening of the duration of the sign, or enlargement of the sign movement. Modified signs may result from the mother’s attempts to gain the child’s visual attention (Waxman & Spencer, 1997). However, these modifications also sometimes appear when the mother already has the child’s attention, indicating that these properties of sign motherese are not purely a product of the mother’s sensitivity to the child’s visual attention. Instead, for example, mothers sometimes repeat signs in situations in which she is attempting to get the child to imitate her signs.

Properties of child-directed signing may be an important contributor to the robustness of early sign learning in deaf children born into deaf families. Carefully tuned input might obviate whatever consequences may follow from the relatively lower quantity of input that signing parents may present to their children (Spencer & Harris, 2006). However, at this point, we can’t know whether all deaf mothers produce child-directed signing that appropriately accommodates their deaf children. Are there other
factors that might contribute to robust vocabulary acquisition in signing children? I’ll discuss two types of factors. First, I’ll ask whether the iconicity of many signs might guide early sign production. I’ll then ask whether properties of infant motor development may contribute to children’s success at early sign production.

**Iconicity and Early Vocabulary Development**

Iconicity is a much richer resource in the visual-gestural modality than in the oral-aural modality of spoken languages. In spoken languages, the typical word is an arbitrary pairing of form and meaning (Saussure, 1916). Nonetheless, some spoken words iconically represent the characteristic sounds of objects. For example, roosters belonging to English speakers say *cockadoodledoo*; those belonging to Portuguese speakers say *cocoricó*; and those belonging to Spanish speakers say *quiquiriquí*. The differing words across these three languages demonstrate that these iconic forms are conventionalized. But the fact that these forms are fully conventional does not mean that they are fully arbitrary. Across many spoken languages, a rooster’s call is represented by a multisyllabic, often reduplicative word, in which CV syllables beginning with a velar consonant are most typical (Ball, undated). The crosslinguistic similarity in these words demonstrates that not all words in spoken languages are arbitrary in form; some are motivated at least in part by iconicity.

The visual-gestural modality offers more frequent opportunities for iconic representation. The movement of the two hands in space allows signs to represent the shape of objects, as well as the movements of objects in space. The iconic potential of the visual-gestural modality means that deaf children of hearing parents can invent gestures (so-called “home signs”) that will be understood by non-signing parents (Goldin-Meadow, 2003). Even though different signed languages may choose different iconic representations for the same concept (see Klima & Bellugi’s, 1979, illustration of the signs for ‘tree’ in American, Chinese, and Danish Sign Languages), signed languages may independently arrive at signs that share the same icon. The result is that even unrelated signed languages such as Japanese and Mexican Sign Languages may exhibit considerable overlap in their vocabularies. On one estimate based on a small sample of signs (Guerra Currie, Walters, & Meier, 2002), approximately 20% of the vocabulary in
Japanese and Mexican Sign Languages is similar, where “similar” was defined as exhibiting the same values on two of the three major parameters of sign formation (handshape, place of articulation, and movement).

In spoken languages, transparent form-meaning mappings may facilitate children’s acquisition of morphology; thus, inflectional morphology may be early to emerge in children acquiring morphological systems (e.g., Turkish) in which there is a one-to-one mapping between units of form and meaning (Slobin, 1982). Children’s over-regularization errors (e.g., ungrammatical runned in lieu of the irregular past tense verb ran) might be seen as a bias on the part of children that leads them to produce form-meaning mapping that are sometimes more transparent than those in the adult language. However, because monomorphemic words are generally arbitrary in spoken languages, we can’t readily ask whether children would prefer more transparent—that is, more iconic or more imagistic—mappings between form and meaning in such words. In contrast, the frequency of iconic mappings between form and meaning within simple, monomorphemic signs makes this an important question to explore in research on the acquisition of signed languages. Recently, Slobin et al. (2003) have argued that the iconicity of certain ASL classifier forms permits their early use by signing children. Casey (2003) has also argued that there are effects of iconicity on children’s acquisition of verb agreement in ASL.

My colleagues and I have reasoned that signing children might notice that the mappings between form and meaning are frequently non-arbitrary in signed languages (Meier, Mauk, Cheek, & Moreland, 2008). The iconicity of signs might facilitate a child’s identification of the meaning of a novel sign. And, importantly for current purposes, iconicity might guide children’s production of signs; children might seek to enhance the transparency of form-meaning mappings and thereby produce erroneous forms that are more iconic than the adult target forms.

In a series of studies, we have examined the acquisition of ASL by four deaf girls whose ages ranged from 8 to 17 months. All four deaf children had Deaf, signing parents; all had at least one Deaf grandparent. Thus, each of the children had at least one native-signing parents. We followed their language development longitudinally; children were videotaped in their home while interacting with a parent and/or a signing experimenter. In
subsequent coding of these videotapes, we identified a corpus of 632 sign tokens. Pointing signs were excluded from consideration. Each of these sign tokens was then judged by a Deaf adult rater as to whether it was more iconic than the adult target sign, less iconic than the adult target sign, or as iconic as the adult target sign. Inter-rater reliability was high.

The results were unequivocal. Contrary to the hypothesis that children would err by enhancing the transparency of the signs they attempted, only 5% of their tokens were judged to be more iconic than the adult target. For example, the ASL sign MILK is a one-handed sign in which there is a repeated opening-and-closing movement of a fisted hand in neutral space; one child’s rendition (Noel 12 mo., 2 weeks) was two-handed rather than one-handed. In contrast, 39% of the children’s tokens were judged to be less iconic than the adult target. The balance were considered to be no more and no less iconic than the adult target sign.

An example of a child’s production that was judged to be less iconic than its adult target was Noel’s production of FALL at 15 months. The adult sign suggests that a legged being changes orientation while falling onto the horizontal surface represented by the static nondominant hand; see Figure 2. When she produced her rendition of the sign, Noel was commenting on the fact that a toy horse had just tumbled over. Noel substituted an index handshape (index finger only extended; others fisted) for the V-handshape of the target sign, thus obscuring the image of legs. Instead of the nondominant hand being oriented with palm up, the nondominant palm was oriented inward toward the midline; the image of a horizontal flat surface was lost. The movement of the sign was executed entirely from the shoulder; there was no change in the orientation of the dominant hand. And, crucially, the nondominant arm moved downward in tandem with the dominant hand, exactly mirroring its movement. So, in Noel’s rendition, the surface (that in the adult language is represented by the nondominant hand) moves with the falling object represented by the dominant hand. In sum, although the downward movement of the Noel’s sign may be considered iconic, the many ways in which her sign diverged from the adult model made it less iconic than the adult target sign.
What do we conclude from this study? First, it is clear that iconicity cannot explain the bulk of children’s errors in early sign production. Although pro-iconic errors do occur (see Launer, 1982), children’s errors are far more likely to reduce the judged iconicity of a sign than to increase it. These results on early sign production are consistent with a variety of prior results. For example, iconic signs do not appear to be over-represented in children’s earliest vocabularies (Orlansky & Bonvillian, 1984). The forms that children produce are often less motivated than the adult targets; this appears to be true in children’s acquisition of ASL pronouns (Petitto, 1987), verb agreement (Meier, 1982, 1987), and classifiers (Supalla, 1982). In sum, iconicity clearly has an important role in children’s innovation of sign systems (Goldin-Meadow, 2003). As children gain metalinguistic awareness, they may come to recognize the iconicity that motivates particular signs belonging to the vocabularies of established signed languages. But we have to look to other factors besides iconicity if we are to explain the bulk of the errors that very young children make in their articulation of signs. I’ll suggest that motoric factors may explain many of the patterns that emerge from close analysis of children’s early sign production.
Articulatory Constraints on Early Sign Production

Parameters of Sign Formation

Signs can be described informally in terms of three major parameters of sign formation: handshape, place of articulation, and movement. Figure 3 shows the ASL sign GOOD. Its initial place of articulation is the chin. Its handshape is a flat hand with the fingers closed (a B-hand in the parlance used for describing ASL signs). Its movement is an outward movement away from the signer.

Fig 3. The ASL sign GOOD (Photograph copyright RPM).

Let’s consider first the accuracy with which children produce these three major parameters of sign formation. In Cheek et al. (2001), we examined the same database of signs that I just discussed in the analysis of the iconicity of children’s sign productions. Figure 4 shows the accuracy with which these four children (aged 8-17 months) produced handshape, place of articulation, and path movement (hand-internal movements and rotations of the forearm are excluded here). These data reveal a pattern that has now been found in several studies of ASL and of other signed languages. Specifically, the children were quite accurate on place of articulation, less accurate on path movement, and quite inaccurate on handshape. This same result has been reported for other signed languages, including LIBRAS (Karnopp, 1994, 2002) and Spanish Sign Language (Juncos et al., 1997). Children’s accuracy on place of articulation may help parents and experimenters.
to recognize their earliest signs. This may be one factor that has contributed to persistent, but controversial, reports that first signs are earlier to emerge than first words (Meier & Newport, 1990; Anderson & Reilly, 2002).

![Figure 4. Accuracy by parameter of sign formation of children’s early sign productions (adapted from Cheek et al., 2001).](image)

Why does the accuracy of children’s early sign articulation vary as a function of parameter of sign formation? Motoric factors seem to offer a plausible account of the relative ease of place of articulation and the relative difficulty of handshape. Achieving the correct place of articulation simply requires a child to reach to a location on his/her body; producing a sign at the mouth requires the same kind of gross motor control as when a child feeds itself. However, accurate production of sign handshapes requires considerable fine motor control; the visual similarity of certain handshapes (e.g., a 7-handshape with the thumb and ring finger opposed, all others extended and spread vs. an 8-hand with the thumb and middle finger opposed, all others extended and spread) also raises the possibility of perceptual confusions. Errors in handshape production persist until relatively late ages (see Meier, 2006, for a review).
Articulatory constraints on movement

But what accounts for children’s relative inaccuracy on movement? Articulatory explanations for why children show relatively poor control over movement, whether path or hand-internal, have not been available. In our work (Meier et al., 2008) we’ve looked at three trends in infant motor control that may help us understand the kinds of errors that young children make. In doing this, we have also looked at which joints of the arm and hand children employ in early sign production.

Sympathy. Spoken and signed languages differ in that signed languages employ paired articulators; we have two arms and hands, but only one jaw, one tongue, and one velum. As is well known, some signs involve action of just the dominant hand; in other signs, both hands execute the same movement (although the two hands may be out of phase); in a third class of signs, the dominant hand is active, while the nondominant hand is static (Battison, 1978). In articulating signs from this third class, children must inhibit movement of the nondominant hand.

Early in infant motor development, the nondominant hand tends to mirror the movement of the dominant hand. So when the dominant hand rolls a toy truck across a table, the nondominant hand may execute a similar movement (even though it holds no toy). Production of these mirror movements, or what I have called sympathetic movements, is normal in typically-developing infants, but persists in children with developmental disorders (see Mayston, Harrison, & Stephens, 1999, for a recent report). Bimanual behaviors in which one hand must remain static emerge at 9-10 months (Fagard, 1994).

Cheek et al. (2001) report data on a small sample of signs that have a static nondominant hand in the adult language (just 62 tokens); in 40%, the action of the child’s nondominant hand mirrored that of the dominant hand. An example of this phenomenon was described earlier: in Noel’s production of FALL at 15 months, her nondominant hand was not static, as in the adult target sign. Instead, the nondominant hand matched the downward movement of the dominant hand.

Cyclicity. The infant tendency to movement sympathy appears in deaf and hearing children alike, but only for signing infants will this tendency affect their production of language. In contrast, an infant tendency toward cyclic, repetitive motor patterns may
characterize children’s early articulation of sign and speech. Infants show a tendency toward repetitive movement patterns in their nonlinguistic behavior (Thelen, 1979) and in their vocal development (MacNeilage & Davis, 1993; Meier et al., 1997). Thus, typically-developing speaking children at 8 months produce repetitive babbles such as [bababa]. Meaningless prelinguistic gestures, whether from deaf children with early sign exposure or from hearing children with no sign exposure, tend to be multicyclic (Meier & Willerman, 1995; Cheek et al., 2001). Given that children favor repeated movement patterns in their prelinguistic gesture, we hypothesized that this tendency might carry over into their early signing. We also predicted that children would tend to preserve repetition in adult target signs that have repetition, but that they would tend to err when producing adult signs that have only a single movement (Meier et al., 2008).

Most sign tokens in the sample we examined were multi-cyclic, with the median number of cycles per sign being three and the maximum number of cycles in a single sign token being 37. Fewer than 25% of the children’s productions consisted of just a single movement cycle. The children in our sample favored multicyclic productions of multicyclic signs. In contrast, they attempted many fewer monocyclic signs and, when they did so, they typically erred; across the four children 69% of the monocyclic targets were produced with repeated, that is, multicyclic, movement. A typical example was produced by Noel at 12 months; she produced the monocyclic ASL sign BLACK with three movement cycles; in the same conversation, her native-signing mother produced the sign with just one cycle. Similar errors have also been reported in a case study of a young child learning British Sign Language (Morgan, Barrett-Jones, & Stoneham, 2007).

**Proximalization.** Unlike the oral articulators, the manual articulators comprise a series of jointed segments; signs are articulated at joints ranging from the shoulder to the second knuckles. The shoulder joint is “proximal” to the torso, whereas the second knuckles are “distal” from it. A proximal-to-distal trend has long been observed in the literature on infant motor development (Gesell & Thompson, 1934). According to this hypothesis, children show better early control over joints that are close to the torso, as opposed to joints that are relatively far from it. A tendency to proximalization has been observed in children’s walking (Jensen et al., 1995) and in their writing (Saida & Miyashita, 1979). Adults may also show proximalization of movement under certain
circumstances, for example when asked to write with the nondominant hand (Newell & McDonald, 1994). Proximalization of movement has also been reported in adult learners of signed languages (Mirus, Rathmann, & Meier 2001; Rosen, 2004), suggesting that it may in part be a phenomenon of the acquisition of new motor skills.

We hypothesized that in early sign production infants might tend to use proximal joints of the arm in lieu of the more distal articulators that would be expected in adult signing (Meier et al., 2008). For this analysis we therefore had to code, for each early sign token in our database, the joints that the child used. We compared the child’s usage to what would be expected in the adult language. Our results were clear: when children substituted a joint for the expected target joint, they tended to substitute a joint that was proximal to the adult target joint. A good example is Suzie’s production of the sign HORSE at 12 months. The adult target sign has a repeated bending at the first knuckles of the extended first and second fingers; Suzie instead produced a repeated bending at the wrist. In an analysis of children’s omission errors (from signs that required action at two or more target joints), children were more likely to omit action at the more distal joint than at the more proximal joint.

Our results were not entirely simple, however; we also found a surprising class of distalization errors. Specifically, when the children attempted a sign that had the first knuckles as the target joint, they tended to add movement at the second knuckles. The results was a production that seemed to have a simple opening and closing action of the hand, much as when a child might grasp an object. For example, Katie (15mo., 1 wk.) produced the sign DIRTY. The target sign has a fluttering movement at the first knuckles; she substituted an opening-and-closing movement of the hand that was articulated at the first and second knuckles.
The results that I’ve discussed pertain to children’s errors. With the exception of the one class of distalization errors that I’ve just noted, children tended to proximalize. Does this mean that children only showed effective control over the proximal joints of the arm? The answer is no. In fact, children were accurate in their usage of two joints: the elbow and the first knuckles (Meier et al., 2008). Children thus controlled two movement types: path movements articulated at the elbow and hand-internal movements articulated at the first knuckles. This means, in essence, that from a rather early age signing children control two “syllable” types: elbow oscillations and open-close movements of the hand. Still, however, when children erred, they typically proximalized.

**Conclusion**

Let’s return now to the issue of the differing properties of the two language modalities and the consequences that those properties may have for language development in speaking and signing children. As discussed at the outset of this paper, the information necessary to identify words and referents occupies distinct sensory channels in speech. In contrast, signs and their referents compete for a single visual channel. Yet, early vocabulary development occurs on very similar developmental schedules for signing and speaking children. Given published evidence suggesting that signing children may receive relatively less linguistic input than hearing, speaking children (Spencer & Harris,
2006), it may be that signing children’s acquisition of vocabulary is actually facilitated by the fact that they must make intramodal associations between sign and referent, unlike hearing children who must make intermodal (i.e. cross-modal) associations between words and their referents. Another possibility is that deaf mothers are carefully tuning the linguistic input they address to their deaf children to the attentional demands that signing places on those children. As we observed, some of the characteristic properties of sign motherese may not only ensure that signs are visible to children, but may also juxtapose signs and their referents. However, the hypothesis that deaf mothers carefully tune their signing to the attentional demands upon their children raises the possibility that the course of language development in signing children — even in deaf children of deaf parents — will be strongly linked to the sensitivity that individual deaf mothers show to the visual and attentional capacities of their children.

The fact that the mappings between signs and their referents are generally intramodal is not the only respect in which signs and words differ. The visual-gestural modality also affords richer opportunities for motivated mappings between form and meaning in sign than in speech. In particular, many mappings between form and meaning in ASL and other signed languages show some degree of iconicity. However, in our data, the potential for iconic representation seldom leads infant signers to produce forms that are more iconic than would be expected in the adult language. Nonetheless, iconicity has a crucial role to play when deaf children innovate home sign systems (Goldin-Meadow, 2003).

When we seek to account for the bulk of the errors that children make in early sign production, we need to look to articulatory factors, just as we need to look to articulatory constraints when we describe infant speech production. However, there are very different articulators in sign and speech; we might thus be tempted to conclude that there is no overlap between the motoric tendencies guiding early sign and speech development. As we’ve seen, however, an infant tendency toward repetitive movement patterns persists into early sign and speech production. Other motoric factors are modality-specific: for example, both proximalization of movement and the tendency for the nondoninant hand to mirror the movement of the dominant hand may be aspects of motor control in signing infants that have no obvious counterparts in speech motor control in infancy. Properties
of maternal input may also promote some of the patterns we have encountered in early
sign production; repetition of signs and enlargement of them (with consequent
proximalization) are frequent in child-directed signing (Holzrichter & Meier, 2000).

Where infant speech and sign development may show a surprising and interesting
difference is in the number of available oscillators. This difference may extend to the
articulation of spoken and signed syllables. MacNeilage and Davis (1993) have argued
that there is a single oscillator that constitutes the “frame” around which the spoken
syllables are organized; that oscillator is the mandible. They have also argued that
hearing infants in the babbling period only have effective control of the mandible and
may have little independent control of the tongue. In signed languages, it does not appear
that there is a single predominant oscillator around which syllables are organized. To
understand this suggestion, note that in the sign GOOD, articulation is restricted to the
elbow, whereas the adult sign DIRTY has articulation at the first knuckles. The infants in
our sample controlled articulation at both these joints.

The patterns of success in children’s early sign production suggest that infants have
relatively early and effective control of place of articulation, although errors certainly
occur (Marentette & Mayberry, 2000). Their control of place may also mean that they
control a number of phonological contrasts (Siedlecki & Bonvillian, 1993). Likewise, the
early independent control of two or more articulators in sign may mean that infants have
an early phonological contrast between path movements of the elbow and hand-internal
movements produced at the first knuckles. These results lead to the speculation that more
phonological contrasts may be available to signing infants than speaking infants. The
signing infant’s control of a set of contrasts may make their early sign productions
recognizable. This possibility suggests a particular interpretation of oft-discussed claims
that first signs appear somewhat earlier than first words. Signing infants may not be
attempting signs any earlier than hearing infants are attempting words; instead their early
cumbersome attempts may be more recognizable to parents and experimenters than are the
garbled first words of speaking children (Newport & Meier, 1985).
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Ball, C. undated. Sounds of the world’s animals. [http://www.georgetown.edu/faculty/balle/animals/animals.html](http://www.georgetown.edu/faculty/balle/animals/animals.html). Retrieved 5/19/07.


This paper offers a new look at the traditional analysis of verb classes in sign languages. According to this analysis (Padden 1988), verbs in many sign languages fall into one of three classes: plain verbs, spatial verbs and agreement verbs. These classes differ from each other with respect to the properties of the arguments which they encode. Agreement verbs, verbs denoting transfer, encode the syntactic role of the arguments, as well as their person and number features, by the direction of the movement of the hands and the facing of the palms. In spatial verbs, the class of verbs denoting motion and location in space, the direction of movement encodes the locations of locative arguments, the source and the goal. The shape of the path movement the hands are tracing often depicts the shape of the path that an object traverses in space. Plain verbs, which constitute the default semantic class, do not encode any grammatical features of their arguments.

The above analysis focuses on the role of the hands in encoding the relevant grammatical features. The hands are the active articulator in sign languages, and they carry most of the informational load of the sign. However, in this paper we would like to offer a novel look at verb classification in sign languages, by looking not at what the hands do, but rather at the role the body plays in different classes of verb. We argue that the basic function of the body in verb forms in a sign language is to represent the subject argument. Other grammatical functions encoded by verbs, such as 1st person, develop later, and are superimposed of the basic function of "body as subject", thus creating more grammatical complexity in the language. This analysis has the following advantages: it explains a typological peculiarity of sign language verb agreement, namely the prominence of the object over subject in verb agreement forms. It offers an explanation of why some verb forms are more complex than others, in terms of a competition between the different roles of the body in various sub-systems of the language. Finally, it makes interesting predictions regarding sign language typology and diachronic developments within sign languages.
1. LEXICALIZATION PATTERN IN SIGN LANGUAGES

The term 'lexicalization patterns' was first used by Talmy (e.g., 1983, 1985) in his description of how spoken languages encode motion events. Talmy (1985, 2000) points out that verbs alone do not encode all the meaning components of such events. Languages tend to be systematic about which meaning components are encoded by which types of lexical items. So, some languages (e.g., English, German, Russian and Chinese) encode manner of motion in verbs and direction of motion by prepositions or particles ('satellites' in Talmy's terms), while other languages (e.g., Hebrew, Spanish, Japanese and Turkish) encode direction of motion in the verb and the manner component is expressed by adverbials. The systematic way in which a language encodes particular components of the event by the linguistic means at its disposal is referred to as 'lexicalization patterns'.

In sign languages, the linguistic means employed to convey an event are the hands and the body of the signer, and the space around the signer. When examining lexical items denoting events in three different sign languages (American Sign Language, Israeli Sign language and Al-Sayyid Bedouin Sign Language), we find that specific formational elements of a sign may correspond to specific meaning components; that is, the hands and the body (the chest and the head) may each separately be used to encode different parts of an event. We now show that this correspondence between a part of an encoded event and the body or hands is not random, but rather that the body and the hands encode particular aspects of the event in a systematic way.

1.1. Body as subject

The signer’s body is not merely a formal location for the articulation of signs, but may, in principle, be associated with a particular meaning or a particular function. We argue that in iconic or partially iconic verbs articulated on the body, the so called 'body-anchored verbs', the body represents the subject argument.

We use the term *iconicity* to refer to the regular mapping between formational elements of an expression and components of its meaning (Taub 2001, Russo 2004). This mapping can be demonstrated by showing the correspondence between formational elements and meaning components (based on Taub 2001). Take for example the verb EAT in Israeli Sign Language (ISL) and American Sign language (ASL), illustrated in Figure 1 below. The hand assumes a particular shape, moving toward the mouth from a location in front of it, and repeats this movement twice. 'Eat' means 'to put (food) in the mouth, chew if necessary, and swallow' (Webster's New Word Dictionary, Third College Edition). A possible Lexical Conceptual Structure representation is:
1. X CAUSE [Y GO [INTO MOUTH-OF X]]

As is obvious from Figure 1, the sign EAT is iconic. However, if we go beyond the global impression of iconicity, we see that an explicit mapping between form and meaning as a set of correspondences has the advantage of showing which of the various formational elements correspond to which aspects of meaning. Such a mapping is illustrated in Table 1.

Figure 1: The verb EAT (ISL and ASL)

<table>
<thead>
<tr>
<th>FORM</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>-handshape</td>
<td>Holding an object (food)</td>
</tr>
<tr>
<td>Mouth of signer</td>
<td>Mouth of eater, agent</td>
</tr>
<tr>
<td>Inward Movement</td>
<td>Putting an object into</td>
</tr>
<tr>
<td></td>
<td>mouth</td>
</tr>
<tr>
<td>Double movement</td>
<td>A process</td>
</tr>
</tbody>
</table>

Table 1: Iconic mapping for EAT.

Crucial to our point here is the correspondence between the location of the sign (the mouth) and the mouth of the eater, the agent argument in the event. In other words, the body, constituting one of the formational components of the sign, represents one particular argument in the event, the agent. It is important to note that the body does not represent 1st person. The sign EAT is signed on the mouth of the signer whether the subject in a particular event of eating is 1st, 2nd or 3rd person. In other words, the sign EAT has one form in all three sentences 'I eat', 'you eat' or 's/he eats', and this form is signed on the signer's mouth.
Examining a wide variety of body-anchored verbs shows that in iconic signs, the body corresponds to an argument participating in the event. The following examples are from ISL, but similar lists of words can be found in ASL as well.

2. Psych verbs (Location: chest): HAPPY, LOVE, SUFFER, UPSET, BE-FED-UP-WITH, HURT: Chest corresponds to the location of emotions of the experiencer argument

3. Verbs of mental activities (Location: temple and forehead): KNOW, REMEMBER, FORGET, LEARN, WORRY, THINK, DREAM, UNDERSTAND, GRASP, INFORM (an idea): Temple or forehead represents the site of the mental activity of the experiencer.

4. Verbs of perception (Location: sense organs): SEE, LOOK, HEAR, LISTEN, SMELL: Eyes, ear or nose represents the site of the activity of the experiencer

5. Verbs of saying (Location: mouth): TALK, SAY, ASK, ANSWER, EXPLAIN, SHOUT, WHISPER: Mouth represents the relevant part of the body of the agent argument

6. Change-of-state verbs (Location: face, chest, eyes): BLUSH, GET-WELL, WAKE-UP: Face, chest, eyes represent the relevant part of the body of the patient (undergoer) argument

As the above list shows, the argument represented by the body and corresponding to specific features of the body can be associated with a variety of thematic roles: agent, patient, experiencer, recipient. However, the choice of the particular argument to be represented by the signer's body is not random. In case of a one place predicate, the body naturally is associated with the sole argument of the predicate. In case of transitive events, we find that the argument associated with body features is the highest ranking argument: the agent in <agent, patient> verbs (e.g., EAT, DRINK, LOOK) or <agent, patient, recipient> verbs (such as ASK, INFORM, EXPLAIN), and the experiencer or perceiver in <experiencer, theme> verbs (e.g., SEE, HEAR, LOVE).¹ According to general principles of mapping between thematic structure and syntactic structure (e.g., Fillmore 1968, Jackendoff 1990, Grimshaw 1990, Falk 2006 and others), the argument associated with the highest ranking thematic role is the subject argument. The correct generalization, then, is that the body is associated with the subject argument of the verb rather than with a particular thematic role. An implication of our analysis is that the basic lexicalization pattern when representing a state of affairs in sign languages is BODY AS SUBJECT.

¹ Psych verbs of the ‘frighten’-type, whose arguments are a causer and an experiencer, and exhibit a different thematic-syntactic mapping, are not attested in ASL or ISL. In order to express an event of frightening, ISL uses a periphrastic light verb construction ‘GIVE FRIGHT’, whereas in ASL one would use a paraphrase such as ‘I was frightened because of…’.
In other words, the body represents or corresponds to some property of the subject argument (that it has feelings, is sentient, has a mouth etc.). In spoken languages, properties of the arguments are inferred from or are part of the meaning of verbs. For example, the verb sneeze implies that the subject has a nose; the subject of lick has a tongue; the subject of faint is animate, and the subject of angry is sentient. In signed languages, such properties can actually be represented by some aspects of the form of the sign, in particular, parts of the body. If the sign denoting an event is signed on some part of the body, then the body is interpreted as associated with properties of the subject argument.2

1.2. Hands as event

The iconic mapping for the sign EAT points to a basic asymmetry between the body and the hands. The body represents one aspect of the event, its subject argument. The hands, in contrast, have more degrees of freedom. They have a specific shape, in a specific orientation, and move in a specific manner and a specific direction. As a consequence, the hands may represent many more aspects of the sign's meaning components. Aspects of the movement can correspond to temporal aspects of the event (such as telicity), direction of motion often encodes spatial thematic roles of the arguments such as source and goal, and the final location of the sign is associated with the recipient argument. The handshape often represents the argument in motion (the theme) or the manipulation of the (patient) argument by the subject.3 In EAT, for example, the inward movement of the verb represents putting something into somebody's mouth; the specific handshape represents holding or manipulating a solid object, food in the case of 'eat'; and the double movement denotes an action, or an atelic event.

The hands, then, may encode many more aspects of the event than the body. This is to be expected. The hands are much more versatile than the body: first, they can move in space; second, they can take different handshapes; third, they come in pairs. The movement component in itself is complex, as it includes both manner of movement and direction. The body, on the other hand, does not show any of these properties. It does not move in the same way that the hands can, and there is only one body. In this sense, it can encode considerably fewer aspects of the event. Interestingly, it encodes one particular aspect of the event, an argument – the subject. This argument is in a sense

2 Kegl (1986) also suggests that the body is associated with the subject argument. While her analysis is not incompatible with the one presented here, it differs in several important ways. First, she refers to BODY SHIFT ('a subtle shift of the body into a specific position in the signing space', p.289), and not to the body itself as part of the phonological components of the sign. Second, she argues that BODY SHIFT (which she calls 'Role prominence clitic') is a morpheme, functioning both as a subject clitic and as indicating 'role prominence' (a term left vague in her analysis). We do not argue for a morphemic status of the body, nor do we make any claims about its syntactic functions.

3 See Wilbur (in press) for a detailed analysis of the various manual components of the signs and their semantic correlates.
privileged, since it is set apart formationally from the other meaning components of the event. We find then, that a basic lexicalization pattern in sign languages provides support to the primacy of subject in language: it is the argument represented by the signer's body, to the exclusion of all other aspects of the event.

1.3. Factors obscuring the basic pattern

The basic lexicalization pattern 'body as subject' described above is most salient in body anchored iconic verbs, which belong to the class of plain verbs. In other domains of the lexicon and grammar of any given sign language, this pattern is often obscured by other structures and processes in the language. The versatility of hands vs. the stability of the body may mean that the hands assume more and more roles in the lexicon and grammar of sign languages as the lexicon expands, resulting in forms which do not conform to 'body as subject'. We mention briefly two such factors here, and examine in depth the third factor, namely the role of the body in inflected forms of agreement verbs.

First, not all body parts are possible locations for the articulation of a sign. Typically, the signing space is on or in front of the body, in the area between the waist and the head. Body parts that are lower than the waist, then, hardly ever function as locations for signs. Therefore, actions which are performed by the legs and feet of the subject are not articulated by these appendages; rather, the legs and feet are represented by the arms and hands. It is very common across sign languages for the index and middle fingers to represent the two legs. Verbs that denote actions such as standing, getting up, jumping, falling, sitting, walking (in ASL and ISL) have a handshape on the dominant hand, often performing the action on the non-dominant hand (in the horizontal plane, palm up or down, representing a surface). Verbs denoting a special way of walking, such as walking on high heels, are expressed by a handshape in ASL and a handshape in ISL, with the pinky pointing down. In such verbs, then, the body is not part of the phonological structure of the sign, and properties of the subject are represented by the handshape (e.g., that it has legs).

Second, body represents subject only for animate beings. Events involving inanimate subjects are articulated by the hands, usually in the space in front of the signer. Quite often, the dominant hand is performing the sign on the non-dominant hand. Take, for example, the verb 'eat'. In English and other spoken languages, the same verb can be used metaphorically with inanimate subjects, as in The acid ate the metal, The house ate all my savings. In ASL and ISL, the verb EAT cannot refer

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4 For an in-depth discussion of the primacy of subject in language, see Meir et al (2007).
to inanimate referents. The iconicity of the sign, especially the location (the mouth of the signer), constrains the possible contexts and metaphorical extensions of the sign (Meir 2004). Similarly, the sign ABSORB (ISL), when signed on the temple (Figure 2a), can only refer to a human subject absorbing information. When the sign is signed in neutral space (Figure 2b) it can refer to an inanimate subject, like a sponge absorbing water. It seems that the properties of the body itself, the body of an animate being, constrain the possible meanings that the body can represent.  

Figure 2: ABSORB: a. with a human subject.             b. with a non-human subject.

2. THE BODY IN AGREEMENT VERBS: 1st PERSON

Agreement verbs are those verbs which encode person and number features of their subject and (indirect) object arguments. Semantically, agreement verbs denote transfer events, the transfer of an entity (concrete or abstract) from a former to a future possessor. Unlike plain verbs, which have one verb form, agreement verbs have numerous forms. However, each agreement verb also has a citation form, a form used as a dictionary entry, to represent the lexeme. Citation forms of agreement verbs still manifest the 'body as subject' strategy: the hands move with respect to the body. The move away from the body when the subject argument is the source possessor (in verbs such as GIVE and SEND, the so-called 'regular agreement verbs'), and towards the body when the subject argument is the goal possessor (in verbs such as TAKE or COPY, the so-called 'backwards verbs'). However, in inflected forms of agreement verbs, the body is no longer subject, but rather it encodes 1st person.

Inflected forms of agreement verbs incorporate the grammatical category of person, encoded in the pronominal system of the language by employing a contrast between the signer and the space around the signer. In the pronominal system of ASL and ISL, and many other sign languages, the

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5 There are functions in ASL and ISL, notably theatrical or poetic functions, under which the body can be used for inanimate objects. These are cases of personification, where objects take on animate-like qualities. One well-known deaf performer of humorous ASL narratives depicted the flight of a golf ball by using the head, complete with expressive eyes and other facial features as if the golf ball were human. The golf ball, 'happily sitting on a tee' (with the tee represented by a hand in appropriate scale underneath the chin), was 'surprised to find itself sailing through the air' when it was hit by a golf club. Such forms are rarely found in everyday ASL conversation, unless the signer intends to make a humorous play on the language.
signer's body represent 1st person, while locations in the signing space are associated with non-1st-person referents (Meier 1990). The association of 3rd person referents to specific locations in space is often achieved by signing the sign for that referent and then pointing to, or directing the gaze towards a specific point in space. Subsequent pointing towards that location in space (often referred to as R(eferential) locus, cf. Lillo-Martin and Klima 1990) has the function of pronominal reference. Pointing towards oneself denotes 1st person pronoun, and pointing towards an R-locus already established in the signing space denotes pronominal reference to the referent associated with the given R-locus.

Inflected forms of agreement verbs build on the system of R-loci, and the opposition between body and space. In these forms, aspects of the movement of the hands encode the syntactic and semantic roles of the verb's arguments, while the initial and final locations of the sign are associated with R-loci and encode pronominal features of the arguments. The hands move between the R-loci associated with the subject and (indirect) object arguments of the verb in a systematic way. The linear order of the R-loci encodes the semantic role of the arguments: the hands move from the source argument to the goal, or recipient argument. The facing of the hands, that is the direction towards which the palm or fingertips are oriented, encodes their syntactic roles: the hands face the syntactic indirect object (Meir 1998a,b).

In these forms, the body represents 1st person, not subject. Let us look at the following verb forms: 1GIVE2 ('I gave to you'), 2GIVE1 ('You gave to me'), 2GIVE3 ('You gave to him/her'). In all of these forms, the hands move from the subject R-locus to the object R-locus. If subject is 1st person and object 2nd person, the hands move from the body towards the direction of the addressee. If subject is 2nd person and object is 1st person, then the direction of movement is reversed. In case both arguments are non-1st person, the body is not involved in the form, and the hands move from the R-locus associated with the addressee towards another locus in space, associated with the 3rd person referent.

Agreement verbs, then, encode two grammatical categories: grammatical person and syntactic roles. Person is encoded by the body and locations in space: a locus on or near the region of the signer’s chest marks 1st person. Any other locus around the body marks non-1st - person, including 2nd and 3rd person (Meier, 1990). The syntactic roles of the arguments are encoded by the movement of the hands between these loci. It follows then, that in fully inflected forms of agreement verbs, body is no longer subject; rather, it is 1st person. The basic, default lexicalization pattern is obscured by a morphological process, which makes use of the same formational elements, but associates them with different grammatical functions.
3. Sign Language Verb Classes Reconsidered: the Role of the Body

With the understanding of the role of the body and the roles of the hands in the various types of verbs in ASL and ISL, we can return to the classification of verbs in these languages, and offer an alternative way of characterizing these classes, by taking into consideration the role of the body in addition to the role of the hands.

Plain verbs, in particular body anchored plain verbs, can now be defined as the set of verbs in which the body is subject and the category of grammatical person is not encoded. In the inflected forms of agreement verbs, the body is no longer subject. Rather, body is 1st person, locations in the signing space are associated with non-1st-person referents, and the the hands, in particular the direction of movement and the facing of the hands, encode syntactic and semantic roles of the arguments. The detachment of the event from the body offers more flexibility in the encoding of the event: the body-space opposition represents the grammatical category of person (1st vs. non-1st), while the movement and the facing of the hands can encode the syntactic roles of the arguments.

Spatial verbs, including classifier constructions, are those with beginning and end points determined by spatial referents, that is, by their actual or designated locations in a spatial array, and not by the syntactic arguments of subject or object. The locations encoded by verbs in this class are interpreted analogically and literally, and not as representing grammatical arguments (Padden, 1998). In such signs, the movement begins at some location and ends at a different location, depicting the trajectory of motion of an entity. Spatial verbs, e.g. DRIVE-TO and MOVE-TO, incorporate fine distinctions of location and movement throughout the signing space in front of the body, but importantly, do not contact the body itself. T. Supalla (1982) describes verbs of motion and location as existing in appropriate 'scale'. If the signs contact the body, then the scale becomes relative to the signers body, and the meaning changes to ‘a toy car driven into the side of a human body.’ In spatial verbs and classifier constructions, then, the hand(s) represent entities moving in space; the body is typically not involved in the event at all, or can be used as a spatial reference point (the Ground cf. Talmy 1983), with respect to whom the motion event is depicted.

The characterization of the three verb classes is summarized in Table 2:
Table 2: Verb classes redefined

<table>
<thead>
<tr>
<th>Verb class</th>
<th>Body</th>
<th>Hands</th>
<th>Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain verbs</td>
<td>Corresponds to Subject</td>
<td>Do not encode referential properties of arguments</td>
<td>__________</td>
</tr>
<tr>
<td>Agreement verbs</td>
<td>1st Person</td>
<td>Encode syntactic and semantic roles of arguments</td>
<td>Non-1st-person referents</td>
</tr>
<tr>
<td>Spatial verbs</td>
<td>Spatial reference point or not involved</td>
<td>Encode locative roles of arguments</td>
<td>Locations in space</td>
</tr>
</tbody>
</table>

4. A Sign Language Typological Puzzle

4.1. Object over subject primacy

Sign language verb agreement presents interesting challenges to linguistic theory, because it is similar to, but also very different from verb agreement systems in spoken languages. One difference is that in sign languages verb agreement is marked only on one class of verbs, verbs denoting transfer, whereas in spoken languages agreement systems usually apply to all the verbs in a particular language. A second difference is that in the sign language system, agreement with the object takes precedence over agreement with the subject. This contrasts with the situation in spoken languages, where the subject is the highest ranking argument in the Grammatical Relations (GR) Hierarchy (Greenberg 1966: 37-38) and therefore the most accessible argument for verb agreement. This hierarchy implies that if a language has object agreement, it also has subject agreement, but not vice versa. We expect then to find spoken languages with subject agreement and no object agreement, but not languages with object agreement and no subject agreement (see e.g., Keenan 1976: 316, Lehmann 1988: 64). The hierarchy also implies that within a given language, if a verb

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6 For an analysis addressing this issue, see Meir (2002).
form encodes agreement with object it also encodes agreement with subject. In sign languages, this is not the case. First, no sign language is known to have subject agreement and no object agreement. But more crucially, there are several phenomena in the verb agreement system of particular sign languages that result in forms marked for object agreement but not subject agreement. Two phenomena are described here.

(a) Single agreement verbs: In ASL and ISL, agreement verbs fall into a number of subcategories. Some verbs agree with only one argument. In such verbs, the beginning point of the verb is marked for being located at some body-part (mainly some part of the face) and therefore is not determined by the R-locus of the other argument of the verb. ASK (ISL) is such a verb: its initial location is near the mouth, and its final location is towards the R-locus of the object of the verb. Even if the subject is not 1st person, the verb nonetheless begins at a location near the mouth. Thus a verb form meaning 'He asked you' has the form ASK$_2$ rather than 3ASK$_2$. Examples of other single-argument agreement verbs in ISL are: ANSWER, EXPLAIN, TELL (mouth), SEE (eye), VISIT (eye), CARE-(for) (forehead), TELEPHONE (ear). In ASL, single-argument agreement forms include SEE, TATTLE-ON, SPY-UPON. Interestingly, in these verbs it is always the subject agreement marker (that is, the R-locus associated with the syntactic subject) that is omitted. The object agreement marker, then, seems to be obligatory, while the subject marker is not. The same phenomenon is described in other sign languages, e.g., Danish SL (Engberg-Pedersen 1993: 191), and Italian Sign Language (LIS) (Pizzuto 1986: 25-26).

(b) Subject agreement marker omission: It has been observed that the subject agreement marker is optionally deleted (Padden 1988, Bahan 1996, Liddell 2003). As Padden points out, the subject agreement marker of a verb may be optionally deleted, whether it is realized as the beginning point of the verb (as in 'give'-type verbs) or as its end point (as in 'take'-type verbs). When the subject agreement marker is deleted, Padden notes, “the resulting form has a reduced linear movement”. (ibid. p. 117). However, when the subject of such reduced verb forms is 2nd or 3rd person, signers tend to sign the verb from the body, not from a location near the R-locus of the subject. In other words, when the R-locus functioning as subject agreement marker is omitted, the verb often anchors to the body in its initial point, agreeing only with its object. Such verb forms resemble the single-agreement verb forms discussed in the previous section.

Sign languages, then, appear at first to have a reverse hierarchy with respect to verb agreement: the object is more prominent than the subject. If a verb agrees with only one argument, it is the (recipient) object argument. And if a verb form encodes agreement with subject, it encodes

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7 When the object is 1st person, the verb retains its movement towards the signer's body. In such forms, the body is 1st person and not subject. The single agreement verb forms described here occur, then, only for non-1st person objects.
agreement with object as well. Several researchers have noticed this peculiar behavior, and tried to offer an explanation. Janis (1995: 220) points out that the agreement hierarchy of ASL parallels the hierarchies found in other languages for case markers. Meir (1998b, 2002) builds on this observation, and analyzes the facing of the hands (which, according to her analysis marks the syntactic roles of the arguments) as marking case relations. However, both Janis and Meir admit that sign languages are still unusual in that case relations are marked on the verb rather than on the arguments. Thus, no satisfactory solution has been offered so far for this typological puzzle.

We suggest that the puzzle can be resolved by taking a new look at the sign language verb classification, one that takes into consideration the role of the body in the three verb classes. Such an approach will show that the subject is the most prominent argument in sign languages as well, but that this prominence is manifested in a somewhat different way in sign languages.

4.2. The solution

As we pointed out in section 3 above, an important difference between agreement verbs and plain verbs is in the role of the body. In plain verbs, the body represents the subject, and the category of person is not encoded. In agreement verbs, the body encodes 1st person, and the hands take care of all the rest, that is, encoding non-1st person referents as well as their syntactic roles.

Turning back to single agreement verbs, we can now suggest a solution to the typological puzzle they present. Single agreement verbs can be regarded as a kind of ‘hybrid’ of plain verbs and agreement verbs. As with plain verbs, in single agreement verbs the body represents the subject. The hands, on the other hand, behave as in (full) agreement verbs: they encode non-first-person features, as well as the syntactic object. These verbs, then, represent the subject by the body. What is dropped in these forms is not the subject marker, but rather the specificity with respect to person. These verbs retain their trajectory with respect to the body as subject, as they still move from near the body outward (or toward the body if a backwards verb). Our analysis suggests that reference to the subject is not optional, but rather obligatorily represented by the signer's body. In other words, the subject is not encoded by the verb agreement system, but rather by the lexical form of the verb, as in plain verbs. In a way, the subject is more deeply entrenched in plain verbs and single agreement verbs than in full agreement verbs, because it is part of the lexical entry itself, and not added by an inflectional affix.

This line of thought suggests that the subject is a privileged argument in both signed and spoken languages. But the two modalities afford different possibilities for expressing this special status. The manual-visual modality makes use of the natural asymmetry between the body and the hands to encode the subject-predicate asymmetry in the form of lexical items denoting state of
affairs. The asymmetry is encoded in the structure of lexical items in these languages. Grammatical processes such as verb agreement may cause this pattern to become opaque, but this basic tendency surfaces as a default pattern on various occasions. The auditory modality of spoken languages cannot encode features of the subject in the lexical structure of words. The special status of the subject is expressed in the grammar, by being the most accessible target for various morphological and syntactic processes.

5. Competing roles of body: subject, 1st person, human body

The examination of the role of the body in plain vs. agreement verbs shows that the body may subsume different grammatical functions in the language, both building upon different properties of the human body. Different sub-systems of the language make use of these different properties of the body. Humans use their body to perform various kinds of actions. Hence the body may be used to represent these actions, from the perspective of one particular argument participating in the event, the subject. This aspect of the body is encoded in the lexical form of plain verbs. The body is also the body of the signer, the addressor in the communication situation. The addressor's role is encoded in the linguistic category of person; the body represents 1st person, as in the pronominal system and inflected forms of agreement verbs.

The body also may stand for a human body and all its various organs: the mouth, eyes, ears, forehead, chest, arms etc. Pointing to a specific organ can have the function of referring to that organ. And indeed, the signs for eyes, nose, mouth, heart, arms and other body organs are very often deictic signs, pointing to the relevant organ. Signs referring to actions performed on various body organs may be modulated to express the specific part of body involved in the event. The signer can use his/her body to indicate where on the body he was hit in an event expressed by the following sentence – 'He hit me on the arm.' Depending on where on the arm the signing hand makes contact with the body, for example, the upper or lower part of the arm, the signer can specifically mark where on the arm the event took place. Or, in an event such as ‘The surgeon cut open my chest,’ the sign OPERATE involves a short contacting movement down the signer’s own sternum. The signer can contrast this location with surgery elsewhere on the body, such as brain surgery (contact on some part of the head) or a cesarean section (on the abdomen). In these forms, the upper torso is available as a detailed set of locations, used for signs that refer to specific points on the body.

These three different roles, of representing the subject, 1st person and locations on the body, are employed in three different sub-systems of the language. Yet there could be incidents where
they can compete with each other. For example, in single agreement verbs the body represents the subject; but it is also "needed" to represent 1st person object forms, such as in (ISL) 'he asks me'. Similarly, a location on the body may represent not only an event happening to the signer, but also the signer acting on a body part of a 3rd person referent, as in 'I combed his/her hair'. How do sign languages resolve such competitions? It turns out that such forms are indeed more complex and complicated, and different sign languages offer different solutions to these problems. We briefly examine two cases here: 1st person object forms of single argument agreement verbs, and transitive verbs denoting body activities.

5.1. 1st person object forms of single argument agreement verbs
In single argument agreement verbs, the initial location of the sign is on the body, and the hands then move towards a location in space associated with the object argument. But if the object argument is 1st referent, then both initial and final locations of the signs are on the body. If the same body location is used, then the sign would have no path movement at all, resulting in a phonologically impossible sign. How do sign languages resolve this conflict? ISL and ASL present two different strategies. In ISL, a verb form such as 'he asked me' starts at the R-locus associated with the subject referent ('he'), moves towards the mouth (the lexically specified location of the sign), and then moves down towards the signer's chest, the location encoding 1st person. Such a form, then, is more complex than regular inflected forms of agreement verbs, since it has setting specifications for three distinct locations: the subject's R-locus, the mouth and the chest. Similarly, the verb form 'you see me', starts at 2nd person locus, moves towards the eyes and then towards the chest. ASL has this strategy too for some verbs, such as SEE and TELL.

ASL also has a different strategy, used with some verbs. For example, a verb form meaning 'He phoned me' starts at the ear, then moves to the R-locus established for the 3rd person, and then moves to the signer's chest. In ASL, as in ISL, such forms have specifications for three settings, but the ordering of these settings is different: the movement is from location on the body, to the subject R-locus, and then to the object R-locus. If the object is 1st person, it moves to the signer's chest; but it can move to other R-loci as well. In ISL, such forms are restricted to the object being 1st person. When the object is non-1st person, the verb cannot encode the subject agreement marker, resulting in single argument agreement verbs. The differences and similarities between ASL and ISL show that solutions to similar linguistic problems can take different forms.
5.2 Transitive verbs denoting body activities.

Signs for verbs denoting actions performed on body organs, such as BRUSH-HAIR vs. BRUSH-TEETH, HIT-ON-SHOULDER vs. HIT-ON-FACE, are signed on the respective body organs. Such forms take advantage of the fact that the body of the signer is always there in the discourse event, and therefore reference to body organs can be done simply by pointing to or signing a sign near the relevant organ. In such forms, the body is not necessarily associated with the subject argument or with 1st person, but rather as a real-world entity that is being employed in the signing discourse as a referential device. However, the default interpretation of such forms is that the body is also the signer's body, hence 1st person. The unmarked interpretation of a form such as BRUSH-HAIR, then, is 'I brushed my hair'. But how does one sign 'I brushed her hair?' Signing the sign on the signer's head would tend to be interpreted as brushing one's own hair, while performing the sign in neutral space, in the direction of the R-locus associated with the 3rd person referent, loses the specification with respect to the hair. Such forms are notoriously difficult, and signers of different languages may devise different strategies to meet such a challenge. One strategy is to sign the sign first on the signer's body, specifying the exact location on the body where the action takes place, and then directing the sign towards the other referent, specifying the grammatical object. Another technique is to break the transitive event into two intransitive sub-events, specifying what each of the arguments is doing. Thus a clip showing a girl brushing her mother's hair can be conveyed as 'MOTHER SIT; GIRL COMB'. We elicited depictions of three actions involving body parts in two languages: ISL and ABSL. These clips showed: a girl feeding her mother, a girl brushing her mother's hair, and a man tapping on a girl's shoulder. Responses from 16 ABSL signers (both adults and children, age range 4~40) and 17 ISL signers (age range 30-90) were coded and analyzed. Of the 63 ABSL responses, 22 involved verbs performed on the signer's body (35%), 12 were signed towards a location in space (19%), 20 forms involved signing the sign on the signer's body and then signing it towards a location in space and 7 were signed in the reverse order. Two forms involved three verbs: other-self-other. It seems, then, that ABSL prefers body anchored signs, or body anchored signs first and then directing the verb away from the body.

In ISL we find a different pattern: of the 72 responses, only 15 were body anchored (about 20%), whereas 39 verb forms were directed towards a location in space (54%). 23 forms were complex: self-other (15), other-self-other (4), (3) and self-other-self (1).

These results indicate that in both languages there is no one established form for expressing such events, but each language shows different preferences. In ABSL body anchored signs are preferred, as well as complex forms starting with body anchored signs. In ISL, signs directed
towards locations in space are preferred, and the ordering of the signs in the complex forms varies. As with the 1st-person object forms above, similar challenges may result in different solutions, or at least different tendencies in different sign languages.

6. CONSEQUENCES AND PREDICTIONS OF 'BODY AS SUBJECT' THEORY

We argued that 'body as subject' is a basic default lexicalization strategy in sign languages, and that verb agreement is a more complex mechanism, which builds on this basic strategy but also obscures it, as it involves an additional grammatical category (grammatical person) and the detachment of the subject from the body. Since 'body is subject' is more basic, the following predictions emerge: (a) If a sign language has verb agreement, it must also have 'body as subject' verbs (that is, plain verbs) but not vice versa. (b) From a diachronic perspective, the appearance of 'body as subject' verbs precedes that of agreement verbs. That is, a sign language would move from having basically 'body as subject' verbs towards adding verb agreement to its verbal system only in later stages.8

We describe here two languages conforming to these predictions: Al-Sayyid Bedouin Sign Language (ABSL), a young language with plain verbs but no agreement verbs, and Israeli Sign Language (ISL), a language that did not have verb agreement in earlier stages of its history, and developed this system in later stages.

6.1. ABSL: A sign language with no verb agreement

The Al-Sayyid Bedouin group was founded about 200 years ago in the Negev region of present-day Israel. Originally fellahin ‘peasants’ from Egypt who worked for traditional Bedouins as laborers, the Al-Sayyid now function autonomously and are regarded by outsiders as Bedouin. The group is now in its seventh generation and contains about 3,500 members, all of whom reside together in a single community exclusive of others. Consanguineous marriage has been the norm in the group since its third generation. Such marriage patterns are common in the area and lead to very strong group-internal bonds and group-external exclusion. It is indicative that the Al-Sayyid still view themselves as a single large family, though now subdivided into subfamilies.

In the fifth generation since the founding of the community (about 70 years ago), four deaf siblings were born into the community. In the next two generations, deafness spread in many other families as well. The number of deaf individuals in the community today is about one hundred. The particular distribution of deafness in the community, typical of recessive congenital deafness (Lane,

8 We do not claim, however, that all sign languages must develop verb agreement as they grow older. Our claim is that if a sign language develops verb agreement, we expect such a development to follow a stage when the language had only 'body as subject' verbs.
Pillard, and French 2000), has had socio-linguistic implications: deaf members of the community are integrated into its social structure and are not shunned or stigmatized, and a sign language developed in the community as a means of communication, used by both deaf members of the community and a significant fraction of its hearing members (Kisch 2000).

The sign language, Al-Sayyid Bedouin Sign Language (ABSL) is different in lexicon and structure from other sign languages used in the region, including Israeli Sign Language (ISL) (Sandler et. al. 2005) and Jordanian Sign Language (LIU) (Al-Fityani & Padden 2006), and, as expected, the languages are not mutually intelligible. In an earlier study, we showed that ABSL developed consistent SOV word order within a span of generation, which is different from the word order of the ambient signed and spoken languages (Arabic and Hebrew) in the region. What we did not find is inflectional morphological processes such as verb agreement. As a result of the lack of verb agreement morphology in ABSL, the basic lexicalization pattern of ‘body-as-subject’ is more apparent. Of the three verb classes of many other sign languages - plain, agreement and spatial - ABSL has only two: plain verbs and spatial verbs. Verbs denoting transfer, which in many sign languages constitute the class of agreement verbs, behave like plain verbs in ABSL.

This observation is based on data elicited from 9 signers of the second generation (age range 28–45), and 12 signers of the third generation (age range 4-24). The signers were shown a set of short video clips set up to elicit a range of transitive and intransitive verbs across different semantic categories. From these we identified a subset of clips as involving the following actions of transfer between two entities: GIVE, THROW, CATCH, TAKE, and FEED. Two other clips involved the actions of SEE and SHOW, which in many sign languages behave as agreement verbs. We then analyzed the signers’ responses to these elicitation clips, resulting in a total of 201 verb forms (which include repetitions and descriptions of single events with two clauses).

Of the 201 transfer forms produced, 176 involved movement with respect to the body: center-out movement when the subject is the source (as in GIVE, THROW and FEED), or center-in if the subject is the goal (as in the backwards verbs TAKE and CATCH). There was little or no shifting of the movement to the side; instead the movement was either center-out or center-in. The center-out/in movement appeared despite the fact that the action clips showed the actors as transferring an object from one side of the screen to the other. Signers did not mimic the direction of motion in the action clip; instead they used movement along their own central plane. Figure 3 shows pictures from an action clip in which a woman gives a ball to a man. In her response, the signer indicates that the woman is to her right on the screen, and the man to her left, but her verb form did not make use of either of these locations; instead the movement of the verb GIVE was center-out. The signer’s response is shown in Figure 4 below.
In a smaller number of responses (25 of 201), signers used a form with path movement not from the body, but from one side to the other (as illustrated in Figure 6). On closer analysis, we noticed that these involved holding or manipulating an object and moving it to another location. For example, five of these responses came from an action clip in which a man picks up a scarf lying on the floor and moves it in front of the woman who then accepts the scarf (Figure 5). This action is less like one of transfer than of picking up the scarf from its initial position on the floor and moving it to the woman’s location. The scarf was not initially in the possession of the man, but on the floor in front of him. We analyze these verb productions as spatial verbs, since they conform to those produced by the same signers in response to action clips in which an object is moving through space with no transfer involved. For example, when describing a ball being thrown through a hoop across the room, signers often depict the trajectory of the motion of the ball by moving the hand from one side of the signing space to the other. Of the 13 clips of the younger generation involving movement to the side, 12 came from the clips showing a seeing and a showing event, and the verb form was accompanied by a movement of the head to the side.
ABSL, then, does not have a verb agreement system. Crucial to our point here is the default lexical pattern of 'body-as-subject' that verbs of transfer in ABSL show. In these verbs, the body represents the subject argument, whether the subject is the source of transfer (as in GIVE, THROW and FEED) or the goal of transfer (as in TAKE and CATCH). These forms do not encode person distinctions. That is, signers did not vary the direction of the verb form when the person of the subject and object of the clause varied. Verbs that involve transfer from one entity to another behave like the default class of plain verbs.

As pointed out above, in sign languages with a verb agreement system the body is 1st person, and the hands encode the syntactic roles of the arguments. In such a system, the 'body-as-subject' pattern is no longer apparent, since the category of person is superimposed on it. The ABSL verb system does not encode grammatical person, hence giving supportive evidence to the basic 'body-as-subject' pattern.
6.2. Israeli Sign Language: The diachronic perspective

Israeli Sign language (ISL) is a comparatively young sign language, which came into existence as the Israeli Deaf community evolved, beginning about 70 years ago. Unlike ABSL, ISL developed in a pidgin-like situation. The members of the first generation of the Deaf community come from different backgrounds, both in terms of their country of origin, and in terms of their language. A few of that generation were born in Israel, but the majority were immigrants who came to Israel from Europe (Germany, Austria, France, Hungary, Poland), and later on from North Africa and the Middle East. Some of these immigrants brought with them the sign language of their respective countries. Others had no signing, or used some kind of homesign.9 Today, four generations of signers exist simultaneously within the Deaf community: the very first generation, which contributed to the earliest stages of the formation and development of the language, to the fourth generation, that has acquired and further developed the modern language as a full linguistic system.

While the signing of the first generation signers (age 65 and older) shows considerable individual variation in terms of vocabulary, word order and grammatical devices, the signing of this generation is consistent in lacking verb agreement. Older signers usually do not inflect transfer verbs at all. They use them as plain verbs, similar to our findings in ABSL. Signers in their late 40s and 50s use agreement verbs as single agreement verbs, originating from the body and agreeing with the (recipient) object. Younger signers (in their 30s and younger) inflect agreement verbs for both subject and object, but the object-agreement-only forms are still being used as well.

Engberg-Pedersen (1993: 193) describes a similar tendency in Danish Sign Language: older signers tend to use agreement verbs as single-agreement verbs, agreeing only with their (indirect) object argument. Younger signers in contrast use verb forms in which agreement is marked with both subject and object. However, they, too, can use the ‘earlier’ pattern.

7. Conclusions

Sign languages show that the privileged status of the subject is manifested not only in its behavior in various structural levels, but also in the inherent lexical structure of signs. That is, the notion of subject is built into the structure of the words themselves, even before they combine into larger units. The division of labor between the body and the hands in such signs suggests that we

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9 For a description of the history of the Deaf community in Israel and the development of ISL, see Meir & Sandler (2008).
conceptualize an event in terms of a predicate which is predicated over the subject. The subjecthood of one of the arguments participating in the event is a basic component of the lexical structure for expressing the event.

The 'body as subject' pattern, though very basic, as we claim, is often obscured by other systems in sign languages. However, once this pattern is recognized, it becomes a powerful explanatory tool for accounting for a variety of phenomena, both inter-language and intra-language. It explains why this pattern surfaces as a default strategy in single argument agreement verbs, it explains the complexity of 1st person object forms, and it accounts for apparent object supremacy in sign language verb agreement system. Diachronic developments within a sign language, as well as typological differences between sign languages also find a natural explanation when the role of the body in the structure of signs is recognized. It might also prove useful in bringing together other phenomena as well, for example the fact that character view-point gestures are more transparent than observer view-point gesture (Marentette et al 2007), and observations regarding stages of acquisition of verb agreement by deaf children in various sign languages. We leave these issues to future research.

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References


The morphological realization of semantic fields

Irit Meir
University of Haifa, Israel

1. Introduction

Though the lexicon is sometimes referred to as 'a collection of idiosyncratic forms', it has nonetheless also been pointed out that there is a lot of regularity and generalizations that hold between different lexical items. Restricting ourselves to verbs, such systematic meaning relations may refer to aspectual notions, i.e., perfectivity, telicity, and stativity; to valence-changing operations such as causativization, passivization and reflexivization; and to systematic metaphorical extensions across different semantic fields, for example by using spatial lexical items to denote possessional or temporal notions (Rappaport-Hovav & Levin (henceforth RH&L) 1998).

Quite often, systematic meaning relations among words are encoded morphologically. Many spoken languages have morphological markers for marking aspectual notions or for valence-changing operations. In Russian, for example, a telic verb may be derived from an atelic verb by affixation, as in (1). In Hebrew, many valence-changing operations are encoded by using the different verb patterns (the so-called binyanim), exemplified in (2). In such cases, there seems to be some kind of parallelism between the morphology and the semantics, in that morphological complexity corresponds to semantic complexity.

1. Russian: pit’ (‘drink’, atelic), vypit’ (‘drink up’, telic)

However, the third type of semantic relations mentioned above, systematic metaphorical extensions across different semantic fields, is not morphologically encoded in spoken languages. For example, a verb such as go and the prepositions to and from (in 3a-c below) are systematically polysemous when used in spatial, possessional or identificational semantic fields (Gruber 1965, Jackendoff 1990, 2002).

3. a. The messenger went from Paris to Istanbul.
   b. The inheritance finally went to Fred.
   c. The light went from green to red.
In (3a), the verb denotes actual motion along a path. In (3b-c), there is no actual motion; rather, the verb expresses that the subject argument underwent some kind of a change: change of possessors in (3b), and change of properties in (3c). The specific sense of *go* in each of these sentences is inferred from the nature of the complements of the prepositions *from* and *to* (locations, possessors or properties respectively). Using Jackendoff's terminology, we may say that each sentence denotes an event in a specific semantic field: spatial, possessional and identificationally respectively. It is the specific semantic field that determines the special interpretation of *go*, *from* and *to*. However, though the meaning relationship between lexical items in different fields are systematic and recur in many lexical items within a language, and in many languages, such relations are not encoded morphologically. This is, by no means, a peculiarity of English. RH&L (1998;264) point out that "We know of no language in which the morphological shape of a verb reflects the semantic field it is being used in." This statement points to a gap in the relationship between morphology and semantics. Though semantic notions referring to aspect or to valence are often expressed in the morphology, semantic field features are not.

In this paper I argue that Israeli Sign Language, as a representative of sign languages in general, constitutes precisely such a language; that is, a language in which the morphological properties of a verb reflect and are determined by the semantic field the verb is being used in. By this claim I do not mean that there is a specific morpheme in the language encoding semantic field or indicating metaphorical use. Rather, different semantic fields have different morphological properties in ISL, which are reflected in the morphological properties of the verbs used in these fields.

I first examine the various manifestations of semantic fields in spoken languages (section 2), and then turn to look at the morphological properties of each of the fields in ISL (section 3-6). Section 7 examines the implications the analysis for general linguistic theory.

### 2. Semantic field effects in spoken languages

Before turning to ISL, let us first look at how the different semantic fields are manifested in the linguistic structure of spoken languages. The examples here are from English, but similar phenomena are attested in other spoken languages. The term 'semantic field' is used here in the sense of Jackendoff's lexical-semantic theory (1990, 2002), whereby a situation is encoded in terms of core conceptual functions around which situation are organized, such as BE, STAY, GO, the arguments of these functions, and a semantic field feature. The conceptual functions specify the type of situation expressed by the predicate, and determine the (number and type of) arguments
participating in the event. The semantic field feature “… determines the character of the arguments and the sort of inferences that can be drawn.” (Jackendoff 2002;360, emphasis mine, I. M.). The semantic structure of a predicate is given in a Lexical Conceptual Structure (LSC) schema.

Let us look at a set of sentences expressing a change event in four different semantic fields (the first three sentences were presented above (3a-c), and are repeated here for convenience):

4. a. The messenger went from Paris to Istanbul. [location]
   b. The inheritance finally went to Fred. [possession]
   c. The light went from green to red. [identification]
   d. The meeting was changed from Tuesday to Monday. [temporal]

   (Jackendoff 2002;356-357)

All of these sentences denote a change event: the subject of each sentence undergoes some kind of change; it is being characterized as being at state 1 at the beginning of the event, and at state 2 at its end. This is represented schematically by the LCS in (5), where the change is captured by the GO function, and state 1 and state 2 by the arguments of the FROM and TO functions:

5. GO (X, [Path FROM (Y) TO (Z)])

The sentences in (4a-d) differ with respect to the nature of the arguments, that is, the variables in the LCS. This is determined by the specific semantic field, as summarized in Table 1:

<table>
<thead>
<tr>
<th>The semantic filed</th>
<th>X</th>
<th>Y and Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial</td>
<td>An object</td>
<td>Locations</td>
</tr>
<tr>
<td>Possession</td>
<td>An object (concrete or abstract)</td>
<td>Human beings (possessors)</td>
</tr>
<tr>
<td>Temporal</td>
<td>An event</td>
<td>Points in time</td>
</tr>
<tr>
<td>Identificational</td>
<td>Entity</td>
<td>Properties of the entity</td>
</tr>
</tbody>
</table>

Table 1: The nature of arguments in different semantic fields

In addition to determining the nature of the arguments, semantic fields often determine specific lexical choices. For example, in sentences denoting states in English, each semantic field employs a different preposition (or none at all), as illustrated in (6a-d). The choice of verb may also vary depending on the field: the verb go is used in the spatial, possession and identificational fields,
as shown in sentences (4a-c) above, but in the temporal field a different verb is used, *be-moved* or *be-changed* (ibid., p. 359):

6. Choice of prepositions:
   a. The book is *in* the drawer.
   b. The meeting is *on* Monday.
   c. The money is *with* Fred. (?)
   d. The light is ∅ green.

7. Choice of verb:
   a. He *went* to Istanbul.
   b. The meeting (*went) was changed* from Tuesday to Wednesday.

   (Jackendoff 2002, 359)

   Another difference between the fields is in the variety of prepositions that can be used. The spatial semantic field allows for finer (gradient) distinctions (exemplified in 8), while other fields are much more restricted (9-11).

8. He went *to/towards/in the direction of/closer to* the hill.
9. He gave the book *to/*towards/*in the direction of/*closer to* Tom.
10. The light changed *to/*towards/*in the direction of/*closer to* green.
11. The meeting was moved *to/ closer to /*towards/*in the direction of* Monday.

Jackendoff attributes this difference to the nature of the semantic field in question. He points out (ibid., p. 361) that possession, for example, unlike space, is discontinuous; there are no intermediate points between one possessor or another. Hence the only specifiable points on the possessional 'path' are the initial and final points, that is, the former or future possessors.

The effects of the semantic fields in English, then, are mainly on the types of arguments and possible inferences, on lexical choices and on some aspects of the syntactic structure of the sentences. There are no effects on the form of the verbs. We now turn to a language in a different modality, the visual-spatial modality, and examine the effects of the semantic fields in this language. My claim is that in visual-spatial languages, illustrated here by ISL, the semantic field effects are manifested in the morphology of the verbs as well. The reason is that each semantic field has distinct morphological properties, which determine at least some of the morphological properties of verbs and predicates in that field. These properties have to do with two factors:
1. whether or not R-loci are employed; 2. the nature of use of space. The next three sections examine the morphological properties of the four semantic fields in ISL with respect to these factors.

3. Spatial and possessional fields in ISL

Verbs denoting change in the spatial and the possessional semantic field show strong morphological resemblance. In both types of verbs, the beginning and end points are not lexically specified, but are rather determined by locations in space associated with the arguments of the verb. These points, often referred to as R-loci, determine the direction of the path movement of the verb. R-loci lie at the heart of the referential system of sign languages, and are central to understanding the morphological properties of the different semantic fields. Therefore they are described in some detail here.

In sign languages, nominals in a clause are associated with discrete locations in space, called ‘R(eferential)-loci’. This association is usually achieved by signing a NP and then pointing to, or directing the gaze towards, a specific point in space.1 These R-loci are used for anaphoric and pronominal reference for the nominals associated with them, and are therefore regarded as the visual manifestation of the pronominal features of the nominals in question (see, among others, Bahan 1996, Janis 1992, Klima and Bellugi 1979, Lillo-Martin and Klima 1990, Meier 1990). Note, however, that these locations are not determined by categories of features like e.g., gender or noun class. Each argument is assigned its own R-locus, and therefore it can be regarded more as an index than as feature complex. Sign languages, then, have overt R-indices (Lillo-Martin and Klima, 1990).

In addition to pronominal signs, verbs denoting motion (change of location) and transfer (change of possession)2 also make use of the system of R-loci: the initial and final points of the verbs are not lexically specified. Rather, they are determined in each discourse with the locations in space associated with the R-loci established for the source and goal arguments of the verb. The verb's path movement, then, is from the R-locus associated with the source argument to that associated with the goal argument.

The two ISL sentences in (12-13) below denote a change of location and a change of possession. In both, two arguments are associated with specific locations in space, and the verb's path moves from the source location to the goal location.

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1 The pointing sign is often glossed as INDEX, and the subscript following it indicates a specific point in space.
2 Motion and transfer verbs are often called 'spatial verbs' and 'agreement verbs', respectively, based on Padden's (1988) classification of verbs in ASL.
12. JERUSALEM INDEX\textsubscript{a}, TEL-AVIV INDEX\textsubscript{b}, CAR \textsubscript{a}PATH\textsubscript{b}.

'The car went from Jerusalem to Tel-Aviv.'

13. BOY INDEX\textsubscript{a}, GIRL INDEX\textsubscript{b}, BOOK \textsubscript{a}GIVE\textsubscript{b}.

'The boy gave the book to the girl.'

The two pointing signs in (12), INDEX\textsubscript{a} and INDEX\textsubscript{b}, are associated with locative referents, that is, locations. The same two signs in (13) are associated with human referents, the two possessors (former and future possessor) in the giving event depicted in the sentence. In both sentences, the predicate is a sign whose path movement is variable, in the sense that its initial and final points are determined by the points in space established by the INDEX signs. And in both sentences, the path moves from source to goal.

The spatial and possessional semantic fields, then, both make use of R-loci in a similar way. In verbs in both fields, the initial and final points are associated with R-loci of the Source and Goal arguments of the verbs (Meir 2002). Yet there are important differences between the two fields. These differences have to do with the use of space. In the spatial semantic field, the signing space is taken as an analogous representation of real world space, which is continuous. In the semantic field of possession, the signing space consists of discrete points/sub-parts. This difference, between a continuous and a discrete use of space, determines the interpretation of the relationship between the R-loci, and the possible forms of the path movement of the verb.

The differences between the two uses of space can be illustrated by the following example: Consider two loci A and B in the signing space. In (a) these loci correspond to locations, while in (b) they correspond to persons\textsuperscript{3}.

14. 

\begin{tabular}{ccc}
  & o & o & o \\
  A & C & B \\
\end{tabular}

a. A=Jerusalem \hspace{1cm} B=Tel-Aviv  
I LIVE INDEX\textsubscript{a} \hspace{1cm} ‘I live in Jerusalem’

b. A=John \hspace{1cm} B=Mary  
INDEX\textsubscript{a} HAPPY \hspace{1cm} ‘He (John) is happy.’

\textsuperscript{3}This example is based on Janis’s example for ASL (Janis 1992:135), but it holds for ISL as well.
The difference between the two types of pronouns emerges when the signer points to point C, a location close to, but not identical with point A. In the case of (b), this phonetic variation does not result in a change of the meaning of the sentence. As long as point C is closer to A than to B, the sentence would still mean ‘John is happy’. In the case of (a), however, the sentence would have a different meaning: ‘I live in a place between Jerusalem and Tel-Aviv which is closer to Jerusalem’. The difference between (a) and (b) when pointing to C rather than to A, highlights the differences between the two uses of space. This difference manifests itself in various aspects of the morphological behavior of R-loci and verbs in the two fields, described in (i-iv):

I. **Phonetic variations**: Variations in the actual forms of pointing signs, that is, pointing to locations close to each other, but not to the same location, are regarded as phonetic variations in the case of personal pronouns, but as meaningful distinctions in the case of locative pronouns, as illustrated above.4

II. **Expression of spatial relations**: Locative forms express spatial relations, whereas personal pronoun forms do not. Therefore, loci assigned to personal referents do not imply any spatial relations between these referents; but with locative referents, the relative position with respect to each other is representative of the spatial relations between them.

III. **The space between two loci**: Since locative forms express spatial relations, establishing two locative loci necessarily assumes that there is space between them. Thus the notion ‘between x and y’ is implicitly expressed (Janis 1992:137). In other words, the space between two locative pronouns is meaningful, and can be later referred to in the discourse. In the case of personal pronouns, on the other hand, the space between two pronouns is non-meaningful.

IV. **Introducing a new locus**: Since the space between two locative pronouns is meaningful and in a sense implicit, there is also the implication that there are other loci in that space. Hence, when the signer points at a new locus not mentioned previously (such as point C in the example above), this locus is interpreted with respect to the already established spatial relations that hold between A and B. That is, it is interpreted as a point (or a location) between A and B, but closer to A. The situation is different when A and B are associated with non-locative referents: the space between A and B is not meaningful. Therefore, no other loci are implicated. When a new locus is pointed at, there are two possibilities: either the new point is construed as one of the existing loci (if it is closer to one than to the other), or the new locus is uninterpretable since the locus has not been associated with a referent.

4 This difference was mentioned by Padden (1988) as the most salient criterion for distinguishing between agreement and spatial verbs, but holds of pronouns as well, as pointed out by Janis 1992.
V. Modification of path movement: The path movement of spatial verbs can be modified to reflect the shape of the path traversed by an entity, e.g., zig-zag, circles, ascending, descending etc. The path in change of possession verbs cannot be modified in such way. It has a stable form, specified for each lexical entry. For example, the verbs SEND and HELP have a straight path movement; GIVE, TELL, ASK have an arc path movement; the verbs TEACH and EXPLAIN have a short double movement. It is not possible to change the inherent movement features of these verbs.5

VI. The relationship between the path and the R-loci: In the spatial domain, if the path movement does not reach point B, the interpretation is that the entity in motion has not reached the location associated with B. In the possessional domain, what is important is the general direction of the path. Whether it actually starts at A or ends at B does not result in change of meaning.

Though there are clear distinctions between the two uses of space, they can also overlap. First, when referents are present, pointing signs are directed towards their actual location. In such cases, phonetic variations of the pointing signs (i.e., pointing in a direction close to the location of a referent) are more likely to be interpreted as distinctive than when the referents are not present. That is, though the signs are used to refer to persons and not to locations, the use of space seems to be continuous rather than discrete in these contexts.

Second, sometimes an event involves both a change of motion and of possession. Take for example a sentence such as ‘Mary handed Harry the book.’ In such cases, the verb may exhibit either continuous or discrete use of space, depending of whether change of location or change of possession is highlighted (Meir 1998).

In sum, verbs in the spatial and possessional semantic fields share a common morphological structure: in both fields, the phonological specifications for the beginning and end points are determined by the R-loci associated with the verb’s argument, and the direction of the path movement is from source to goal. They differ in the way the use space. In the spatial domain, space is continuous; R-loci are part of a continuum, so that by establishing R-loci, the continuum between them is also established. Other points on this continuum and the relationship between different points along it (the ‘between’ sense), are all implied in that system. In the possessional domain, on the other hand, space is comprised of discrete sub-parts: each R-locus represents a discrete

5 The path movement of verbs of transfer, as well as other verbs in the language, can be modulated to express aspectual modulations, such as continuative and iterative (see Meir and Sandler 2008 for ISL; Klima & Bellugi 1979 for ASL). Another possible modulation is the height of the path. As has been noticed by Liddell (1990) for ASL, and holds for ISL as well, when one of the arguments is taller than the other, the path will go from a lower to a higher R-loci, or the reverse. For example, when the arguments of the verb ASK are a mother and a child, the path of the verb is from a higher to a lower point if the mother is asking the child a question, and from a lower to a higher point in the reverse case.
independent unit. Therefore, what matters is that the loci are distinct from one another, but the spatial arrangement or relationship among the units is irrelevant.

4. Temporal semantic field
In many languages, temporal concepts are often expressed by using spatial expressions, such as spatial propositions and verbs of motion, e.g., the coming year, the time ahead of us, the worst period is behind us, a year ago. Sign languages, as languages articulated in space, can incorporate these spatial notions in the forms of signs themselves. In many sign languages, vocabulary items denoting temporal concepts are located on an imaginary time line, a horizontal line located at cheek or shoulder height. On this line, the signer's body constitutes a reference point denoting the present. The past is conceptualized as the area behind the shoulder or cheek, while the future occupies the area in front of the signer. The direction of the movement in signs denoting time concepts expresses temporal relation. An example will help. The signs YESTERDAY and TOMORROW in Figure 1a-b are a minimal pair. They have the same hand configuration and location, but differ in the direction of movement. In YESTERDAY the hand moves backwards, and in TOMORROW the hand moves forwards. Other pairs of signs in ISL are also similarly distinguished by the direction of the path, e.g., 'last week/year' vs. 'next week/year'.

Since temporal notions and relations are expressed as motion along a time line, one might expect that the structure of signs denoting change of time would be very similar to that of verbs denoting change of location, since change of time could be expressed as a change in spatial location on an imaginary time line. And indeed, there are some similarities in the structure of verbs in the two domains; in both, the sign consists of a path movement whose direction is variable. However,

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6 Lyons (1977;718) points out that "The spatialization of time is so obvious and so pervasive a phenomenon in the grammatical and lexical structure of so many of the world's languages that it has been frequently noted, even by scholars who would not think of themselves as subscribing to the hypothesis of localism."

7 For a detailed analysis of the use of the time line in temporal expressions in ASL, see Taub 2001, ch. 7.
there are important differences as well. These differences stem from two facts: (a) In ISL temporal expressions are not localized, and (b) The nature of the space is different: temporal expressions, unlike spatial expressions, are located on specific axes in space, not in a three dimensional space.

Let us look at an ISL sentence expressing a change event in the temporal domain, that is, re-scheduling an event in time:

15. MEETING TOMORROW INDEX \(_a\) POSTPONE NEXT-WEEK.

'The meeting was postponed from tomorrow to next week' (or – 'The meeting scheduled for tomorrow was postponed to next week'.)

As is evident from the ISL glosses, the temporal expressions TOMORROW and NEXT-WEEK are not associated with R-loci in space. Therefore, the initial and final points of the verb cannot be determined by association with previously established R-loci. The direction of the verb's path movement is determined by its meaning. Since the verb POSTPONE means 'moving forward in time', the direction is from the signer's body forward, that is, from a point proximal to the signer to a distal point. Moving from a distal to a proximal point has the meaning of 'pre-pone', moving backwards in time. The initial and final points, then, are not associated with specific loci in space. Rather, it is the spatial relationship among them (proximal or distal with respect to the signer's body) that encodes the direction of the temporal change.

Some signers localize the event, the meeting in (15) (MEETING TOMORROW INDEX \(_a\)). The initial temporal expression is a modifier of the noun ('the meeting tomorrow') and not an independent phrase. The verb then moves from the R-locus assigned to the event either forward or backward, depending on whether the event was postponed or pre-poned. This is in contrast with verbs of change of location or possession, where the direction of the path is fully determined by the locations in space associated with the source and goal argument.

The prepositions from and to are used in English not only to express change in time (as in 16), but also to express a stretch of time (as in 17):

16. The meeting was moved from 2 to 4.

17. The meeting is from 2 to 4.

ISL differs in that respect: for re-scheduling events, the forward-backward axis is used (that is, an axis perpendicular to the signer's chest, as in Figures 2a-b). A stretch of time, in contrast, is expressed by employing the side-to-side axis (the axis parallel to the signer's chest, illustrated in Figure 2c).
Figure 2: Axes in the temporal field: (a) POSTPONE, (b) PREPONE, (c) time stretch.

The temporal semantic field, then, differs from the spatial and possessional fields in that its Y and Z arguments are not localized. Additionally, verbs in this field move along specific axes in space: the signer-forward axis, and the side to side axis. In ISL, it seems that no reference is made to specific points along these axes; what matters is the relationship between the initial and final points. However, other sign languages may exhibit different behavior. According to Wilbur (in press, 17), in ASL

"It is also possible for the time of the event to be meaningfully manipulated in appropriate contexts (18 [her 15]). In (18b), the final occurrence of the sign POSTPONE can be made with two forward movements, one stopping at a point \( p_1 \) for one week, and the second at a more distal point for two weeks \( p_2 \). The discourse context determines how these time points are interpreted (weeks, minutes, etc.)."

18. a. WEDDING MUST \( x \) POSTPONE\(_Y\)
   ‘The wedding had to be postponed.’

b. ONE-WEEK TWO-WEEK WANT \( x \) POSTPONE\(_Y\) WHICH \( x \) POSTPONE\(_{Y,Z}^{++}\)
   ‘Do you want to postpone it for one week or two?’

In both languages, however, the temporal domain makes use of specific axes in space, unlike the spatial and possessional domains, which employ a 3-dimensional space, whether continuous or discrete.

5. Identificational semantic field: change of properties
Change of properties in spoken languages is often denoted by change-of-state (COS) verbs (blush, redden, get-well). A COS verb encodes as part of its meaning the final state of the argument undergoing change. The verb redden, for example, specifies that a referent has reached the state of being red. The initial state is implied, and can be characterized as "not Final State". That is, COS verbs can only mean 'changing from not-A to A'. The verb redden can only mean 'change from not
red to red'; it cannot mean 'change from yellow or from any other color to red' (Carter 1976). When expressing a CHANGE event where the initial and final states are not reverse values of the same property, spoken languages often use a spatial template, in which the initial and final states are marked as source and goal respectively, by the prepositions from and to (or into, in some cases), as in (19-22):

19. The light went from green to red.
20. Things went from bad to worse.
21. The witch turned the frog into a prince.
22. He changed from this nice young guy into a horrible nerd.

In such sentences, change of properties is conceptualized in terms of change of location. According to Lakoff and Johnson (1999:52), our conceptualization of change of state draws on the primary experience of motion along a path, where change of state is experienced as part of the change of location as one moves.

English, then, as well as other spoken languages, expresses change of state either by lexical means (COS verbs, which are non-spatial in nature), or by a spatial syntactic template, where spatial prepositions mark the initial and final states as source and goal.

ISL, like English, has both lexical means and grammatical means to express change of state. Like English, ISL COS verbs do not have spatial morphology. Yet unlike English, ISL does not use a spatial template to denote change of state. Let us look first at COS verbs.

Verbs denoting change of properties in ISL often have a path movement as part of their phonological structure. However, the direction of the path is not variable; it is lexically fixed, often expressing the direction of a specific change in an iconic way. So in a verb meaning 'to become fat', the hands move away from each other, while in its antonym the hands move towards each other; a verb meaning 'to grow up/ grow tall' has an upward moving path, while 'becoming shorter' has a downward moving path. In other cases, the direction of the path has a less straightforward meaning. In BECOME-BETTER/IMPROVE (Figure 3a), there is a rotation of the wrist outwards; in BLUSH (Figure 3b) the hand moves upwards along the face, whereas in GET-PALE (Figure 3c) the hands move downwards. COS verbs, then, differ from verbs in the spatial, possessional and even

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8 Hebrew has idiomatic expressions that draw on similar metaphors: ha-dam ala lo lapanim ('Blood got up his face', meaning 'His face got red (usually from anger)'; ha-dam azal mi-panav ('Blood ran out of his face', meaning 'He got very pale').
temporal domains in that the initial and final states are not independently specifiable, and the path movement of the verb is not variable but rather is lexically determined.

Figure 3: COS verbs in ISL: (a) (GET)-BETTER, (b) BLUSH, (c) GET-PALE.

What happens when there is no one lexical item to express a specific change of state? As (19-22) show, English uses a spatial template. If ISL were to use spatial means to express change of properties, a sentence meaning 'The leaves turned from green to yellow' would take the following form:

23. *LEAVES, GREEN INDEXa, YELLOW INDEXb, CHANGE  aPATHb

In such a hypothetical sentence, the initial state GREEN is localized in point (a), the final state YELLOW in point (b), and the change from one to the other would be denoted by a sign whose path movement is from (a) to (b). However, as the asterisk indicates, such a sentence is ungrammatical in ISL. The ungrammaticality stems, first of all, from the fact that the initial and final states cannot be localized. This may be part of a general restriction in the language that only referential expressions can be localized. The states in the above sentences are predicates, not arguments, hence non-referential, and therefore cannot be localized (Meir 2004). Any R-locus established in this discourse would be interpreted as associated with the referential expression in the sentence (LEAVES), rather than with its properties. Moreover, since there is only one referential expression in the sentence, the sentence cannot contain two R-loci, since each R-loci is expected to be associated with a different referent. Therefore, a spatial template cannot work for expressing change of state in ISL.

How does the language express such events, then? There are two possibilities. One is to use the verb BECOME/CHANGE-TO, the final state would be expressed as a complement of the verb, and the initial state as a modifier of the nominal referring to the entity undergoing change, as in (24). The second is to use a temporal template, where the initial and final states are marked by the temporal adverbials THEN and NOW, as in (25-26):
24. LEAVES GREEN CHANGE YELLOW.
   'The green leaves turned yellow.'
25. DOCTOR INDEXa THEN FAT NOW CHANGE THIN.
   'The doctor that used to be fat has become thin.'
26. BOY INDEXa THEN SICK NOW HEALTHY.
   'The boy that was sick became healthy.'

A CHANGE event in the identificational domain, then, differs considerably from similar types of events in other semantic fields. COS verbs have an invariant path movement, fully specified in the lexicon. Furthermore, the initial and final states (the Y and Z arguments in the LCS) cannot be localized. Therefore, no spatial means is available in this domain, and the language resorts to non-spatial morphology and sentence structure to express a change of property event.

6. Summary: The morphological properties of the four semantic fields
Verbs denoting change in the four semantic fields examined here have different morphological properties. In the spatial and possessional fields, the initial and final locations of the signs are not lexically specified, and are determined by the R-loci of the source and goal (Y and Z) arguments of the verbs. These loci, in turn, determine the direction of the path movement of the verb. The difference between the two fields is in their use of space – continuous vs. discrete. Space in the spatial domain is analogous to real-world space, and hence is continuous. The spatial relationship between R-loci represents relationship between locations, and the space between these locations is meaningful. In the possessional domain, R-loci represents referents, not locations. The spatial relations between the R-loci is non-meaningful, and no space in between them is implicated.

The temporal and identificational fields do not make use of R-loci; both temporal expressions and properties cannot be localized. Therefore sentences denoting a change event in these domains do not involve localization of the initial and final points of the event. Rather, the referent undergoing change (the X argument in the LCS) may be localized, the initial point (the Y argument) is often expressed as a modifier of that nominal, and the final point (the Z argument) as a complement of the verb. Thus the structure of sentences in these domains may be quite similar. The two domains differ in the use of space. The temporal domain makes use of axes in space, where the direction of the movement of the verb encodes relative order (sequencing) of events. Verbs in the identificational field do not have spatial morphology at all; their path movement, if there is one, is
fully specified for each verb in the lexicon, and cannot be modulated to express motion along different paths in space.

The morphological properties of the different semantic fields are summarized in Table 2:

<table>
<thead>
<tr>
<th></th>
<th>Use of space</th>
<th>R-loci</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spatial</strong></td>
<td>Continuous, Analogous</td>
<td>Locations</td>
</tr>
<tr>
<td><strong>Possessional</strong></td>
<td>Discrete</td>
<td>Referents</td>
</tr>
<tr>
<td><strong>Temporal</strong></td>
<td>Consists of axes</td>
<td>*******</td>
</tr>
<tr>
<td><strong>Identificational</strong></td>
<td>(no directional use of space)</td>
<td>*******</td>
</tr>
</tbody>
</table>

Table 2: Morphological properties of semantic fields

7. Conclusions and consequences

The theoretical significance of the morphological realization of these semantic fields is three-fold. First, it fills a lacuna in the relationship between semantics and morphology. As pointed out in section 1, of the three systematic meaning relations mentioned in RH&L (1998), only two – aspectual and valence changing relations – are encoded morphologically. The third type, the systematic polysemy of lexical items used in different semantic fields, is not encoded morphologically in spoken languages. Yet, as this paper has shown, it is encoded in a language transmitted in the visual-spatial modality, ISL, and quite possibly in other sign languages as well. This suggests that no systematic meaning relations among lexical items is exempt in principle from being encoded by morphological means. The question still arises as to why is it that only sign languages encode semantic fields morphologically. I leave this question open at present. It probably has to do with the fact that sign languages are articulated in space, and have space at their disposal for expressing spatial relations, as well as other types of relations which are metaphorically built on the spatial domain. However, a full explicit explanation has yet to be formulated.
Second, morphological form is often taken as evidence for the existence of the specific semantic categories expressed by these forms. RH&L (1998;260) note, for example, that the existence of morphemes in some languages that express certain semantic distinctions (such as telicity) can be taken as supportive evidence for analyses which assume semantic primitives corresponding to such distinctions. In a similar vein, the morphological differences between the classes of verbs in different semantic domains in ISL may be regarded as support for theories assuming the existence of semantic fields, such as Jackendoff (1990, 2002). Furthermore, the morphological properties of the different fields may provide some insights for their properties. For example, Jackendoff suggests (2002; 361) that the posssional 'space' is discrete. He arrives at this conclusion only on the basis of possible inferences ("something cannot be half way between belonging to A and belonging to B"). Yet in ISL this difference is explicitly evident in the morphological behavior of transfer verbs vs. spatial verbs, thus supplying strong supportive evidence for Jackendoff's suggestion.

Third, the morphological distinctions between the semantic fields, once identified, may be able to support one specific analysis over another. For example, there is a controversy whether COS verbs are similar in nature to change of location verbs. Localistic approaches, e.g., Andersen (1971), advocate for a unified analysis for both types of verbs. Jackendoff in his earlier works (e.g., 1983) argues for a unified analysis as well, but changes his approach in later works (1990, 2002), where he suggests that COS verbs have an INCH(ative) function in their LCSs, rather than a GO function. RH&L (2002, 2005) present strong arguments showing the COS verbs differ from other kinds of verbs in the way their semantic arguments are realized in the syntax. The fact that in ISL COS verbs do not have spatial morphology may present additional support for a non-locative analysis over a locative one of COS, and for assigning different analyses for a CHANGE event in the spatial, possessional and temporal fields vs. a CHANGE event in the identificational field.

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References:


1. Introduction

Computer-mediated communication (CMC) has greatly influenced the teaching and learning experience within the field of Second Language Acquisition (SLA). Broader access to Internet and greater availability of synchronous and asynchronous CMC tools (e.g., e-mails, Internet Relay Chats, MOOs, I-phone, NetMeeting) have affected traditional pedagogies and shifted to new pedagogical paradigms that emphasize learner centred teaching methodologies based on constructivist principles (Mertzani, 2006). However, CMC has not yet been incorporated into sign language teaching and this paper attempts to introduce the effect of such application within British Sign Languages classes for hearing learners.

Traditionally, sign language teaching and learning is heavily depended on visual simulations (e.g., animation, text-books and video) for one and main reason: sign language is visual language and learners, in order to learn it, need to view its motion and its all inhibited non-manual characteristics. Usually, hearing learners of a spoken language hear themselves speaking and thus, are able to monitor their output and compare it with native speakers and/or practice the language in a lab through listening and oral exercises. In contrast, there is “an asymmetry in the feedback mechanism for regulating sign language production” (Woll & Smith 1991: 240). Learners view only their hands while signing or act as observers of others signing; hence, they do not have the whole picture of themselves signing, an essential ability in acquiring sign language.

Learners need to be shown how to execute a sign and how certain modulations affect the meaning of signs as well as to observe themselves signing. Many programmes have incorporated text, CD/DVD multimedia and analog or/and digital video material for the instruction of sign language. However, text-based material (e.g., textbooks and dictionaries) is not enough for the
study of sign language as they consist of pictures and drawings, which cannot express its four-dimensional form (Fourie 2000). Videotapes, CD/DVD-ROMs and animated material solve this problem by incorporating video or/and animating images of sign language.

Animated signing characters (e.g., signing avatars) of 2D or/and 3D designs can represent sign language but they require advanced skills in graphic design and take time for their creation. Video technology usage, especially digital video, appears the easiest solution to these problems. Digitised video – in particular, video streaming - is currently used on the Internet for the representation of information for the Deaf, thus comprising authentic sign language material. In terms of sign language learning, there are websites that offer complete sign language courses containing online sign language dictionaries with sign-search facilities; signed dialogues, vocabulary, grammar explanations and interactive exercises; and test-yourself quizzes with multiple choice questions.

Due to the fact that the Internet is basically a non-linear hypertextual environment (Ryan, Scott, Freeman & Patel 2000) - in a sense that it's not a hyper-signing environment – it permits webpage linking through the medium of text and not through the medium of digital signing (video and or animated signing). As a result, when considering the medium of text and Internet interactivity, there is a passive mode of sign language learning and teaching. There is a fixed, controlled and limited representation of sign language information that resembles previous computer-based applications; multimedia sign language environments stored in a CD constituting simple word – sign sentence drill patterns that students needed to repeat in a mechanistic and linear way.

Consequently, there is one-way transmission of sign language and one mode of interaction; the interaction is between the user and the computer language programme. Nevertheless, network technology allows interaction with other signers, from any distance since computers mediate human interaction. Online sign language communication is feasible through video-based CMC and is recommended here to be considered and applied for distant sign language learning and teaching purposes. This paper presents procedures followed and results taken from a pilot study that investigated the feasibility of a networked video interaction among a Deaf tutor and three hearing learners of BSL within a digital sign language laboratory, the SignLab in the Centre for Deaf Studies, University of Bristol, U.K. Before illustrating the data, the theoretical background of this study is given in the following section.
2. Visual Making in situ for Sign Language Learning

This study is based on two theories; on the theory of situated learning and on the social theory of visuality. The common ground of these theories is the social-cultural perspective of learning. According to the former, learning is linked to goal-directed activities situated in authentic circumstances within and in relation to communities of practice (Youn 2005). From this aspect, learning occurs in situ; that is, in the course of one’s activity within a social-cultural environment. Consequently, it is an ongoing procedure that involves interactions among individuals, their activities and their communities. The theory of situated learning is founded on Vygotsky’s sociocultural theory according to which learning begins and occurs within a social and cultural context but finishes at the individual level (DiCamilla & Anton 2004).

At the earliest stage of earning learners depend on interactions with their teachers and/or their peers but at a later developmental level this dependency is internalised and becomes a self-regulatory mental function that constitutes a profound part of one’s cognitive process throughout his/her entire life. The transfer from the social domain to the cognitive occurs within the zone of proximal development (ZPD); that is, the phenomenon of learning which takes place when less expert individuals interact and collaborate with more expert, knowledgeable ones in order to manage a task that would be beyond them if acting as individuals. Thus, cognitive development occurs when the learner is moving through his/her ZPD to the point where he/she becomes self-regulated in the performance of a task (DiCamilla & Anton 2004: 38).

According to the social theory of visuality (Mirzoeff 1999), the visual - in this study, video-based CMC - is the place of interaction; the place where “meanings are created and contested” (Mirzoeff 1999: 6). CMC structures social relations and is the space within which relations occur. It is a culturally constructed environment that brings together physically distant individuals for intercultural interactions online (Lawley 1994). Learning within CMC environments encompasses two types of interaction; individual and social. The first is an individual activity between the user (e.g., learner, teacher) and the visual material; the second is a social activity as it involves human interaction mediated by computers and which refers to visual material (Ryan et al. 2000: 100).

Research has shown that CMC provides an excellent vehicle for second language learning, since it affords teachers and learners to negotiate meaning while focusing on the linguistic part of language (Meskill & Antony 2005). The main reason cited for this assertion is the increased reflection time provided to teachers and learners. Both are afforded the needed time to attend to and process the target language, since CMC comprises a visual material where language forms are “visually immediate”. Learners are able to reflect upon and look at the form and content of the
visual material as many times and for as long as they wish (Meskill & Anthony 2005; Smith 2003); and teachers can detect learners’ language, edit their responses and respond to the ‘teachable’ moments that rendered by the networked exchange (Messkill & Anthony 2005: 92).

In this context, this study sought to show that sign language learning can occur within a video-based CMC environment whereby hearing learners and Deaf tutors are immersed into authentic sign language environment whereby they negotiate in order to acquire and transfer knowledge on particular target linguistic items. In particular, this study conducted to investigate the nature of sign language learning and teaching during networked asynchronous video communication. The following question was posed: How do learners and the tutor negotiate meaning and focus on BSL forms across three video CMC tasks?

3. Method

3.1. SignLab: the Teaching and Learning Context

SignLab is a digital classroom consisted of seven Apple Mac computers networked and connected to a central 360 GB server within Centre for Deaf Studies, University of Bristol, U.K. Panda is the software installed in all computers and with which teachers and students work while being online and offline. This software allows very easy recording of video (and audio), which automatically compresses it into MPEG-4 format (QuickTime Play file format), a highly compressed format with minimal storage requirements and minimal time spent in waiting for compression and moving files between drives.

In essence, SignLab comprises an asynchronous video CMC environment since it encompasses file sharing for information exchange through the use of Panda, which handles the capturing, restoring and representation of users’ interaction through video. In particular, students and teachers film themselves signing, save their video files in the server and share their work with each other or with other provisional users (Cormier & Carss 2004). File sharing is accomplished by moving one’s video clip from one folder to another while being connected to SignLab server. Thus, teachers and students are not online simultaneously, in real time, but there is a delay of hours or days between video messages sent and replies received.

Teachers and students when logging in SignLab, work in separate folders called ‘home directories’. A home directory folder is everyone’s workplace when entering into SignLab. Thus, everyone’s home directory is on the server and whatever is on his/her desktop, is on the server too. In particular, there are three folders on the server: ‘Staff Homes’, ‘Staff Private’ and ‘Teaching Resources’. Staff Homes contains the home directories of all teaching staff and can be used by staff
and students to send files to each other. Within each person’s home is a folder called Public, and within Public is a folder called Drop Box. Anyone can put a file into Drop Box but only the owner can view the contents of his/her Drop Box.

Staff Private is a shared folder for all staff without that contains the teaching materials that tutors create. Staff can ‘read and write’ to this folder but students cannot access it at all. Teaching Resources is also a shared folder for all staff and students. However, in this folder staff can both read (open and view) and ‘write’ (record and edit) the video files whereas students can read the files only. From the Staff Private folder teachers drop their material to Teaching Resources folder which students access and work while being connected to the server.

For the purposes of this study, Panda was used for the recording, saving and sharing of video files that learners and the tutor produced while being engaged in three tasks.

3.2. Participants

Three female hearing students and one male Deaf tutor participated in this stage of the study. All three students were postgraduate students and had attended BSL classes offered by CDS. They were from Germany, Cyprus and Japan. Only Student one had reported previous experience with another sign language, German Sign Language. Conversations with the tutor suggest that the participants were classified at the beginner level of BSL proficiency (i.e., extensive vocabulary allowing them to produce discourse related to daily activities, daily communication and, forming syntactically simple BSL sentences). They were aged 24, 29 and 32 years old.

The tutor was qualified and experienced in BSL teaching (in all BSL levels), aged over 50 years and, he belonged in staff personnel of CDS for fifteen years. He was familiar with SignLab. Only one student knew how to use SignLab since, at the time the study was conducted, she was providing technical support to staff and students within SignLab. Two students had a training session as an introduction to SignLab and Panda in order to be able to proceed to the completion of the sessions. The tutor was also the model who recorded the educational video material used in the three sessions.

3.3. Procedures

Students completed three sessions. Each session comprised of instructional video clips that students had to watch plus a task to complete. Three tasks were used based on Pica, Kanagy & Falodun’s (1993) task typology; an opinion-exchange task (session one); an information gap (session two); and a jig-saw task (session three). The sessions were arranged so that the tutor was also online at the
time and could give feedback as soon as the video postings from the students were received. During each session, students had to login the SignLab server and retrieve from Teaching Resources the instructional video materials for each session. They had 30 minutes to watch carefully the material and other 30 minutes to interact with their tutor for the task. All students and tutor discourse was collected after the completion of each session. All of the online discourse was saved and archived and those portions that contained instructional moves on the part of the tutor and learner responses analysed. At the end of each session, students had the opportunity to comment on their experience in semi-structured interviews. Transcripts of the interviews were also analysed.

3.4. Data Analysis

All video CMC discourse was analysed quantitatively and qualitatively with regard to the following characteristics: the amount of students’ and tutor’s Negotiated Turns (NTs); the amount of students’ uptake; uptake in the types of NTs; and the effects of the various general characteristics of NTs on uptake. The types of data collected for this study did not allow for the use of inferential statistics. In contrast, the analysis was mostly qualitative as the nature of this expository study was intended to analyse the factors that should be considered in the research design of my main controlled study. The data however, were quantified when necessary for the purpose of showing general trends across sessions.

4. Results

4.1. Video Negotiated Turns and Sign Language Learning1

Overall, 107 NTs were provided across the three sessions, with the most occurring during the first session. Tutor-Initiated NTs dominated the networked exchanges, thus the tutor did most of the ‘talking’ during communication whereas students had a responsive, passive role (Figure 1). Regardless of the task type, NTs were triggered mainly by linguistic items that students needed to learn. NTs were also task sensitive. Session one stimulated the most NTs and the least session three (Figure 1).

Video files produced during communication appear to constitute an example of students’ forced output, a crucial factor for sign language learning. Overall, 60 students’ uptake moves were contained in the NTs. Session one led to the most uptake (n = 42, 70%) and session three led to the least uptake (n = 6, 10%). Of the NTs containing uptake, 67% resulted in successful uptake and

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1 Data is presented in Appendix A.
33% in unsuccessful uptake. The rate of uptake in session one was substantially higher than in session two and three. Thus, students’ uptake proved to be task sensitive as well (Figure 2).

Students’ successful uptake moves were based on repair (n = 15) followed by incorporation (n = 5), self-repair and repetition having the same score (n = 4) each. In sessions two and three, students’ uptake was characterised by incorporation moves. There were few instances of repair and repetition moves in session two as well. In terms of the rate of successful uptake, sessions differ from each other. Session one generated all types of ‘repair’ uptake moves, whereas session two and three promoted mostly incorporation moves which occurred similarly across sessions. ‘Repair’ and ‘repetition’ were substantially low in session two and they did not occur in session three (Figure 3). All types of successful uptake moves indicate one thing; students noticed their errors and corrected or at least attempted to correct their outputs.

Regarding unsuccessful uptake, the most frequent moves were the ‘partial repair’ and ‘same error’ moves in session one. In session two students attempted to repair their errors without succeeding. They repeated the same errors and simply acknowledged tutor’s feedback without producing the target items. Additionally, in sessions two and three there was a considerable amount of ‘off target’ uptake moves, a result indicating that jigsaw task did not force students to use the target items even unsuccessfully (Figure 4).

Uptake occurred in 40 NTs; that is, in Student-Initiated and Responding NTs. Students’ uptake was most frequent in Responding NTs and least frequent in Student-Initiated NTs. Accordingly, the rate of Responding NTs was higher in session one rather than in sessions two and three (Figure 5). It seems likely that students utilised most information from Responding NTs. Thus, they could elaborate on feedback and generate successful uptake moves based on information received by their tutor.

Students’ uptake was affected by tutor’s feedback type. For instance, in session one, successful uptake resulted when the tutor sent explicit feedback to students, such as asking clarifications and explaining the target items. In session two and three, successful uptake occurred when the tutor sent implicit feedback. Additionally, comparing the three sessions it can be seen that students generated more uptake moves during session one rather than in the two other sessions (Figure 6).

The most frequent feedback category is the explicit correction occurred in session one. Other feedback types are distributed as following: clarification request (n = 17) in sessions two and three; metalinguistic feedback (n = 16) in sessions two and three; recast in session two and reinforcement in sessions two and three having the same score (n = 6) each; and elicitation (n = 1) in session one. The explicit correction feedback occurred most often in session one. In sessions two and three it
appears that the tutor preferred to use implicit instructional moves such as clarification request and metalinguistic feedback (Figure 7).

In session two and session three uptake most frequently occurred during NTs that involved negotiation of meaning whereas, in session one, uptake occurred during NTs that involved negotiation of form. This comparison suggests that there is an affect of source on the amount of successful uptake across tasks. The first task manifests a more focused on form learning of the language whereas, the jigsaw enables sign language learning by paying attention to the meaning rather than to forms of the language. Comparing the three sessions, most uptake occurred in session one rather than in session two and three (Figure 8). Possibly, as students commented in the interview, the difficulty of the task has affected their uptake.

The majority of NTs were triggered by syntactical/discourse confusions rather than lexical ones. Specifically, session one and session two proved to promote NTs to discourse focus more than session three (Figure 9). Students’ uptake moves related to NTs regarding this focus. Of these, slightly high percentage resulted in successful uptake; especially in task one and task three 67% in each. These findings again indicate that the focus on particular linguistic features of the language affected students’ uptake moves; that is, paying attention to particular syntactic-discourse function of BSL affected students’ uptake success.

4.2. Students’ Comments on Video Interaction

In general, students were positive about their networked video discussions with their tutor. The most interesting part was their interaction with their tutor, particularly his feedback. The feedback was exact on what they were signing and very helpful for the learning of BSL. The positive aspect of tutor’s feedback was the information students gained about their mistakes and in general about their signing skills. In his videos, the tutor inserted his comments in the video sequence as well as created separate videos giving information about students’ signing, such as correcting their performance of the targeted signs, addressing grammar and syntax points, detecting students’ sign language productions and, generally, responding to students’ questions. Thus, as students watched the video feedback, they used the information from the video and corrected themselves; hence learning the specific items taught in each session. There were also occasions where students utilised feedback information so as to produce other signs apart from the targeted ones.

“Yes, basically yes, because with all his questions I practiced more my mistakes, those which he understood that I did not understand very well. I mean placements. The words were fine but the
placements I somehow stopped and I was … I watched the web cam and I did not do anything. So, with the, with his questions and comments, I used most of them. […] And it was good for my receptive skills, I mean, when he was telling things which I did not use in my signing. I received them and I expressed other things”.

Another advantage of tutor’s video feedback referred to its individual character; that is, tutor gave individualised feedback to each student something which is not happening within traditional sign language classes. In a normal classroom the tutor is not able to control every students’ signing - basically due to time constraints and students’ number in the classroom - whereas in online video communication the tutor is in the position of monitoring students’ signing performance separately. Consequently, this kind of asynchronous feedback offered the possibility of individualised learning since the teaching time was devoted completely to students.

“Basically, you all the time devoted to you. I mean, when you sit on your computer, he gives you for example ten activities, you learn the signs by yourself. I mean all the (learning) time is devoted to you only and, I think you understand more quickly and more easily (in this way), whereas, when you are in the classroom…[…] OK. There are more students. You don’t, don’t analyse the word (the sign), how to, for example, how to place one thing on the table. You don’t analyse it further because you have to move on. Because if you sit down to analyse with everyone, then it takes time, whereas, when you are by yourself, you use all the time available. The time is available to you only”.

Students also addressed few negative aspects of tutor’s video feedback, such as the lack of immediacy and time availability to both sides. Students indicated that filming a video used to take time and as a result, there was a delay of receiving immediately the response from their tutor. This was irritating since they had to wait for few minutes in order to receive it. One solution to this could be the creation of longer videos containing more information in only one video. Additionally, since the teaching time was short, they missed feedback in their second or third video productions thus, wondering whether they signed correctly or not.

“[…] So, I just did the first part because I didn’t even have comments for the rest of it. So, what we could not do was, I could not get comments about my whole signing because that was not enough time and, I could get any second feedback on my reply. You know what I mean? So, I’m signing, he sends correction, I sign again and then I don’t get another correction because there was not enough time”.

Furthermore, students described some learning strategies that had developed in order to acquire the target items. These were applied not only while they were watching the instructional video but also while they were observing tutor’s feedback. These strategies were the same across
sessions and were applied following the same process. Firstly, they watched the instructional videos for as many times as they needed so as to understand the content of the videos. By watching the videos, they observed carefully their tutor modelling specific signs and then imitated him. Students demonstrated that they were picking up signs that were unknown to them and which had to utilise in their tasks. The following examples are representative.

“I watched them mostly just once, one or two. I watched twice to see again how he did it. And I went back when I wanted to sign. I went back once to look at how he did it. “What was that? Where my picture is?”

Before proceeding to the task, students mapped their signing either on a piece of paper or by signing to themselves so as to remember what they needed to sign. Moreover, they planned and practised their signing by filming themselves before sending the final clip to the tutor. This shows an expressed concern about the quality of the content of their video messages. This is also an indication that asynchronous video communication in sign language made it difficult for the students to illustrate their ideas, especially when they are in this level of BSL that they cannot articulate their ideas clearly by signing. Therefore, being able to draw their signing helped them to express their thinking. They wanted to send meaningful messages to their tutor and in order to ensure the meaningfulness of their signing, they pre-recorded their signing. Accordingly, they watched the clips and when they felt that they could change their signing, they repeated the recording.

“OK. I think about, about how I want to set it up and then I draw a picture because otherwise I wouldn’t remember if I get a feedback from him “where did I put the bottle?” you know. So, I thought about it and then I filmed it and then from him I got comments about my signing. It means, or wrong classifier or something”.

Students’ interactions comprised responses relating to their tasks, hence were academically driven; thus, students produced these video with the aim of completing the task; that is, not fulfilling any other social function such as expressing personal information or feelings. However, there were a few instances whereby students expressed some personal information regarding the learning of BSL or their feelings about the tasks. The occurrence of such non-academic interactions related to students’ misunderstanding of tutor’s signing due to wrong positioning in front of the webcam; accordingly, feelings were expressed due to the complexity of a task or due to the difficulty in comprehending the solution of the task. Nonetheless, students and the tutor have
adopted some features from conversational discourse functions of BSL, such as forms of greetings and closing remarks.

5. Discussion and Conclusion

Thus far it has been demonstrated that negotiated interaction can occur for sign language learning within a video-based CMC environment. This particular interaction provides opportunities for students to sign and discuss about the sign language they produce and for tutors to provide feedback to their students. Thus, students can use the feedback in order to develop their target sign language. When students engaged in these video interactions, they generated their sign language for the completion of their tasks, and following feedback, they produced all sort of uptake moves so as to repair and correct their errors. Thus, the majority of their errors were corrected or attempted to be corrected using negotiations, either of meaning or form focused. Overall, these findings indicate that the pattern of error repair following feedback resembles that of face-to-face interactions, a finding that research in second (spoken) language acquisition broadly supports (Sheen 2004; Ellis, Basturkmen & Loewen 2001).

Negotiation elicited by lexical and syntactical/discourse misunderstandings, which confirms previous CMC research (Blake & Zyzik 2003; Morris 2005; Smith 2003). The majority of the negotiated turns were initiated by the tutor who very often responded to students’ queries. Analysis revealed instances of clarification requests, recasts, and other instructional strategies that have been well documented in both face-to-face and CMC research (Meskill & Anthony 2005). The most dominant form of feedback was the explicit one which appeared to have the most significant effect in students’ uptake and which occurred during opinion exchange task. Explicit corrections were the dominant feedback moves and clarification requests with metalinguistic feedback followed. This finding also indicates that task type affected tutor’s feedback; that is, opinion exchange tasks stimulate explicit feedback whereas information gap and jigsaw tasks elicit implicit feedback (Pica et al. 1993). Overall, students perceived tutor’s feedback very helpful for the development of their signing skills as it was referring exactly to their mistakes and thus, promoted their individual learning.

Additionally, it is shown that asynchronous video CMC promoted more noticing of students’ own errors due to its two main features: longer processing time and video permanency. Students had the time to review and evaluate the language they produced not only in their video demo signing performances but also in their actual video messages sent to their tutor. All messages were stored in the server; thus, they were accessible during networked exchanges. Consequently, students could go back and look at their output, analyse their signing capacity, notice their errors and make
revisions and corrections. This SignLab affordance is consistent with Lai & Zhao’s study (2006) whereby it was showed that video permanency permitted students to monitor and correct their problematic output. Moreover, students spent a considerable amount of time in processing their output since they watched the video clips more than once or re-recorded their signing. It seems that students had the time to process the input and monitor BSL output. Some extra time might have afforded students better comprehension and more accurate productions. This finding is also consistent with other research results (Lai & Zhao 2006; Smith 2005).

Appendix A

Figure 1: Frequency and types of NTs
Figure 2: Uptake frequency across sessions
Figure 3: Frequency of successful uptake
Figure 4: Frequency of unsuccessful uptake
Figure 5: Frequency of uptake in Student-Initiated and Responding NTs

Figure 6: Uptake in relation to tutor’s feedback

Figure 7: Tutor’s feedback across sessions

Figure 8: Frequency of uptake according to source

Figure 9: Frequency of uptake according to linguistic focus
References


1. Introduction

The main recent studies on Sign Languages (Engberg-Pedersen, 1993 on Danish Sign Language; Meier, 1990 and Emmorey, 2002 about American Sign Language; Nilsson, 2004 on Swedish Sign Language) converge in analyzing the personal pronoun system of Sign Languages as only distinguishing between two person categories: first vs. non-first person. It is proposed here to reconsider an objection previously raised against the ‘first vs. non-first person’ hypothesis concerning the role of gaze, and to develop its theoretical consequences, in order to propose a unified description of the referential mechanisms observed in a corpus of the Sign Language of Southern Belgium (LSFB¹).

The major argument of this paper is as follows:

- The personal pronoun system in LSFB is organized on the correlation between the manual components of the sign and the gaze address.

- This correlation shows the opposition between three personal pronouns, in the singular forms: first, second and third person pronouns (which reconsider the binary opposition between first and non-first person).

- Studying the correlation between the hand(s) and the gaze provides a consistent and economical tool for the description of the referential mechanisms that are deixis and anaphora, in Sign Language.

- The system of personal pronouns of LSFB offers the opportunity to revisit Benveniste’s theory on personal pronouns (in his “Appareil formel de l’énonciation”): namely, it challenges the particular status of the third person pronoun, which is said to be a ‘non-person’ pronoun.

¹ The initials “LSFB” stand for “Langue des Signes Française de Belgique”, the name used in official decrees about the sign language of the Deaf Community of southern Belgium; however, the name “Langue des Signes de Belgique Francophone (LSBF)” is now also used by the Deaf Community (cf. www.fffb.be).
2. Personal pronoun system in LSFB and deixis: addressed gaze

2.1. The ‘first vs. non-first person’ hypothesis

In line with Meier’s (1990) study on ASL, several influential works (Engberg-Pedersen 1993, Emmorey 2002 and Nilsson 2004) support the idea that the personal pronouns system of signed languages does not distinguish between the second and third person. Instead, there is a binary opposition between first and non-first person.

Meier’s main arguments shared by the other authors are

- the lack of difference in directionality between a pronoun referring to the addressee and a pronoun referring to a non-addressee;
- the non-relevant status of eye gaze, since eye gaze at the addressee occurs with second person pronominal reference as well as with first person pronominal reference, and since it is also present in discourse where no reference to participants in the discourse is made;
- the infinite variety of pronouns that would be classified as third person and second person ones, because of the infinite variety of the possible spatial realization of each.

This argumentation seems to take for granted that the value of person depends on the actual participants of the discourse. The notion of “addressee”, for Meier and his colleagues, is defined as the actual person to whom the actual sender is signing. The fact that, within a model which claims that there is no second person value, the notion of “second person pronominal reference” is nevertheless being used, seems to allude to the real and physical properties of the canonical encounter in conversations.

It also appears that, in this argumentation, if manual and non-manual features are taken into account, they are each expected to be relevant independently of the other, before they are considered to be grammatically relevant. This position is opposed to the suggestion of Baker & Cokely (1980), who suggested – pointing the relation between manual parameters and gaze comportment – that the signer’s eye gaze grammatically differentiates second vs. third person pronouns. This central point of the argumentation of Baker & Cokely, i.e. considering the relation between the gaze and the hand, has been given too little importance, in my opinion, by Meier.
2.2. The ‘person (first–second) vs. non-person (third)’ hypothesis

It is precisely this coordination of elements that Berenz (2002) studies as founding the system of personal pronouns and the possibility to use, for Sign Languages, the Benvenistian distinction between person and non-person pronouns.

She observes that the coordination of manual parameters and gaze comportment distinguishes three personal values (first, second and third). In the first and second person pronouns, the hand and the gaze are in line, following the conversational line; they mark the personal values. On the contrary, the third person pronoun is located outside the conversational line: the manual parameters and the gaze form an angle; in this sense, the third person pronoun marks the value of ‘non-person’.

2.3. The gaze addressing as the fundamental deictic marker

Rather than isolating the third person pronoun because it is located outside the conversational axis, by the angle formed between gaze and manual parameters, it can be highlighted, with respect to the six examples of pronominal forms presented in Figure 1, that in all personal pronouns of LSFB, gaze address is a constant component.

![Figure 1: Personal pronouns in LSFB](image)

In the comparison of these forms (and namely ‘d’ and ‘f’), it appears that no point in space is of itself more appropriate to refer to a ‘you’ than it is to refer to a ‘he’, ‘she’ or ‘it’ referent. This is consistent with Meier’s (1990) claims. But it is worth underlining the permanent relation between gaze and hands through the different forms of ‘I’, of ‘you’ and of ‘he/she/it’:
- the addressed gaze with a pointing sign towards the signer’s chest indicates the pronoun ‘I’;
- the addressed gaze with a pointing sign in the same direction as the gaze indicates the pronoun ‘you’;
the addressed gaze with a pointing sign in another direction than the gaze indicates the pronoun ‘he, she, it’.

Whatever the physical directions of both the pointing of the hand and the gaze, in all six cases gaze is directed, and creates the position of an addressee. In other words, the addressing of the gaze structures the personal oppositions. In this sense, eye gaze is not a second person marker, but rather a constant component which structures the personal oppositions.

The addressed gaze appears, in this analysis, to be the constant landmark from which a pointing sign (the manual indices) receives its personal value (and can be interpreted as ‘I’, ‘you’, ‘he, she, it’): it is the deictic landmark.

Beyond the pronominal system, the behaviour of the so called “agreement verbs” sustains the same claim. Figure 2 shows that within these verbs, as in the pronominal forms, the personal indices come from the relation between the hand parameters and the addressed gaze.

**Figure 2: Agreement verbs including personal values**

\[\begin{align*}
\uparrow & \downarrow PS-1 \\
a: 'I send to you' & \phantom{\downarrow PS-1} \\
\uparrow & \downarrow 1-SEND-2 \\
\uparrow & \downarrow \phantom{PS-1} \\
b: 'You said to me' & \phantom{\downarrow PS-1} \\
\uparrow & \downarrow PS-2 \\
\uparrow & \downarrow 2-SAY-1 \\
\uparrow & \downarrow ACC \\
\uparrow & \downarrow PS-2 \\
c: 'He/she has refunded me the money' & \phantom{\downarrow PS-1} \\
\uparrow & \downarrow MONEY \\
\uparrow & \downarrow 3-REFUND-1 \\
\uparrow & \downarrow ACC \\
\uparrow & \downarrow MONEY
\end{align*}\]
Following this approach, the claimed particularity of the third-person pronoun (in signed as well as in spoken languages) loses its foundation. Within this system, a pointing index directed out of the direction of an addressed gaze still refers to the deictic landmark (i.e. the gaze addressing), in the same way as first and second person pronouns do. There is no more reason to consider it as a ‘non-person’ pronoun.

In conclusion, the addressed gaze creates and organizes a first kind of referential space: the ‘deictic space’. As Figure 3 shows, this space is physically situated between the locutor and his addressee (considered as a discursive being, and not as an empirical person). All the linguistic values that the deictic space supports are constructed in relation to the deictic landmark that is the gaze addressing.

Figure 3: Deictic space

3. Anaphoric frames of reference: unaddressed gaze

Since this status of deictic marker is assigned to the gaze address, cases of non-addressing gaze can be studied as creating anaphoric frames of reference. Two kinds of values can be studied for their particular gaze behaviour: they will be referred as ‘loci’ and as ‘personal transfer’.

3.1. ‘Loci’: gaze centered in front of the signer

The notion of ‘locus’ is adapted here from the morphologic definition given by Engberg-Pedersen (1993). But the gaze will be here recognized as playing a central role in the creation of such morphologic value.

The signer plots grammatical values of ‘locus’ in the signing space in front of him or her, by focusing points or areas of this space. The gaze address is then briefly interrupted by a gaze that is centered in front of the signer. In this sense, we can say that the value of locus is created in a non-direct relation to the deictic frame of reference; for this reason, it can be considered as an anaphoric value.
The example of Figure 4 illustrates the installation of two loci (‘a’ and ‘b’) by this kind of centered gaze. The area located forward right is briefly focused by the gaze during the articulation of GRANDMOTHER, in the first and fifth pictures (locus ‘a’); hence, it receives a grammatical status for the remaining of the utterance. In the same way, the area situated in front of the signer is focused by the gaze in the second and the third picture (locus ‘b’), and is grammatically associated with the noun GRANDFATHER. When in the last picture, the movement of the verb NURSE is oriented from one area to the other, this implies the inclusion of both grammatical (and anaphoric) values and reference to both associated nouns (‘Grandmother nurses Grandfather’).

![Figure 4: Agreement verb including locus values](image)

The gaze which is so centered towards the space in front of the signer structures this space in grammatical, differential values: it installs a second grammatical space of reference, that can be referred to as ‘frontal space’ (Figure 5).

It is worth underlying that the anaphoric values of locus can co-occur with deictic values, and for example with personal values. Figure 6 illustrates this possibility, with the agreement verb NURSE: the marking for a locus within the verb does not exclude the first person pronoun (i.e. pointing toward the chest with an addressed gaze) just antecedent to the verb.
3.2. *Personal transfer* (or *person neutralization*): *eye blink and centrifugal gaze*

The notion of ‘personal transfer’ is defined by Cuxac (2000) in iconic terms: it refers to the possibility for the signer to represent, by his or her own body and attitude, the body and the attitude of the characters of the story he or she is telling. The description of the behaviour of the gaze, during these iconic forms, and the analysis of their relation with the deictic frame of reference, will lead here to explain the iconic effect of ‘personal transfer’ as produced, morphologically, by a neutralization of the value of person.

The iconic effect of personal transfer, as shown in Figure 7a (in contrast with Figure 7b, where the same verb walk does not show the assimilation between the signer’s body and the walking character), is systematically associated with a centrifugal gaze, preceded by an eye blink, or with a total closing of the eyes. The closed and/or centrifugal gaze causes the grammaticalization of the signer’s body, which hence becomes the reference point for the surrounding space.
This grammaticalization of the signer’s body excludes the co-occurrence of any deictic value, i.e. of any sign sustained by an addressed gaze. The comparison of Figure 8 with Figure 6 reveals this incompatibility.

Figure 8: Agreement verb in the form of personal transfer; exclusion of the value of person

‘Grandmother nurses Grandfather who is sick’

In Figure 8 indeed (in contrasts with the example of Figure 6), the diverting of the gaze from the address-line occurs not only with the verb form (NURSE), but also with the pointing chest to the signer (noted as ‘c-locus’). The scope of the interruption of the gaze-addressing is wider, and excludes the marking of a personal value with the pointing sign. The designation of the signer’s
chest in this pointing sign coincides with the breaking away from the deictic frame of reference: the ‘c-locus’ does not receive first person value; instead, the signer’s body becomes the centre of a new frame of reference.

The process of the person neutralization causes the grammaticalization of the signer’s body (the ‘signer’s space’), which is taken as landmark point for the space surrounding it (the ‘surrounding space’). Figure 9 schematizes this double grammatical space.

**Figure 9: The signer’s space and the surrounding space**

In summary, starting from the identification of gaze-addressing as the deictic landmark in relation to which emerges the value of person, the interruption of this address has been understood as building anaphoric fields of reference. Within the anaphoric process, a distinction has been made between the creation of locus values and the neutralization of person. A locus is the result of the grammaticalization of a point or area in the signing space in front of the signer (which becomes the ‘frontal space’) by the fact that this point or area is the target of the gaze. The signer’s body is not part of this anaphoric frame of reference. The personal transfer (or person neutralization) consists on the grammaticalization of the signer’s body, which becomes the very centre of an anaphoric frame of reference; hence the frame of reference is surrounding the signer.

### 3.3. Pseudo-deictic anaphora: an anaphoric value taken as reference point

Both the locus and the personal transfer can be pointed out as the reference point for another anaphoric value. The specificity of this relation that can be called ‘pseudo-deictic’ is that, within the anaphoric frame of reference, one value is pointed out as a landmark for another one. In other words, there is a process of ‘ostentation’ (what is referred to by the concept of ‘deixis’) within the
anaphoric field of references (hence the ‘pseudo-’); it functions as if the deictic coordinates were projected onto the anaphoric spaces.

In Figure 10, it is a locus (locus ‘a’) that serves as reference point from which is defined another one (locus ‘a:b’: ‘b is defined from a’). In figure 11, the reference point is the signer’s body (locus ‘c’), grammaticalized by the personal transfer (or the person neutralization process), from which is defined a value of locus (locus ‘c:a’).

**Figure 10: Pseudo-deictic anaphora from a locus value**

There is a lamp in a; **on its right**, there is a cupboard

**Figure 11: Pseudo-deictic anaphora from a form of personal transfer**

‘[The father] is opening and reading the newspaper; **on his left** sits his daughter’
In both versions of the pseudo-deictic relation, the gaze behaviour shows a systematic sequence of three moments: first, the eyes interrupt the gaze addressing by a blink; second, they follow the movement of the hand; and third, they come back to the addressing position.

4. Conclusion and theoretical issues

This work is underlined by a conception of deictic and anaphoric referential mechanisms as specific issues of the linguistic and grammatical activity. No reference is made to the actual objects or persons that are present or not to the actual situation of communication.

The grammaticalization of space made by LSFB appears to be founded on the linguistic value produced by the relation between the manual parameters and the gaze comportment. This approach allows deictic and anaphoric references, as well as their relations, to be described in a consistent and simple model.

Gaze is seen as creating three kinds of spaces:
- the ‘deictic space’ : it supports the deictic values and its landmark is the addressed gaze;
- the ‘frontal space’: it supports the values of locus and its landmark is the centered gaze;
- the ‘signer’s space and the surrounding space’: it supports the process of personal transfer (or person neutralization process) and its landmark is the closed gaze and the signer’s body.

Benveniste’s model on personal system appears to be revisited by Sign language evidences.

The third person pronoun, as the first and the second person pronouns, refers to the deictic landmark. In this sense, characterizing it as a “non-person” pronoun, as Benveniste do, loses its foundation.

Appendix

The examples of LSFB are transcribed in a multi-line system. The first line indicates the eye gaze behaviour. The second line indicates the activity of the hands. The last line constitutes an English translation (between ‘…’ signs).

Gaze:  
↑ ↔ Addressed gaze (↔: during the reported speech of a direct speech utterance)  
<,>,↑↓ Eye gaze diverted from the addressing line; the direction of the arrow schematize the actual direction of the gaze  
↗a Gaze installing a value of (anaphoric or pseudo-deictic) locus  
v Eye blink
**Hands:**

- **SEND**: English gloss for a manual sign
- **LONG-NOSE**: Multi-word gloss standing for one sign only
- **PS**: Pointing sign (pronoun or determiner, in verbal or nominal contexts)
- **1, 2, 3**: Personal values
- **c or c-locus**: The locus located in the signer’s space
- **a, b**: Loci installed in the signing space by the gaze focus
- **c:a, c:b**: Loci defined in relation to the c-locus of a person
  neutralization form (‘pseudo-deictic locus’)
- **ACC**: Sign marking the accomplished aspect

**References**


"Construction in Eritrean Sign Language: an Anthropological Linguistic Perspective"
Conference paper from TISLR-9, Florianopolis, Brazil; Poster Session

Rezenet Moges,
California State University, Long Beach

1. Introduction:
Last year, Eritreans began to develop a new lexicon for the official sign language of Eritrea. The previous lexicon showed influences from Swedish, Finnish, and Sudanese Sign Languages. In the history of Deaf Education in Eritrea, the missionary from Swedish established the school for the Deaf in Keren, 1955. As a result, Swedish and Finnish Sign Language (SwSL & FSL) were introduced to the sign language of Eritreans. There is no record of indigenous signs prior to the arrival of missionaries. The current local lexicon development project will attempt to erase this historical linkage to Scandinavian sign languages and those of the neighboring countries, such as Sudan. The Eritrean National Association of the Deaf (Eri-NAD) is presently in the process of creating a dictionary of Eritrean Sign Language (EriSL). This paper covers information on imported sign variation, the lexicon of the missionalized EriSL, and will concentrate on the current standardization project and how it affects community identity in Eritrea. This is an ongoing research project.

2. Fieldwork and Research Design
Eritrea is the youngest country in Africa, gaining its independence in 1991, from Ethiopia. The three different main sites of research are: Asmara, the capital city of Eritrea; Keren, the large community of Deaf who graduated from the residential school for the Deaf; and Mendefera, a growing community of the Deaf Eritreans. Each site rents an office space where a branch of Eri-NAD is established.

For the research of this community, I gathered data in the course of a two-month feasibility study. Selected people involved with the dictionary-developments gave interviews. Immersed
experience was gained from participation observation in their Sign Language Researchers’ (SLR) meetings. Video footage recording of several meetings show how the collaborators deliberate to create new signs. On videotapes, several elicited signs signified the problematic confusion with limited expression of a lexicon with the same sign.

The investigation is based on the people who made major contributions in the development of EriSL Dictionary, such as the collaborators, who are seven selected local researchers in SLR. They are volunteers; and sometimes they travel at their own expense. The group consists mostly of Deaf people, including an interpreter and a local linguist.

There are two societal identities of Deaf people: City-people and villagers. A status hierarchy is already built in within those categories. For research purposes, it is more convenient to reach a city-person, rather than a villager who lives remotely. There are an estimated 15,000 Deaf Eritreans and approximately 2,000 members of Eri-NAD, of which 300 are employed in Asmara. The social status predetermines the validity of their contribution to this linguistic development project. Most educated Deaf Eritreans are fluent in the language of Tigrinya, the major spoken and written language of Eritrea. They will put more effort to participate in the EriSL development.

The study is formatted by the Lucas and Valli (1992) systematic research design on signed language-contact study with two or more sign languages. Their design has five foci as research points. The first, third and fourth focus will be used here. The first one is the linguistic factors that are the result of language contact. Given the historical influence, the contact affects the growing variation in the EriSL. That leads to the third focus that will cover sociolinguistic factors. The social status and identity of each individual affects how the SL is distributed throughout the country. The fourth focus is characteristics and attitudes toward language interference. The standardization is a project displays the attitudes and aspiration the Deaf organization, and the desire of the group to spread their language ideology. Inevitably, the construction of a language depends on the distribution of authority in the community, which, in turn, affects the progress of EriSL language development.

3. Questions:

1. What kind of variation is found there?  2. Who uses the distinct variations?  3. How is variation distributed throughout in Eritrea?  4. When and what kind of situation does the variation arise?  5. What do variations mean in local contexts? The final question will be left to ponder and investigate further in my upcoming paper.
3.1. Outcomes of Language Contact

Variation of SL:

The outcome of the missionalized sign language of Eri-SL has multiple influences from SwSL, FSL, and Sudanese SL (generally based on American Sign Language). There are additional immigrated sign languages, but these three are major influences. The given elicited signs show, in Fig. 1 and 2, resemblance to the signs found in SwSL and FSL.

Figure 1. WHAT / ENTAY

Figure 2. WHO / MEN

The sign in Fig. 1 reads as WHAT / ENTAY\(^1\) in EriSL. It moves clockwise whereas FSL motions counterclockwise. This sign also signifies WHERE / ABAY, which matches the Swedish sign for "where". Fig. 2 indicates the sign WHO / MEN, derived from both FSL and SwSL.

Figure 3. SICK / HAMIMU

Figure 4. DIRTY / RESAH

\(^1\) Translated in Tigrinya in an italicized form
The signs may be found in other sign languages other than those mentioned already and known to be influential contact languages. For examples, both Fig. 3 and Fig. 4 were imported from FSL and SwSL but they are also found in Irish Sign Language (LeMaster). Fig. 4 identifies as DIRTY / RESAH, connecting both palms while RH moves clockwise.

4. *Fidel (Letter/Fingerspelling system)*

The phonology in the fingerspellings of EriSL follows two criteria, which form the system for each Halehame, an order of constants in the fidel. The fidel is associated with Tigrinya phonemic in a consonant-vowel syllabic system that lists 291 characters. Stokoe, et al, laid out the three fundamentals of signs: hand configuration, place of articulation and movement (1976). The fidel maintain the same phonological rules for each letter according to its vowel or by itself. The two criteria are mainly focused, which the first is 30 handshapes that represents consonants. Second, the seven movements are distinctive for each sound (vowel). For example, the first consonant is H (Fig. 5) and follows its sounds in order: Ha, Hu, Hee, Hah, Hie, H, and Hoe. In the viewer’s point-of-view, the movements will fingerspell each mark respectively: non-movement, moves to the right (speaker’s left), move in a letter “J” or left, moves downward, circles it, shakes it, and twist the palm orientation from out to in—moves upward.

![Figure 5. The handshape of the first consonant “Ha” on the fidel](image)

Deaf Eritreans who graduate from institutions are acquainted with basic spoken English vocabulary and International fingerspelling system. They spell the phonetics in Tigrinya, and if another person does not understand, they will repeat the word as it is spelled in English but with Tigrinya phonetics. If that fails, they will use the International fingerspelling system.
The variations are found in the fingerspelling systems (discussed in detail below), as seen in both Fig. 6 and 7 using the International fingerspelling "T" when applying the spoken English instead of Tigrinya. Nakamura (2006) disseminated the loanword in JSL fingerspelling and the initialized phoneme (first letter of the word) on the new lexicons from English, developed by the Deaf groups. This morphemic breakdown of both loanwords in Fig. 6 and 7 show its initialized phoneme differing from the native Tigrinya. The translation of THANK initializes with "YE-" whereas that handshape is formed distinctly from "T". The same finding is repeated in the Fig. 7, while TEA is not signed with the handshape for "SHA-" from EriSL. The variation of multilayered language systems take place in these lexicons: the English Spoken word and International Fingerspelling of "T" are embedded in these two lexicons.

4.1. Sociolinguistic factors

Distribution of SL:
The schools are the main source of language development for Deaf Eritrean children. Nevertheless, not every Deaf child gets the opportunity to enroll in the Deaf institutions, depending on the waiting list and the student population. The language does not pause after graduation at 6th grade level. Croneberg's "Linguistic Community" (1965: 310) discussed the cultural and social aspects in the Deaf community as the foundation of the social and linguistic network. The community of a Deaf person will continue to encounter the latest creation of signs. The second category, the villagers, having less socialization, will maintain their initial signs. However, that will not remain the case if they receive visitors from the city or they visit in the city and interact with Deaf citypeople. The
villagers will absorb the evolved signs from the city people. The speed of signing also differs between those two groups. Given the bustle of citylife, the tendency of signing speed is faster among the citypeople than the villagers. The social status tends to be perceived higher for those who speak well. In order to avoid confusion of signs, the good lip-readers will mouth their native language.

4.2. Characteristics and attitudes toward language interference

Authority:
A glimpse of Deaf community structure shows the division in three different floors, which lie under organization, institutions, and government. The Deaf people themselves run the organization provide the social service. The Evangelical Church, with funding from Swedish missions, moderates the Deaf institutions. Last, the governmental section, the Ministry of Education in Special Needs, evaluates the educational needs. This structure designed the pathway of language interference from the foreign missionary funding. It is prevalent that resources from Northern America and Europe assisted the establishment of schools for Deaf across Africa (Zeshan 2002, Schmaling 2001, Kiyaga and Moores 2003). The Deaf Education originally mobilizes the language and the core of the system that feeds the needs of Education is the floor of Church. The institutions are the starting points of language acquisition whereas the EriNAD is centralizing the space as the point to spread the new lexicons.

5. Language Ideology as the Result

EriSL has altered by several language interferences, which caused a rapid transition in its evolvement. The instability of lexicon poses a burden from absorbing interference, creating variations. This results in an obligation to create standardization when there is none available. Hitherto, their aim is to reinforce their language ideology; their approach pushes the community to participate and mobilize this new lexicon project.

The objective of the language standardization is not only to revive the indigenous signs but also to decrease any extreme variations. The language ideology is a method of Deaf empowerment within their country. In the end, EriSL is under construction of "demissionalization" where they can return to the point of origin before the foreign signs were introduced to Eritreans. In this progressive linguistic project, I anticipate similar phenomena from the controversial issue arose in The Netherlands as Schermer (2003) stated but inevitably, the new lexicon will evoke a mixture of reactions from the entire Deaf community in Eritrea.
In this discussion, so far, the contributions to the construction of this SL are found in the missionalized signs and its varied use of fingerspelling. The social network and linguistic project evolves through the distribution of language, authority, and language ideology. The follow-up to this research will concentrate on language planning and purism. This study will continue to document this ongoing linguistic phenomenon.

**Reference:**


LeMaster, Barbara (upcoming manuscript) Gendered Irish Sign Language Dictionary.


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COOPERATION IN INTERPRETATION

JEMINA NAPIER
Centre for Translation & Interpreting Research
Macquarie University, Sydney, Australia

LITERATURE

- Studies of signed language/interpreted discourse:
  - turn taking (Roy, 2000; Van Heesweghe, 2002)
  - attention getting (Cusen & Sutton-Spence, 2001)
  - Cooperative principles of conversation: quantity, relevance, manner & quality (Grice, 1975)
  - Interpreter involved in “communicative pas de deux” (Wanajewi, 1998)
  - “unbalancing” – taking, holding & relinquishing the floor
  - redefining of the message: clarification & reformulation
  - Interpreters cooperate with interlocutors to negotiate & co-construct meaning (Ogawa, 2003; Deardorff, 2002; Maran, 2006; Vanwesenbeeck, 1999; Wanajewi, 2002, 2006; Wilson & Marler, 2005)

RESEARCH QUESTIONS

- What discourse markers are used to negotiate meaning and cooperation in interpretation?
- How do deaf people and sign language interpreters turn take as a form of cooperation in interpretation?
- How do sign language interpreters and deaf people work together to negotiate meaning in interpretation?
- What are the cooperative principles of interpretation?

THE STUDY

- Analysis using framework of interactional-secodiagnostic
- Recording of naturalistic data
- Three stages of analysis:
  1. Pre-assignment briefing (15 minutes)
  2. In-situ (20 minutes)
  3. Post-assignment debrief (15 minutes)
- Deaf presenter at disability seminar
- 20 minute Auslan monologue interpreted into spoken English
- Team of 2 interpreters – one actively providing voice-over, one supporting
- Focus on use of pauses, nods and eye contact (looks) as key discourse markers between all three participants

RESULTS

BRIEFING

- Agreed on cues for communication
- Established “pause-lock-mod” technique

EN-SITU

- Pause marker used by presenter – marking of episodes, monitoring of interpreter
- Pause & Look markers used in combination only by presenter – monitoring of interpreter and audience reaction
- ‘No’ marker used by all 3 participants – signalling completion, comprehension, affiliation, satisfaction, proceed

CONCLUSIONS

- Both the interpreters and the presenter used Pause, Look and ‘No’ markers deliberately and strategically for signalling comprehension, marking episodes, clarification, controlling pace of presentation.
- Use of these discourse strategies established framework of cooperation in interpretation.
- Cooperative principles of interpretation: (1) trust (2) preparation (3) negotiation (4) eye contact (5) turn-taking (6) visual cues.

SELECTED REFERENCES

1. Introduction:

For practically all signed languages that have been the object of linguistic study, the structure of narrative discourse has been thoroughly described.

Terry Janzen, in his 2005 study *Perspective Shift Reflected in the Signer's Use of Space*, for example, describes perspective taking and perspective related constructions in narrative ASL texts. His examples are primarily taken from one single narrative, where the signer does not use the often discussed overt 'body shift'. In his study "...the space does not remain static, but instead the signer rotates the conceptualized space so that the perspective of various referents align and realign with her own stance" (2005:5). This is precisely what we have seen in studies of narratives in Swedish Sign Language, too.

Janzen summarizes his study like his: "For utterances that describe events that move the story forward, the narrator adopts a perspective of some agent, actor or experiencer within the scene." (Janzen, 2005:67) and...

“For utterances that supply background or orienting material, comment on a character or event, or that appear more objective in nature (are more "off stage"), the perspective remains that of the narrator." (Janzen, 2005:67)

What I will present today, is a detailed analysis of another kind of material: a primarily descriptive (Swedish Sign Language ) discourse. Though I have seen examples from descriptive discourse in various studies, there are, to the best of my knowledge, no studies of the structure of an entire discourse of that kind. The present study mainly concerns; perspective, and the spatial strategies used in this discourse. There are some similarities to what Janzen describes for an ASL narrative, but there are also some strikingly different structures being used.
The material used for this study is an almost ten minutes long monologue, where the signer retells the contents of an autobiography she has read. The general aim of the discourse is thus descriptive in nature – to describe the contents of the book. A closer look, though, reveals that there are also several sequences with constructed dialogue, constructed action, and what I am referring to as constructed thought.

As we saw from the quotes earlier, Janzen uses the concepts 'narrator's perspective' & 'story character perspective'. I am using 'narrator's perspective' & 'character perspective', but also Scott Liddell's concepts: surrogate space and token space - which Janzen does not.

We know that signers, as well as speakers, frequently conceive of the space around them, and of themselves (or parts of themselves) as if they were something or someone else. The fact that we do this is central to the understanding of blending, which in turn is a key concept in understanding the notions of token and surrogate.

Token blends are described like this, by Liddell: *Signers frequently create blends such that the entire blend exists ahead of the signer and the signer is not a part of the blended space. Tokens are elements of such blended spaces ahead of the signer.* (2003:190) And… *Token blends are created by blending an area of space and some conceptual content. Signers can direct signs toward tokens to refer to that conceptual content.* (2003:221)

Liddell also defines surrogate blends: *When the signer or speaker is projected into the blend, the result is a surrogate blend.* (Liddell, 2003:175)

Some may recognize the signer on the screen, and the somewhat morbid topic of the discourse to come. It has been used for previous studies, and my aim is to study recordings of eight simultaneous interpretations into spoken Swedish of it, as well, and therefore reference has been of special interest.

As we will see, the discourse of this study differs from that described by Janzen in some significant ways. The most noticeable one is precisely the spatial strategies used. In this discourse:

1a. During the introduction of the book, and of the main character and background facts, the direction to the signer's left is used for reference – not only for the main character, but for other referents too. This direction is used during the first 2 minutes 18 sec. introductory part. As we will also see, there is a brief return to the use of this direction, approx. 5 minutes into the discourse, when the area to the left is used again, during a 10 second sequence.

1b. But, during the largest parts of this discourse, when the bulk of the contents of the book is described, the area in front of the signer's chest is used for reference. Here too, tokens & surrogates for several referents use the same main direction. It is actually only a "contrasting" 3:rd (or 4:th) token that will occur "on the opposite side" – otherwise, tokens are stacked/piled above each other.
Also…

2a. When the left side of the signing space is used for reference, there is almost exclusive use of token space.

2b. Whereas, after the change into use of the forward direction for reference, the signer frequently switches between token space and surrogate space. There are many instances of constructed dialogue & constructed action, both between the main character and other characters, and between other characters only. There are even long stretches where the main character is not mentioned at all.

Intro to 1st video-clip:

Let us now look at the beginning of the introductory part of this discourse, where we will see the area to the left used for reference; and token space used almost exclusively. I will first play through the first 28 seconds, and what the signer says can be summarized like this: "I have read a book by Elizabeth Kübler Ross. She was born in Switzerland, but moved to the US because she married an American, right after WWII. She studied to be a doctor, but got interested in psychology and graduated as a psychiatrist. She is an interesting person…”

Here we go…

2. Video #1.

We will now return to the video-clip, I will use slow, and then stop at the specific instances I have mentioned. The aim is that by doing so, we can get this to work well for all of us and nobody will have to constantly switch back and forth between watching an interpreter and watching the example.

Apart from the three things I mentioned earlier, we will also see something else:

Even though, as I said, this part of the discourse is produced using token space almost exclusively, we will see use of surrogate space as well. A pronominal pointing sign directed at the signer's chest (which I refer to as INDEX-c) is here used for reference, not to the signer but to EKR. Having signed 'she studied'; from narrator's perspective, using the pronominal pointing sign directed to the left and then the sign STUDY, this is then repeated, now from the main character's perspective (so we get, INDEX-c & STUDY). In this type of use, the handshape of INDEX-c is assimilated to that of the previous and/or next sign. This is an instance, then, where the signer "rotates the conceptualized space", instead of using body shift.

So, what we will now see, among other things, are:
1. the introduction of the main character by fingerspelling #Elizabeth Kübler Ross (I will also refer to her as EKR),
2. directly after this, the signer creates the token |EKR|, to the left: first her gaze goes down/left, then the signs meaning SELF and cl-PERSON are produced, slightly more to the left than the citation form would normally be,
3. then we will see reference to EKR done with pronominal pointing signs toward that token, the first one occurs at the end of a sentence.
4. Then, after saying that 'she studied (to be a doctor)', from narrator's perspective, producing STUDY TO DOCTOR followed by the pronominal pointing sign directed to the left & using token space; the signer then produces INDEX-c & STUDY in surrogate space, that is – from character's perspective.

3. Video #1, second time.
Intro to the 2nd video-clip: which contains the first change from left to forward:

Now, we move on to the second clip. Here we will first see the final signs of that introductory part of the discourse that we just saw the beginning of, where the signer mainly uses narrator's perspective, token space, and reference to the left. She here ends this part, by saying: "They start living." Then, after a pause, the signer changes direction and says "She has interviewed many patients, especially patients with cancer." Now she is using the area in front of her for reference…

4. Video #2.

Let us go back to this again, using slow, then after that pause you will see the signer first produce:
1. the pronominal pointing sign INDEX-f>|EKR| directed forward, and then
2. a fingerspelled pronoun, that can be directed in signing space: #SHE-f>|EKR|, also directed forward, both of them for reference to EKR, and finally
3. we will also see an introduction of the referent |dying patients|, where the signer uses a THEME-buoy (which is also a blended entity) on the non-dominant hand, and a noun phrase and a pronominal plural pointing sign on the right hand.
5. Video #2, second time.

And this then, is the beginning of the use of the area in front of the signer for reference, and the two tokens |EKR| & |dying patients| are both placed in front of the signer, "above each other". This direction is used for approximately 2 min. 30 seconds.

Intro to the 3rd video-clip: where we see the return from forward to left:

In the third clip, we will first see the end of that first part where forward is used for reference, containing some examples of the very frequent switching that is typical for the two main parts of the discourse where the forward direction is used for reference. Then, we will also see the return to using left. What the signer now says is roughly: "That's why you mustn't… if say you have a patient who is dying, who says I want to meet so-and-so, to talk - now. The patient wants to do that now. And you say 'No, wait till tomorrow' - then it's too late. That's her view. That's why you know that if they say now, then now it is… And she is now 80, or more?, well - in her eighties, and she lives in Arizona, in the US."

6. Video #3.

When we now return to the video-clip, again using slow, I will stop at the specific instances I have mentioned in this quite complex sequence. You will first see the signer:

1. using narrator's perspective & token space re-introduce a |dying patient| (in the singular), in front of her, then
2. switch to character perspective & surrogate space, showing us the feelings of that |dying patient|, and then
3. return to narrator's perspective & token space, for a comment on this, using the pronominal pointing forward for reference to a dying patient, then
4. switch to a new surrogate space where we see |an unspecified person|, which is a third contrasting token and thus placed "on the opposite side", saying 'no' to that |dying patient|, then the signer
5. returns to narrator's perspective & use of token space, to make some more comments on this whole situation and then…
6. suddenly, the area to the signer's left is used for pronominal reference to EKR again, still using token space and narrator's perspective. During the ten seconds this sequence lasts, EKR is the only animate referent, some additional facts about her are provided, and only token space is used. After those ten seconds, the signer returns to use of the forward direction for reference again, and that is the direction used for the remaining 4 min. 40 sec.
7. Video #3, second time.

Gaze direction, etc.:

Time limitations have prevented me from saying much about, for example, the signer's gaze direction, which, of course, is of great importance – and much more will have to be said about that as well as other aspects of this discourse. What I wanted to do today, however, was to look at the signer's use of perspective; and at the spatial strategies used by her.

8. Conclusions:

As we have seen, there are several interesting differences regarding the use of perspective in the ASL narrative discourse that Janzen describes, and this mainly descriptive Swedish Sign Language discourse…

First of all… even though this kind of discourse does not have a clear temporal ordering of events such as narratives have, there is still a kind of temporal structure, starting with EKR's background, and then her early work, followed by later work and finally her current situation. Here, new information is added to move the discourse forward, not only by adopting the perspective of "some agent, actor or experiencer within the scene" (as in Janzen's study). In the third video-clip for example, we saw new information being added continuously, both from narrator's perspective and from character perspective. So; in the discourse of this study, the story moves forward also when narrator's perspective is used.

Secondly… just as in the discourse of Janzen's study, narrator perspective is frequently used to provide background information and facts here too. But, in the introductory part for example, we saw the sign STUDY repeated in surrogate space. That is, we saw the signer now providing background information (even though it is repeated) from character perspective. There are several brief sequences in this discourse, which actually repeat something that has already been told from narrator's perspective. It is then retold from a character's perspective – in effect "stopping" the story, not moving it forward.

Then, we have the spatial strategies which are specific for this descriptive Swedish Sign Language discourse. When you see the whole discourse these spatial strategies are very clear, which maybe they are not when you only see a few clips, even though they have been selected to show it.

Firstly, the same main direction is used to make reference; and several tokens are "stacked" above each other, only a third or fourth contrasting token uses "the opposite direction". A close analysis of these pronominal pointings made it clear that it is the signer's gaze direction that makes
the locations of two different tokens distinct, though the pointing signs are in fact directed toward the same area in signing space.

Secondly, there seems to be a connection between discourse content and how signing space is used:

a. When the area to the left is used to make reference, the signer presents facts and background info. When the area in front of the signer is used to make reference, the book content is presented.

b. When the area to the left is used to make reference, token space is used almost exclusively. When the area in front of the signer is used to make reference, there are frequent switches between token space and surrogate space.

Thank you!

References:


1. **Three ways to compare lexicons:**

1.1. **Lexical Similarity**

Goal:
- To gain an understanding of the similarity between two languages by comparing lexical items.

**Methodology:**
- Collect a list of basic vocabulary (200+ signs).
- Compare pairs based on feature similarity (same handshape, location, movement, etc.).
- Use scalar scoring: more shared features receive a higher score.

**Intelligibility hypothesis:**
- The more similar the two lexicons are, the more likely the users of the languages will be able to understand each other.

1.2. **Potential Cognates**

Goal:
- To gain an understanding of the similarity between two languages by comparing lexical items.
Methodology:
- Collect a list of basic vocabulary (200+ signs).
- Compare pairs based on potential cognates – those signs that are either still the same or have evolved in reasonable ways to the point where they can still be traced to their roots.
- Use binary scoring: Are they possible cognates? Yes or No

Intelligibility hypothesis:
- If the lexicons of two languages have evolved from one language, the grammatical and semantic fields will also have likely undergone a similar process of change.
- The more closely related the languages are, the more likely the users of the languages will understand each other.

1.3. Verifiable Cognates

Goal:
- To identify genetic relationships between languages. (If there are many daughter languages, we can tell which ones are more closely related.)

Methodology:
- Collect a large sample of vocabulary (1,000 – 2,000 signs).
- Eliminate all signs that show no relation, as well as signs that are similar by chance.
- Identify systematic changes (e.g. non-selected fingers extended in one language and flexed in another).

Intelligibility hypothesis:
- If the lexicons of two languages have evolved from one language, the grammatical and semantic fields will also have likely undergone a similar process of change.
- The more closely related the languages are, the more likely the users of the languages will understand each other.
2. Establishing Benchmarks

Percentages of similarity (or potential cognates) are affected by so many factors it is difficult to compare one person’s study with another’s.

Factors that affect the scores:
- Which word list did they use?
- How did they score similarities?
- How rigidly did they follow their scoring guidelines (role of intuition)?
- How did they elicit the word list (one example only or look for synonyms)?

It is important to establish an upper and lower benchmark.

The upper benchmark is the range of similarity expected from within one language community. This can be determined by collecting word lists from several people within the same community. Calculate what it would take to be statistically significant from those scores (two Standard Deviations from the mean score). Anything below that benchmark would be considered a separate language variety. *(Whether you call it a separate language or just a separate dialect is another issue.)*

The lower benchmark is the range of similarity expected between languages that are not related but culturally similar. This can be determined by collecting word lists from several languages that are known to be completely unrelated. Calculate what it would take to have a score that is statistically significant from these scores. Anything above this benchmark would be considered to have had some influence by the other language.

Non-iconic lists give the greatest range between benchmarks. Pictureable lists give the smallest range between benchmarks.
3. THREE TYPES OF WORD LISTS:

3.1. EASILY-PICTUREABLE LEXICON

DESCRIPTION:
- Clear, easy-to-identify pictures

BENEFITS:
- Easy to elicit in non-literate societies

DRAWBACKS:
- Elicit primarily highly iconic vocabulary items, which are not good for dialect and language comparisons
- Sometimes you get the wrong word (E.g. show a picture of a window and you may get the sign for curtains – or is the sign for window really an iconic reference to curtains?)

EFFECTS ON WORD LIST COMPARISONS:
- High levels of similarity between unrelated languages
- Slightly lower levels of similarity between closely related languages
- Possible to detect totally unrelated languages and very closely related languages; does not show with accuracy anything between the extremes

3.2. CORE VOCABULARY

DESCRIPTION:
- A list of basic vocabulary from a variety of grammatical categories and semantic fields

BENEFITS:
- Gain a small window into the whole language, including such things as basic verbal morphology
- Easy to elicit with persons who have a minimal understanding of the spoken language

DRAWBACKS:
- Difficult to elicit accurate data in highly non-literate societies
Effects on word list comparisons:

- Includes many highly iconic signs but also some non-iconic signs
- Shows with more accuracy different levels of similarity (potential relatedness), but still there is a broad range of inconclusive data

3.3. Potentially Non-iconic Vocabulary

Description:

- A list of words or concepts that are less likely to be universally depicted using the same iconic reference

Benefits:

- More accuracy in discovering potential relatedness

Drawbacks:

- Many abstract concepts are harder to elicit with accuracy in low-literate societies
- Very few lexical items fit this category so it is hard to find a large enough database to give statistically significant data
- Does not give an overall view of the whole language

Effects on word list comparisons:

- Drastically drops similarity scores between unrelated languages
- Can increase similarity between closely related language varieties
- Shows the greatest range of significant data

Recommendation:

- Use a word list of more than 200 words of core vocabulary.
- Be sure to include more than 50 potentially non-iconic signs.
- Find out what other word list studies have been done in your geographic area of interest and use a list that is compatible with their list. An overlap of at least 100 words is ideal. Word lists for Europe and the Middle East are included here.
For a more complete discussion of the effects of iconicity on lexical comparisons see:
Word list used in Europe (Overlap with Middle East in bold (130). Potentially non-iconic underlined (50))

<p>| | | | | | |</p>
<table>
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<td>sun</td>
<td>70.</td>
<td>bathroom</td>
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<td>9.</td>
<td>horse</td>
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<td>moon</td>
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<td>book</td>
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<td>bear</td>
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<td>stars</td>
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<td>11.</td>
<td>bull</td>
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<td>1</td>
<td>73.</td>
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<td>bug</td>
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<td>2</td>
<td>74.</td>
<td>field</td>
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<td>apple</td>
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<td>3</td>
<td>75.</td>
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<td>bread</td>
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<td>77.</td>
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<td>blue</td>
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<td>1000</td>
<td>84.</td>
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<td>23.</td>
<td>black</td>
<td>54.</td>
<td>Africa</td>
<td>85.</td>
<td>wind</td>
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<td>55.</td>
<td>Europe</td>
<td>86.</td>
<td>winter</td>
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<td>25.</td>
<td>red</td>
<td>56.</td>
<td>Jesus</td>
<td>87.</td>
<td>summer</td>
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<td>57.</td>
<td>Mary</td>
<td>88.</td>
<td>birthday</td>
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<td>flower</td>
<td>58.</td>
<td>angle</td>
<td>89.</td>
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<td>priest</td>
<td>90.</td>
<td>city</td>
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<td>nun</td>
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<td>window</td>
<td>62.</td>
<td>fire</td>
<td>93.</td>
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</table>

94. teacher
95. water
96. fat
97. thin
98. cold
99. hot
100. dirty
101. clean
102. sad
103. happy
104. day
105. night
106. afraid
107. dry
108. wet
109. sweet
110. old
111. young
112. true
113. false
114. good
115. bad
116. beautiful
117. ugly
118. yes
119. no
120. thank you
121. you’re welcome
122. weak
123. strong
124. envy
| 125. free      | 154. to lie | 183. new  | 212. Monday   |
| 126. angry     | 155. to need | 184. nothing | 213. Tuesday  |
| 127. to exercise| 156. to meet | 185. now   | 214. Wednesday|
| 128. tired     | 157. to pay  | 186. only  | 215. Thursday |
| 129. to ask    | 158. to play | 187. other | 216. Friday   |
| 130. to begin  | 159. to read | 188. paper | 217. Saturday |
| 131. to end    | 160. to sell | 189. peace | 218. Sunday   |
| 132. to continue| 161. to sign | 190. some   | 219. God     |
| 133. to build  | 162. to sing | 191. story | 220. Devil    |
| 134. to buy    | 163. to understand | 192. animals | 221. sin     |
| 135. to confess| 164. to work | 193. salt  | 222. judge    |
| 136. to come   | 165. to write | 194. color | 223. president|
| 137. to cook   | 166. to love | 195. poor (person) | 224. family |
| 138. to dance  | 167. what?  | 196. rich (person) | 225. mother |
| 139. to die    | 168. when?  | 197. January | 226. father |
| 140. to live   | 169. where? | 198. February | 227. child   |
| 141. to sleep  | 170. who?   | 199. March | 228. son      |
| 142. to dream  | 171. how many? | 200. April | 229. daughter |
| 143. to eat    | 172. how?   | 201. May   | 230. brother  |
| 144. to fight  | 173. all    | 202. June  | 231. sister   |
| 145. to forgive| 174. almost | 203. July  | 232. grandfather|
| 146. to go     | 175. always | 204. August | 233. grandmother|
| 147. to hate   | 176. garbage | 205. September | 234. cousin |
| 148. to help   | 177. hungry | 206. October | 235. spouse |
| 149. to kill   | 178. law    | 207. November | 236. boyfriend |
| 150. to listen | 179. many   | 208. December | 237. girlfriend|
| 151. Deaf      | 180. more   | 209. month | 238. sweethearts|
| 152. to see    | 181. name   | 210. week  | 239. police   |
| 153. to search | 182. never  | 211. year  | 240. kitchen  |
Word list used in Middle East (Overlap with Europe in **bold** (130). Potentially non-iconic *underlined* (50))

1. cat  
2. mouse  
3. dog  
4. chicken  
5. rabbit  
6. horse  
7. goat  
8. lion  
9. elephant  
10. monkey  
11. bear  
12. frog  
13. locust  
14. spider  
15. apple  
16. grapes  
17. tomato  
18. carrot  
19. onion  
20. pepper  
21. bread  
22. rice  
23. tea  
24. egg  
25. meat  
26. bone  
27. blood  
28. flower  
29. tree  
30. grass  
31. sand  
32. mountain  
33. rock  
34. water  
35. sun  
36. moon  
37. star  
38. cloud  
39. ice  
40. day  
41. night  
42. man  
43. woman  
44. boy  
45. girl  
46. baby  
47. soldier  
48. doctor  
49. student  
50. beggar  
51. shirt  
52. shoes  
53. ring  
54. table  
55. bed  
56. candle  
57. lightbulb  
58. telephone  
59. television  
60. broom  
61. clock  
62. toy/doll  
63. paper  
64. door  
65. window  
66. blue  
67. green  
68. yellow  
69. black  
70. white  
71. money  
72. hundred  
73. thousand  
74. city  
75. film  
76. bus  
77. ship  
78. train  
79. sit  
80. lie down  
81. run  
82. pain  
83. dry  
84. tall  
85. short  
86. dirty  
87. empty  
88. full  
89. old age  
90. strong  
91. fat  
92. thin  
93. picture  
94. wood  
95. glass  
96. gold  
97. iron  
98. leaf  
99. sea  
100. house  
101. sign  
102. name  
103. light  
104. rough  
105. smooth  
106. young  
107. weak  
108. oil  
109. wind  
110. louse  
111. animal  
112. color  
113. morning  
114. month  
115. week  
116. year  
117. friend  
118. hearing  
119. interpreter  
120. school
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<th>169. good</th>
<th>193. because</th>
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<td>122. teacher</td>
<td>146. buy</td>
<td>170. bad</td>
<td>194. if</td>
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<td>123. director</td>
<td>147. sell</td>
<td>171. happy</td>
<td>195. with</td>
</tr>
<tr>
<td>124. shout</td>
<td>148. number</td>
<td>172. sad</td>
<td>196. family</td>
</tr>
<tr>
<td>125. enemy</td>
<td>149. problem</td>
<td>173. afraid</td>
<td>197. pay</td>
</tr>
<tr>
<td>126. God</td>
<td>150. go</td>
<td>174. tense</td>
<td>198. peace</td>
</tr>
<tr>
<td>127. police</td>
<td>151. understand</td>
<td>175. relaxed</td>
<td>199. free (no cost)</td>
</tr>
<tr>
<td>128. judge</td>
<td>152. love</td>
<td>176. hot</td>
<td>200. law</td>
</tr>
<tr>
<td>129. mother</td>
<td>153. ignore</td>
<td>177. cold</td>
<td>201. tired</td>
</tr>
<tr>
<td>130. father</td>
<td>154. smell</td>
<td>178. early</td>
<td>202. three</td>
</tr>
<tr>
<td>131. married</td>
<td>155. visit</td>
<td>179. late</td>
<td>203. eight</td>
</tr>
<tr>
<td>132. person</td>
<td>156. talk</td>
<td>180. easy</td>
<td>204. ten</td>
</tr>
<tr>
<td>133. poor</td>
<td>157. laugh</td>
<td>181. difficult</td>
<td>205. Monday</td>
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<td>134. rich</td>
<td>158. holiday</td>
<td>182. start</td>
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<tr>
<td>135. cook</td>
<td>159. story</td>
<td>183. finish</td>
<td>207. Saturday</td>
</tr>
<tr>
<td>136. life</td>
<td>160. crazy</td>
<td>184. continue</td>
<td>208. Syria</td>
</tr>
<tr>
<td>137. dead</td>
<td>161. lazy</td>
<td>185. what?</td>
<td>209. Egypt</td>
</tr>
<tr>
<td>138. kill</td>
<td>162. responsible</td>
<td>186. where?</td>
<td>210. Iraq</td>
</tr>
<tr>
<td>139. dream</td>
<td>163. ask</td>
<td>187. who?</td>
<td>211. Turkey</td>
</tr>
<tr>
<td>140. work</td>
<td>164. lie</td>
<td>188. always</td>
<td>212. mosque</td>
</tr>
<tr>
<td>141. play</td>
<td>165. yes</td>
<td>189. many</td>
<td>213. angels</td>
</tr>
<tr>
<td>142. sports</td>
<td>166. no</td>
<td>190. some</td>
<td>214. devil</td>
</tr>
<tr>
<td>143. party</td>
<td>167. true</td>
<td>191. new</td>
<td>215. Muslim</td>
</tr>
<tr>
<td>144. birthday</td>
<td>168. correct</td>
<td>192. other</td>
<td>216. Christian</td>
</tr>
</tbody>
</table>
Possession and existence in three sign languages

Deborah Chen Pichler
Gallaudet University
Deborah.Chen.Pichler@Gallaudet.edu

Katharina Schalber
No current affiliation
schalberk@yahoo.com

Julie Hochgesang
Gallaudet University
Julie.Hochgesang@Gallaudet.edu

Marina Milković
University of Zagreb
mmilkov@erf.hr

Ronnie B. Wilbur
Purdue University
wilbur@purdue.edu

Martina Vulje
University of Zagreb
martina_vulje@net.hr

Ljubica Pribanić
University of Zagreb
ljubica@erf.hr

Abstract

This study describes and compares possessive and existential constructions in three sign languages: American Sign Language (ASL), Austrian Sign Language (ÖGS) and Croatian Sign Language (HZJ). We note structural similarities in possessives and existentials across these three languages, as well as similar semantic restrictions on the types of possessor and possesum permitted. We also point out evidence for an underlying relationship between possessives, existentials and locatives, similar to that frequently reported for many spoken languages.

1 This work was funded by grant #0345314 from the National Science Foundation. Thank you also all our Deaf participants for their contribution to this project, and to Ulrike Zeshan and her research team.
1. Introduction
This talk is the result of a cross-linguistic study of possessive and existential structures in American Sign Language (ASL), Austrian Sign Language (ÖGS) and Croatian Sign Language (HZJ). We will begin with a descriptive overview of the relevant constructions as produced by our project participants. This overview will include comparison of both syntactic and semantic characteristics across various possessive constructions in our three target languages, noting similar patterns that occur across our corpora. Next, we address the notion that possessive and existential constructions are syntactically related not only to each other, but to locatives as well. This is a long-standing notion in the spoken language literature, popularized by the syntactic proposal laid out by Freeze (1992), but the plausibility of its extension to sign language data has not been extensively explored. We will close with some discussion of potential evidence from our ASL, ÖGS and HZJ data for an underlying locative nature of possessives and existentials in these sign languages.

2. Methodology
Our data come from Deaf subjects from Gallaudet University (United States; 6 subjects), Vienna, Austria (5 subjects) and Zagreb, Croatia (4 subjects). Data were elicited using tasks developed for the comparative study entitled Sign Language Typology: Possession and Existentials, directed by Ulrike Zeshan. Participants engaged in four “games” targeting possessive and existential constructions. A short description of each of these tasks is provided in Appendix A at the end of this report. In some cases, our elicitation data were supplemented by consultation and discussion of specific structures with native signers (to varying degrees across teams).

3. Descriptions of possessive and existential constructions in ASL, ÖGS and HZJ
Our data cover a wide range of possessive and existential constructions, only a subset of which will be discussed here. This report will focus on existentials (eg. There is a problem; There is a man in the room), nominal phrase (NP) possessives (eg. my car; John’s sister) and the have form of predicate possessives (eg. I have a car).

3.1. NP possessives: Structural characteristics
We found possessive structures in the form of nominal phrases in all three of our target languages. All three languages employ a possessive pronoun (glossed as POSS in the examples below) formed
by displacing the B hand configuration towards the locus of the possessor\textsuperscript{2}. The canonical word order for NP possessives was in all cases (Possessor)-POSS-Possessum, with the sign for the possessor appearing only when necessary (eg. for reasons of clarity or emphasis).

(1) POSS-1s CAR / AUTO / AUTO         [ASL, ÖGS, HZJ]
    poss-1s car / car / car
    ‘my car’

(2) (MOM) POSS-3s COUSIN       [ASL]
    ‘Mom’s cousin / her cousin’

(3) (VATER) POSS-3s BRUDER     [ÖGS]
    father poss-3s brother
    ‘my father’s brother / his brother’

(4) (MAMA) POSS-3s MAČKA      [HZJ]
    Mom poss-3s cat
    ‘Mom’s cat / her cat’

In addition to this basic form described above, we also observed variant forms of the NP possessive, including one in which the possessive pronoun is replaced by the corresponding personal pronouns (5-7) or dropped altogether (referred to as a “juxtaposed” NP possessive structure, illustrated in examples 8-9).

(5) (MOM) PRO-3s COUSIN    [ASL]
    ‘Mom’s cousin / her cousin’

(6) PRO-2 OMA LEBEN NOCH ?    [ÖGS]
    pro-2 grandmother live still

\textsuperscript{2} See Appendix B for a photo of the B-configuration possessive pronoun, as well as other possessive and existential signs relevant to this study.
‘Is your grandmother still living?’

(7) PRO-2 BAKA PRO-2
    pro-2 grandmother pro-2
    ‘your grandmother’

(8) VATER BRUDER
    [ÖGS]
    father brother
    ‘the brother of (my) father’

(9) MAJKA SESTRA
    [HZJ]
    mother sister
    ‘the sister of (my) mother’

In ASL we observed a fourth possibility for NP possessives employing the sign APOSTROPHE-S, originating from written English. This form was likely borrowed into ASL via Signed English, but was judged by our informants as acceptable in ASL, particularly in utterances with reiterated possession, as in the example below.

(10) POSS-1 FATHER ’S BROTHER’S WIFE
    [ASL]
    ‘my father’s brother’s wife’

    Our Austrian and Croatian participants did not produce possessive structures of the type shown in (10), although lexical borrowing does occur from Signed German and Signed Croatian into ÖGS and HZJ, respectively. Thus we are unable to comment on the frequency or acceptability of similarly borrowed structures in ÖGS and HZJ.

3.2. NP possessives: Semantic characteristics

The NP possessives in our corpora display certain structural restrictions depending on the semantic characteristics of the possessor and possessum, as well as the type of possession that holds between
them (ie. alienable vs. inalienable). These restrictions are, with a few exceptions, strikingly similar across our three target sign languages. The most basic configuration for NP possessives in our data is that involving alienable possession of an inanimate possessum by an animate possessor. The possessum can be either concrete (11) or abstract (12). Expressions of inalienable possession between an animate possessor and a family member is also quite acceptable in all three of our target languages, as was illustrated in examples (5-9) above. In all these cases, the NP possessive structure may take the form of any of the structural variations discussed in section 3.1.

(11) POSS-1 AUTO [HZJ]
    poss-1 car
    'my car’

(12) POSS-1 IDEJA [HZJ]
    poss-1 idea
    'my idea’

Structural restrictions appear in NP constructions involving inalienable possession of a body part by an animate possessor (13-14). In this case, the juxtaposed form is strongly preferred, i.e. the structure is only fully acceptable when there is no pronoun between the signs for possessor and possessum. The same restriction applies in cases with an inanimate possessor, as in the part-whole relationship observed in (15). These restrictions were most clear in our ASL and ÖGS data; although we have some evidence that the same restrictions may also apply in HZJ, we do not presently have sufficient data for that language to determine the extent to which they are active. The first table in Appendix C summarizes our observations of semantic characteristics for ASL, ÖGS and HZJ.

(13) SISTER (?POSS-3) NOSE [ASL]
    'my sister’s nose’

(14) MAČKA (*POSS-3) BRKOVI [HZJ]
    cat poss-3 whiskers
    'the cat’s whiskers’
3.3. Predicate possessives

We next move on to discussion of predicate possessives, or possessives in the form of sentences. These fall into two subcategories, depending on the type of predicate used to express possession in the target language. As has been observed for spoken languages, some sign languages form possessives using an existential, while others exhibit the opposite pattern, expressing existence with a possessive verb. As we will see, both patterns are represented in our data: ASL and HZJ use a verb glossed have to form both possessives and existentials, while ÖGS uses a verb glossed exist to serve the same functions.

3.3.1. Predicate possessives in ASL and HZJ: Structural characteristics

Predicate possessives in ASL involve the possessive verb HAVE (16). Negative possessives tend to involve the suppletive form NONE (17). While our data include instances of negative possessives formed using NOT HAVE, these were later judged by native informants as “sounding English,” and may have been artifacts of the elicitation methodologies used in this project. In HZJ, possession is expressed using the verb IMATI have (18); the negative form (also suppletive) is NEMATI not-have (19). As both ASL and HZJ are canonical subject-verb-object (SVO) languages, the most common sign order for predicate possessives is Possessor- HAVE/IMATI-Possessum, as illustrated in the examples below.

(16) PRO-1 HAVE CAR [ASL]
    'I have a car’

(17) PRO-1 CAR     NONE [ASL]
    'I don’t have a car/ I have no car’

(18) DJED     IMATI KAPA SIVO [HZJ]
    old-man have cap grey
'The old man has a grey cap’

(19) PRO-1 NEMATI KUĆA

[HZJ]
pro-1 not-have house
'I don’t have a house/ I have no house’

In addition to the predicate possessive structures discussed above, our American participants also produced a variant without the possessive verb, in which two possessed items (null, but represented by their modifiers GREEN and BLUE in example (20) below) were displaced towards the loci of their respective possessors.

(20) SEE BOOK THERE? GREEN(displaced to PRO-2), BLUE(displaced to PRO-1)

[ASL]
'See books there? The green (one) is yours, and the blue (one) is mine.’

3.3.2. Predicate possessives in ÖGS: Structural characteristics
Possession is expressed in ÖGS with the verb DA exist (see Appendix B for an image of this verb). Since ÖGS is an SOV language, DA comes at the end of the sentence, resulting in the basic form POSSESSOR - POSSESSUM – DA for predicate possessives (21). Negative possessives are formed with the sign KEIN no or ÜBERHAUPT-NICHT not at all, either with or without the verb DA (22).

(21) PRO-1 AUTO DA

[ÖGS]
pro-1 car exist
'I have a car.’

(22) PRO-1 KEIN KIND (DA)

[ÖGS]
pro-1 no child exist
'I have no children / I don’t have any children’
3.3.3. Predicate possessives in ASL, ÖGS and HZJ: Semantic characteristics

As we saw for the NP possessives above, predicate possessives in ASL, ÖGS and HZJ occur the most naturally and acceptably with an animate possessor and a concrete possessum. Also common in our data are expressions of alienable possession of abstract objects (24) and inalienable possession of family members (23; see also example 22).

(23) PRO-3 HAVE THREE KIDS [ASL]
‘He has three kids’

(24) PRO-1 IDEE DA [ÖGS]
pro-1    idea   exist
‘I have an idea’

Inalienable possession of a body part appears to occur in ASL, ÖGS and HZJ, illustrated by examples (25 -27). However, it is possible that some of these cases, notably in our HZJ and ASL data, reflect strong influence from the grammar of the spoken/written majority language. An example is the use of the verb HAVE with physical states, as in example (25), rather than displacement of the sign “HURT/PAIN” in front of the affected part of the body, as is standard in ASL. As most of these expressions were produced during the “Doctor Patient” task, we speculate that this task may have unexpectedly elicited a more English-like register of ASL commonly used with medical professionals, who in the US are overwhelmingly nonsigning and hearing. Example (26), where the Croatian preposition _u_ “in” is mouthed, with no corresponding sign, is also compatible with this hypothesis.

(25) PRO-2 HAVE HEADACHE? [ASL]
‘Do you have a headache?’

(26) IMATI PRO-2 BOLJETI _u_ UHO? [HZJ]
have     pro-2    hurt     ‘in’   ear
‘Do you have an earache?’
There are a few examples of predicate possessives with an inanimate possessor in our data but these appear to be subject to severe restrictions. One of our Austrian consultants, for example, commented that as an inanimate object, a house “can’t possess anything.” As we saw earlier with the possessives in NP form, predicate possessives with an inanimate possessor (eg. part-whole relationships) tend to be expressed using mechanisms other than the standard Possessor-HAVE/DA/IMATI-Possessum construction. Our data include several instances of part-whole relationships expressed via classifier constructions, in which the whole entity is established as ground entity, and the part entity as figure (cf. Talmy (1978)). Three of these examples appear below.

(28) TAXI VIER REIFEN DA
[ÖGS]
taxi four wheels exist
‘The taxi has four wheels’

(29) TAXI VIER REIFEN CL-wheels-shape-and-location
[ÖGS]
taxi four wheels cl-wheels-shape-and-location
‘The taxi has four wheels’

(30) WALL CL-F:hole-in-wall
[ASL]
‘The wall has a hole’

The second table in Appendix C summarizes our observations on the semantic characteristics of predicate possessives in ASL, ÖGS and HZJ.
3.4. Expressions of existence

As we have already mentioned earlier, ASL and HZJ are languages that express existentials using a possessive verb, while ÖGS displays the opposite pattern, expressing possession with an existential verb. This typological difference, along with the previously mentioned fact that ASL and HZJ are SVO languages, while ÖGS is an SOV language, account for the only major differences we noted across existential constructions in our three target languages.

3.4.1. Existential structures in ASL and HZJ

Existence is expressed in ASL with the possessive verb HAVE, with a corresponding negative suppletive form NONE. In our data, NOT HAVE also occurred for some negative existentials. There are distinctions between NONE and NOT HAVE, notably the fact that the latter tends to take an animate possessor. Existential HAVE appears most commonly before the object whose existence is being expressed (31), while NONE appears most commonly after the object (32). In addition to constructions using HAVE, our participants also used alternative mechanisms for expressing existence, including a head nod over the object (33), a locative point towards the locus of the object (34) and classifier constructions establishing the object in space (35).

(31) HAVE PROBLEM
    [ASL]
    ‘There is a problem’

(32) PROBLEM NONE
    [ASL]
    ‘There is no problem’

    ________head nod

(33) PROBLEM
    [ASL]
    ‘There is a problem’

(34) MONEY IX(table)
    [ASL]
    ‘There is money on the table’
(35) WALL CL-F:hole-in-wall
    [ASL]
    ‘There is a hole in the wall’

Existentials in HZJ are expressed with the possessive verb IMATI *have*, with a corresponding suppletive negative form NEMATI *not-have* (36). As in ASL, existence can also be expressed alternatively using a locative point towards the possessor and the classifier constructions establishing the position of the object in space. In addition, HZJ has a second existential-only verb POSTOJATI *exist* (37), which is used primarily in formal contexts, and did not appear in our corpus.

(36) PRO-1 SLIKA IMATI / NEMATI PTICE
    [HZJ]
    pro-1 photo have / not-have birds
    ‘In my photo, there are / are no birds’

(37) POSTOJATI PROBLEM
    [HZJ]
    exist problem
    ‘There is a problem’

3.4.2. Existential structures in ÖGS

Existence in ÖGS is expressed with the verb DA *exist* (38). This verb is ordered at the end of the sentence and can be displaced in space to show multiplicity or location (39). Negative existentials are signed with KEIN *no* or ÜBERHAUPT-NICHT *not at all*, either with or without the verb DA (40). Our Austrian participants, similarly to their American and Croatian counterparts, often produced classifiers displaced in space to express existence, as shown in example (41).

(38) PROBLEM DA
    [ÖGS]
    problem exist
    ‘There is a problem’
4. Relationship between possessive, existential and locative structures

It has been noted by many researchers that possessive and existential expressions in a large number of spoken languages share certain relationship with locatives (cf. Lyons (1968), Clark (1978), Freeze (1992), Harley (2003), inter alia). Here we will briefly consider the widely cited syntactic analysis advanced by Freeze (1992), designed to unify these three constructions. Freeze posits that possessive and existential constructions both derive from the same locative underlying structure. He bases his analysis on the paradigm in spoken Russian, where the structural similarities of the three constructions in question are readily recognized.

(42) Kniga byla na stole
    book-NOM was on table-LOC
    ‘The book was on the table.’

(43) Na stole byla kniga
    on table-LOC was book-NOM
    ‘There was a book on the table.’

(44) U menja byla sestra
    to 1sg-GEN was sister-NOM
    ‘I had a sister.’
According to Freeze, the underlying structure in examples (42-44) includes a prepositional complement of the verb «byla», as we see in the representation shown in (45).

(45) Derivation of locative, possessive and existential structures according to Freeze (1992)

Under Freeze’s proposal, the locative structure in (42) is derived by moving the P’ constituent encoding the location of the book (na stole) to subject position (spec of IP), making it the grammatical subject of the sentence. Similarly, the existential construction in (43) is derived when the semantic theme, encoded in this case by the NP knjiga, raises to become the grammatical subject. As for the possessive construction, Freeze proposes that the possessor NP (menja in example (44)) essentially functions as a [+human] location for the possessum. This analysis follows straightforwardly for languages like Russian, where possessives are expressed using an overt preposition; in languages where this is not the case, Freeze assumes that the preposition is null. This proposal has the advantage of essentially reducing possessives structures to existential structures with a human location. Just as in the case of existentials, then, the NP “location” raises to Spec of IP, becoming the grammatical subject of the possessive construction.

In addition to structural similarities, Freeze (1992) also cites diachronic evidence that corroborates his hypothesis for the underlying locative nature of possessive and existential constructions. He notes a long list of proforms with locative origins used in the expression of existence in spoken French, Catalan, Italian, Spanish, Arabic and Samoan, as well as the lexically locative subject there used in English existential expressions.

Although signed and spoken languages share a great number of critical features in common, we are conscious that they also differ in important ways. By citing the analysis of Freeze (1992), we do not intend to insist on the specific syntactic structure that he proposes. Rather, we invoke it as a useful model for systematic investigation of the plausible underlying relationship between

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3 This graphic is excerpted from Harley (2003).
possessives, existentials and location in sign languages. In recent years, several researchers have pointed out evidence for such a relationship in a variety of signed languages. Kristofferson (2003) notes that in Danish Sign Language, possessive, existential and locative constructions all use the same verb and are distinguished only by sign order (*ground-figure* for possessive and existential constructions, and *figure-ground* for locatives). More recently, a cross-linguistic typological comparison of possessive and existential expressions in sign languages, launched by Ulrike Zeshan and her research team, focuses on the relationship between these two constructions in over twenty sign languages, including Finnish and Flemish Sign Languages (De Weerdt and Takkinen (2006)), ASL (Chen Pichler and Hochgesang (to appear)) and ÖGS (Schalber and Hunger (to appear)). As we examined the possessive and existential constructions collected for the present project, we asked ourselves what evidence there might be for an underlying locative structure in possessives and existentials in ASL, ÖGS and HZJ. So far, we feel there are two aspects of our data in particular that exhibit locative characteristics: the recurring usage of space (with locative points and classifiers) and the fact that some of the predicates we observed are plausibly derived from locative signs.

Again, the structural organization of sign languages is known to diverge from that of spoken languages in many areas, and it is important take such differences into account when seeking to extend to sign languages analyses originally developed for spoken languages. The Freeze (1992) analysis hinges on a prepositional phrase complement of the verb in possessives and existentials, and it is in this PP that the locative characteristics of these two constructions originate. Overt prepositions of the type common in spoken languages are quite rare in the sign languages we studied (and perhaps in sign languages in general). However, we find locative information encoded by the use of space instead. For instance, all three in our study languages make use of the locative index (including personal pronouns) for expression of possession and existence. To the extent that a point used as a personal pronoun indicates the location of a possessor (eg. à la Liddell 2003), this usage can be thought of as encoding the possessor as a human location, in the spirit of Freeze (1992). Furthermore, while we do not yet have the relevant data for ÖGS or HZJ, ASL allows possession to be expressed with nothing else but the displacement of signs in space towards the loci of possessors, as in the example cited earlier in (20).

As for expressions of existence, the use of the index illustrated in example (34) constitutes a third example of a locative characteristic. Note that these constructions are ambiguous, allowing both an existential reading (*there is money on the table*) and a more directly locative reading (*The money is on the table*). We find the same ambiguity (also noted by Kristofferson (2003) for Danish Sign Language) in the *ground-figure* classifier constructions such as examples (29), (35) and (41),
another alternative structure used in ASL, ÖGS and HZJ to express existence. If we are willing to consider the noun phrase representing ground in these examples (i.e. TAXI, WALL or RAUM) as a location, and the noun phrase representing figure (i.e. REIFEN, HOLE or 25 SESSEL) as the theme, these structures might even be amenable to the syntactic analysis proposed by Freeze (1992), under which a location is realized as the grammatical (but not necessarily conceptual) “subject” of the sentence.

We also find limited evidence supporting a diachronic link between locatives, possessives and existentials. Most obviously is the fact that the ÖGS verb used with possessives and existentials bears a locative gloss (here). Schalber and Hunger (to appear) point out that in its existential use, DA functions to indicate the actual presence and location of the object to which existence is being attributed, and can even be replaced with a locative adverb sign such as HIER here. Interestingly, the present form of the sign DA bears a striking resemblance to the sign used in HZJ sign MJESTO place (the HZJ sign adds a B configuration base hand). Deaf Croatian children were sent to Austria for schooling in the late 19th century, so there are historical ties between the HZJ and ÖGS. Similarly, the alternate HZJ existential verb POSTOJATI to exist may have locative origins, given its superficial resemblance to the HZJ sign for STOJITI, meaning roughly “to be located at.” This sign is clearly locative, allowing displacement in space to indicate the location of the object in question. Of course, this type of etymological comparison is fairly speculative, but we mention them here as secondary, supportive evidence, in the same spirit as Freeze’s discussion of the (similarly suggestive) diachronic evidence for locative origins of possessives and existentials in spoken languages.

5. Conclusions

The initial purpose of this study was to describe and document possessive and existential constructions in ASL, ÖGS and HZJ. As we examined our data, we noted similarities across these three languages in terms of the syntactic structures employed to express possession and existence, as well as an apparent restriction on which of these structures can occur with inanimate possessors and certain cases of inalienable possession (e.g. body part possession). In these cases, for both NP and predicate possessives, it is preferable not to have an overt possessive pronoun. We speculate that this restriction may be due to the fact that possession is, in its most canonical instantiation, a relation between an animate possessor and an inanimate possessum, and that this particular relation is emphasized by the overt POSS pronoun.
A second goal of the present work was to draw attention to underlying locative or spatial characteristics of existential and possessive structures that we observed in ASL, ÖGS and HZJ. In particular, we noted alternative mechanisms for expressing possession that involved pointing towards the locus of the possessor or movement of the possessum sign to the locus of its possessor. Also spatial in nature was the expression of existence via establishment of ground-figure constructions in which ground is encoded as a location, and figure as the object to whom existence is attributed. Lastly, we reported secondary, diachronic evidence for locative origins of the ÖGS existential/possessive verb and a HZJ existential verb. There has long been discussion in the spoken language literature of a syntactic link between possessives, existentials and locatives. We discussed Freeze (1992) as one such proposal, not as a proposition to adopt the specific structural details of that analysis, but simply as a first attempt to capture similarities between these three structures in sign languages as well as in spoken languages. We are of course aware of the need for caution when extending analyses originally developed for spoken language data to sign languages. Nevertheless, we feel that the evidence so far for an underlying locative nature of (certain) possessive and existential structures in ASL, ÖGS and HZJ is compelling enough to merit rigorous further investigation.

References


**Appendix A: Elicitation games from the Zeshan Cross-linguistic project**

All of the games used in this study are played by two participants and are presented almost exclusively through graphics. Written language was used only for the list of symptoms in the Doctor-patient game and to record the names of family members in the Family Tree game.

<table>
<thead>
<tr>
<th>Name of game</th>
<th>Description</th>
<th>Target structure(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doctor - patient game</td>
<td>Participant A, as the patient, receives a card marked with a selection of symptoms such as headache, fever, etc. Participant B, as the doctor, tries to diagnose Participant A’s ailment by asking if he/she suffers from each symptom.</td>
<td>Inalienable possession (of body parts and physical states)</td>
</tr>
<tr>
<td>Family tree game</td>
<td>Participant A asks Participant B about the members of his/her family tree, their ages, jobs, etc.</td>
<td>Inalienable possession (of family members); Alienable possession of abstract objects (eg. jobs, hobbies, etc.)</td>
</tr>
<tr>
<td>Matching game</td>
<td>Participants A and B assign a series of concrete objects (eg. a horse, a gun, a book) to a variety of fictional individuals (eg. a young girl, a man, an old woman)</td>
<td>Alienable possession of concrete objects</td>
</tr>
<tr>
<td>Picture comparison game</td>
<td>Participants A and B each receives one of two images that differ in 5 or 6 small details. They must identify these differences by verbally (through signing) comparing the contents of their respective pictures.</td>
<td>Existentials</td>
</tr>
</tbody>
</table>
### Appendix B: Examples of possessive and existential signs in ASL, ÖGS and HZJ

<table>
<thead>
<tr>
<th>Language</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ASL/ÖGS/HZJ] POSS-2</td>
<td><img src="image1" alt="Image" /></td>
<td>The B hand configuration displaced towards the locus of the possessor</td>
</tr>
<tr>
<td>[ASL] HAVE</td>
<td><img src="image2" alt="Image" /></td>
<td>The bent-B hand configuration, fingertips contacting the chest.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sign may be made with one or two hands.</td>
</tr>
<tr>
<td>[HZJ] IMATI</td>
<td><img src="image3" alt="Image" /></td>
<td>The U hand configuration closing (with downward wrist bend) to the N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>configuration, but with the thumb left extended.</td>
</tr>
<tr>
<td>[ÖGS] DA</td>
<td><img src="image4" alt="Image" /></td>
<td>The “open-8” hand configuration produced with a short downward movement;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>articulated with one or two hands; can be displaced in space to show</td>
</tr>
<tr>
<td></td>
<td></td>
<td>location or multiplicity.</td>
</tr>
<tr>
<td>[ASL] APOSTROPHE-S</td>
<td><img src="image5" alt="Image" /></td>
<td>The S configuration held in front of signer and twisted inwards once.</td>
</tr>
<tr>
<td>[ASL] GREEN(PRO-2), BLUE(PRO-1)</td>
<td><img src="image6" alt="Image" /></td>
<td>The sign GREEN is displaced towards the PRO-2 locus while the sign BLUE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>is displaced towards the PRO-1 locus.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>‘The blue (one) is mine, and the green (one) is yours.’</td>
</tr>
</tbody>
</table>
Appendix C: Summary of semantic characteristics of NP and predicate possessives

In the following two tables, full circles indicate that a construction was common and/or fully acceptable according to our data. Half circles indicate that there was some inconsistency or restrictions in the data concerning acceptability of the particular construction.

<table>
<thead>
<tr>
<th>NP Possessives</th>
<th>ASL</th>
<th>ÖGS</th>
<th>HZJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>animate possessor with concrete possessor</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inalienable possession: kinship possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inalienable possession: body part possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>alienable possession: abstract concept possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inanimate possessor</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Predicate possessives</th>
<th>ASL</th>
<th>ÖGS</th>
<th>HZJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>inalienable possession: kinship possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inalienable possession: body parts possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inalienable possession: physical states</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>alienable possession: abstract concept possessum</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>inanimate possessor</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>
1. Introduction

In this paper, we present an analysis of the signing that three deaf mothers directed to their deaf children, when those children were between 9 and 24 months of age. Researchers looking at child-directed signing in a number of sign languages have provided a quite consistent description of the ways that deaf parents modify their signs when addressing their young children (e.g., Erting, Prezioso, & O’Grady Hines (1990) and Spencer, Bodner-Johnson, & Gutfreund (1992) for American Sign Language; Mohay, Milton, Hindmarsh, & Ganley (1998) for Australian Sign Language; Harris, Clibbens, Chasin, & Tibbitts (1989) for British Sign Language; Masataka (1992) for Japanese Sign Language; van den Bogaerde (2000) for Sign Language of the Netherlands, among others). They have noted that these modifications are well-suited to ensuring that their signs are visible to their children, and that deaf parents are skilled at producing visually accessible sign language input to their children.

Following on this previous research, our own analysis has three goals:

1. To describe the language input that these three children received from their mothers, focusing on the ways that the mothers modified their sign production when addressing their children and on the ways that this signing changed as the children grew older.

2. To investigate the degree to which the mothers’ sign modifications are related to the child’s gaze or visual attention. Signing children must use vision both to access their parents’ signs and to see the objects that their parents’ language refers to. This may often require the child to shift visual attention between signs and their referents. Signing parents’ modifications of their signs may indicate their
sensitivity to the attentional demands that signing places on their child. As children grow older, and they become more skilled at shifting their attention as required, we would expect parental sign modifications for this purpose to decrease in frequency.

3. To investigate whether the phonological characteristics of particular signs are related to the ways that they are modified in child-directed signing.

2. Methods

To address the above research questions, we looked at three to four sessions of videotaped interaction between mothers and children for each of three mother-child dyads. Table 1 shows the pseudonyms of the three children we looked at and their ages at the sessions we analyzed. All three deaf girls have deaf parents and are acquiring ASL as a first language in the home. Each child has at least one deaf grandparent and therefore has access to a native signing model in at least one of her parents. Katie and Suzie’s mothers had hearing parents, and Noel’s mother had deaf parents.

<table>
<thead>
<tr>
<th>Katie</th>
<th>Noel</th>
<th>Suzie</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 mos.</td>
<td>9 mos. 2 weeks</td>
<td>9 mos.</td>
</tr>
<tr>
<td>13 mos.</td>
<td>13 mos. 2 weeks</td>
<td>13 mos., 2 weeks</td>
</tr>
<tr>
<td>18 mos.</td>
<td>17 mos.</td>
<td>15 mos.</td>
</tr>
<tr>
<td>23 mos., 3 weeks</td>
<td>23 mos., 2 weeks</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Children’s Ages at Videotaping Sessions

We analyzed 10 minutes of tape from each session. These 10 minutes were not necessarily continuous, in that we disregarded periods of one minute or more when there was no attention or interaction between mother and child; for example, a stretch of time when the mother was chatting with the researcher while the child drank from a bottle, or periods when either the mother or the child was out of view of the camera.

We transcribed all sign productions in the 10-minute section. We then coded all signs for their place of articulation and for whether they had been modified in some way from their citation form. Based on previous researchers’ studies of child-directed signing, the types of modifications that we coded were: displacement (the sign is produced away from its normal position); repetition (the cyclicity of the sign is increased); signing on the child’s body (producing a sign such that the child’s body is
used for its place of articulation); molding (moving the child’s hands to make the child produce the sign); lengthening (the sign is produced slowly or held, increasing the sign’s duration); and enlargement (the movement excursion of the sign is increased). An additional modification we coded for was whether the mother was noticeably leaning in toward the child, rather than sitting or standing upright. Unlike the other modifications, which applied to individual signs, leaning-in generally occurred across an entire utterance or more.

All maternal signs were also coded for whether the child had visual access to them. In a separate coding pass, we coded the child’s eye gaze, or where she was looking at any point in the interaction. It is important to note that even when a child was not focusing on her mother’s face or hands, it may still have been possible for her to have visual access to signs, as long as the signs were produced somewhere within her visual field. Finally, we coded the attention-getting cues produced by the mother, such as touching or waving at the child, along with whether those cues were successful in gaining the child’s attention. In this category of attention-getting cues, we included only those designed to draw attention to the mother, rather than cues, such as points, that the mother used to draw attention to an object or another person. While the latter category is important to the larger question of the development of the child’s attention, our focus in the current project was on investigating connections between the child’s attention and her access to the mother’s signing.²

3. Results

3.1. Quantity of Mothers’ Signing

Our first analysis concerning the mothers’ sign production examined the quantity of maternal signing. How much sign vocabulary did the mothers address to their children? Figures 1 and 2 show the number of lexical sign types and tokens produced by each of the mothers at each coded session. These numbers include all signs except points (and body part signs that resemble pointing). Most pointing signs cannot be said to have a citation form in the same way as lexical signs do and thus cannot readily be included in an investigation of how signs addressed to children may be modified from their citation form. Moreover, pointing signs can be very difficult to discriminate from pointing gestures.³ This exclusion

² We would like to thank Beppie van den Bogaerde for bringing up the importance of pointing in mothers’ directing of their children’s attention. We intend to analyze the mothers’ use of cues that draw the children’s attention to objects in a later stage of this project.

³ For similar reasons, Anderson and Reilly (2002) excluded pointing signs from the ASL version of the MacArthur Communicative Development Inventory.
of points from the count of sign types and tokens means that these numbers cannot be directly compared to similar counts of child-addressed speech, which would include pronouns and words for body parts.⁴

⁴ A comparison of our data with that from other studies of child-addressed sign and speech would also require a count of the mothers’ utterances, rather than only sign tokens. Because utterance boundaries are not always obvious, we are still in the process of developing clear criteria for utterance boundaries that will allow such a count.

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Figure 1: Number of Sign Types in Maternal Signing
We can see from Figures 1 and 2 that both the number of sign types and the number of sign tokens tended to increase with the children’s age: with the exception of Noel’s 24-month session, the children received a larger quantity of more varied linguistic input as they got older.

### 3.2. Frequency of Sign Modification

The modification of signs in child-directed signing appears to be quite frequent throughout the timeframe studied. In all sessions except one, at least 20% of the signs addressed to the children were visibly modified. Figures 3 and 4 show the percentage of the sign tokens that were modified. As mentioned above, the mother’s leaning in toward the child is somewhat different from other kinds of sign modifications, in that it operates on the level of the utterance (i.e., over a span of signs) rather than on the level of the individual sign. We found leaning important to look at, because it is clearly one way for the mother to get her signs into the child’s line of sight, if the child is not looking at her before she starts to sign. However, counting every sign within an utterance produced with a lean as modified could drive up the numbers of sign modifications. We therefore calculated sign modification frequency twice: once counting signs produced with a lean in toward the child as modified, as shown in Figure 3, and once not, as shown in Figure 4.
Figure 3: Percentage of Maternal Sign Tokens Modified (Including Leaning)

Figure 4: Percentage of Maternal Sign Tokens Modified (Excluding Leaning)
If we look at the percentage of signs that are modified excluding leaning, there does not appear to have been a clear decline in modified signs as the children got older. However, at least for Katie and Suzie, if we include leaning, the percentage of modified signs did seem to decline with age. Unlike the other two mothers, Noel’s mother seemed to maintain a relatively stable frequency of sign modification across the period studied.

3.3. Attention-Getting Cues

We have limited evidence from the success rate of the mothers’ attention-getting cues (e.g., touches, waves) that the children got better at paying attention to their mothers as they got older, as shown in Figure 5. For Katie, at 9 months and 13 months, only about a third of the attention-getting cues addressed to her were successful. For example, in one instance at 9 months, Katie’s mother tapped repeatedly on Katie’s leg, arm, and face, but only succeeded in getting her attention by taking away her toy and holding it up to her face. In contrast, at 18 and 23 months, about 80 percent of the attention-getting cues led to Katie looking at her mother. This finding is consistent with previous research showing a marked increase in children’s ability to maintain joint attention with their mothers around 18 months of age (e.g., Bakeman & Adamson 1984).

Similarly, the success rate of attention-getting cues addressed to Suzie increased from 28% at 9 months to 68% at 15 months, her last session. In contrast, the success rate of attention-getting cues addressed to Noel remained quite high and relatively steady across all sessions, increasing only from 60% at 9 months to 71% at 23 months. This difference may be the result of a different attention-getting strategy by Noel’s mother. While the other two mothers produced around 20 attention-getting cues at almost every session, Noel’s mother produced only about five per session when Noel was 9 and 13 months old, increasing the number to over 20 during the two later sessions. It appears likely that early on, Noel’s mother accommodated her child’s limited skill in shifting attention by not trying to redirect Noel’s attention very often.
In the following sections, we look at the different kinds of sign modifications individually, investigating whether the children’s attentional development can be seen to influence the frequency of the mother’s sign modifications. Some of the sign modifications do appear to be related to the child’s attention, but others do not.

3.4. Displacement and Leaning

Displacement, or moving a sign away from its normal position, would be expected to be related to the child’s attention, in that it is a way for the mother to place a sign within the child’s visual field without the child having to change her gaze. Previous research by Harris et al. (1989) found a decline in the number of displaced signs in child-directed signing around the age of 18 months, right when children’s ability to maintain joint attention increases, as mentioned above. In our data, it is clear that displacement sometimes functioned to move a sign into the view of a child who had previously not been paying attention, as we can see in Figure 6 where Katie is focused on the toy tower. Here her mother is shown signing WAIT with her hands interposed between Katie’s face and the tower, telling Katie to wait before knocking the tower over.

![Figure 5: Success Rate of Attention-Getting Cues](image-url)
The percentage of maternal sign tokens that were displaced is quite low throughout the period studied, as is shown in Figure 7. For all children at all sessions, the total number of displaced signs per session ranged from zero to 24. There seems to be a peak in displacement frequency at 13 months for Katie and Suzie. However, the age-related pattern is not entirely clear, since Noel’s mother displaced more signs when she was 17 months old than when she was 13 months old. When Katie was almost 24 months old, 7% of the signs that her mother addressed to her were still displaced from their normal position, which is a higher rate of displacement than at 9 and 18 months. Assuming that the ability to shift attention appropriately increases with age, it is not obvious from these data what role the child’s attention plays in displacement.
At almost 24 months, unlike at younger ages, Katie was already looking at her mother’s hands or face before the onset of almost half of the displaced signs. It appears that these particular displacements, like some others from the other mothers, were motivated, not by the child’s unwillingness to shift gaze, but instead by the mother and child being in an awkward position in relation to each other. For example, if the mother was standing, she might therefore reach down to sign; or if the mother was behind the child, she might reach around her. This kind of displacement is likely also true for adult signers, for example, if a passenger in a car is signing to the driver. To get a clearer understanding of the causes of displacement, we would need to separate those displacements motivated by the relative positions of signer and addressee from those motivated by the addressee’s lack of visual attention to the signer.

In our investigation of what kinds of signs could be displaced, we discovered that only signs specified to be produced in neutral space or specified for contact on the non-dominant hand were ever displaced. No signs specified for contact at any other location were displaced, and no signs specified for a location near the body were displaced. This categorical finding may indicate the importance of place of articulation for sign recognition. The finding may also have implications for the phonetic analysis of signs in neutral space and on the non-dominant hand, in that the precise physical location of the hands in relation to the rest of the body appears to be flexible. The specification of contact versus

Figure 7: Percentage of Maternal Sign Tokens Displaced
no contact does not appear to be the deciding factor, in that signs specified for proximity to the body (e.g., BEAUTIFUL, made with a circular, open-to-close movement of a 5-hand in front of the face) occurred in the data and were never displaced.

The mother’s leaning in toward the child is similar to displacement, in that she moves herself and her signs into the child’s visual field. This role of leaning is evident in the picture below, in which Katie’s mother produces the sign DUCK, a sign made with an open-and-close motion of a flattened B-hand at the chin.

![Figure 8: Katie’s mother leaning over while signing DUCK](image)

Although the type of extreme leaning shown here does seem to decrease as the children get older, our data do not give us a clear age-graded pattern. Like displacement, the frequency of leaning may have as much to do with how the mother and child are positioned relative to each other as with how attentive the child is to the mother. Unlike displacement, leaning may affect signs specified for contact on the head or body, as in this example, as well as signs without such contact.

### 3.5. Repetition and Lengthening

The next types of sign modification that we will address are repetition and lengthening. Signs were coded as being repeated if they contained 4 or more cycles. In addition, signs for which the citation
form is specified for a single movement (e.g., \texttt{BLACK}) were coded as repeated if the mother’s production contained more than one cycle. We encountered several examples of this type of repetition, but none had four or more cycles, so there may be a phonologically-based pattern by which cyclic signs are more prone to modification by repetition than are non-cyclic signs.

Our question about repetition at the beginning of this study was whether it might be related to the child’s attention. It would be plausible to think that a parent might continue repeating a sign until the child looked at it; however, this hypothesis does not seem to hold. For all three children at all ages, much of the time that the mothers repeated a sign, the child was already looking at the parent’s face or hands at the beginning of the sign’s production. The percentage of repeated signs for which the child was already focused on the mother before she initiated the repeated sign ranged from just under 20\% to 100\%, with most sessions in a middle ground between 30\% and 60\%, and no clear age-graded pattern.

Like repeated signs, lengthened\textsuperscript{5} signs could plausibly be motivated by a lack of attention from the child. We therefore performed a similar analysis of lengthening and eye gaze. The same generalization holds for lengthened signs as for repeated signs: for most sessions, in more than half the instances that the mother lengthened a sign, the child was already looking at her at the onset of the sign. This result is inconsistent with Holzrichter and Meier (2000), who found increased duration in child-directed signing to be associated with a lack of eye contact with the child.

These findings for repeated and lengthened signs do not preclude an effect of the child’s attention on these parental sign modifications, but they do indicate that there must be some other factors at play. We suggest that one place to look would be at prosodic or discourse factors; for example, whether the sign is utterance-final, particularly in a question, or whether the parent is repeating or holding a sign in order to elicit an imitation of that same sign by the child. A preliminary analysis of these discourse factors shows them to have a strong effect for at least some of the mothers. Strikingly, Suzie’s mother appears to have used lengthening exclusively with signs that terminated questions. When Suzie was 9 months old, her mother produced no lengthened signs; at each of the following two sessions, when Suzie was 13 and 15 months old, her mother lengthened seven signs, all of them at the end of a question. The two other mothers also used sign lengthening in this way, but they produced lengthened signs in other discourse contexts as well.

As the children got older, repetition and lengthening were increasingly used to elicit the child’s imitation of the mother’s sign, especially for Katie. At almost 24 months, over 80\% of Katie’s

\textsuperscript{5} Coding for length was impressionistic, rather than being tied to a particular length of time.
mother’s lengthened signs and about 60% of her repeated signs were followed by Katie imitating the sign. For example, in one instance while Katie and her mother were reading a book, two such elicitations occurred, one immediately after the other. The mother first pointed to the book and produced the sign MOTHER (a 5-handshape with the thumb tapping the chin) with seven cycles, repeating the sign until Katie imitated it. Katie’s mother then pointed to a different picture in the book and made the sign BOY (an open-close movement of a B-hand at the forehead) with nine cycles, which Katie then imitated. In these and other instances, sign repetition appears to be part of a book-reading routine regularly practiced by Katie and her mother. Further research is needed to more fully determine the discourse functions of lengthening and repetition in child-addressed signing.

3.6. Signing on the Child

Another category of modified signs that has been noted in previous research are signs that the mother produces on the child’s body. In our data, signs on the child’s body were not particularly frequent, but they were present in the signing of all three mothers. There were 29 tokens across all sessions, at a range of ages for the children. Not surprisingly, 24 of the 29 tokens were produced when the child was seated on the mother’s lap, and all of these sign types were specified for contact with—or proximity to—the head or torso. Given the child’s position on the mother’s lap, it is not clear how else the mother could have produced these signs in a way that the child would have had access to them, unless for signs on the head she had leaned forward significantly, bringing her head into the child’s visual field. In fact, we saw an example of such leaning, alternating with a sign on the child, when Noel was 13 months old. In this example, Noel was sitting on her mother’s lap as they looked at a book. Noel’s mother first signed FATHER (made with a 5-handshape with the thumb tapping the forehead), alternating between Noel’s forehead and her own, and then signed MOTHER, alternating between Noel’s chin and her own.

Signs produced on the child give the child tactile information about sign location. Spencer and Harris (2006) presented results from a number of studies showing this sign modification to be used most commonly with “younger deaf infants, usually while the infant also has access to visual information from the mother’s facial expressions” (p. 78). These generalizations do not hold for our data, as 10 of our 29 tokens occurred when the children were 17 or 18 months old, and, as previously noted, 24 occurred with the child on the mother’s lap. However, it is true that the five tokens of signs produced on the child in a face-to-face or side-by-side position were at somewhat younger ages: 13 or 15 months. It is possible that, at younger ages, a mother may be more likely to produce signs on the
child’s body when the child can see her; this way the child gets both visual and tactile information about the sign. When the child is older, signs on the child’s body may likely be limited to times when the child is on the mother’s lap; in this position, the mother is constrained in how to form signs that contact the head or torso. However, we would need more data before we could be confident in this generalization.

3.7. Molding

Signing on the child’s body can be seen as a somewhat more intrusive modification than some of the other categories we have talked about; it is certainly not something adult signers would generally do with other adults. Another, similarly intrusive category of sign modifications is molding—when the mother moved the child’s hands to make the sign. Molding was less common than signing on the child’s body: there were just 13 tokens from two mothers. One tentative observation from these limited data is that earlier tokens may involve molding of movement, while later tokens may involve molding of handshape. For example, when Noel was 17 months old, her mother molded the sign BLUE (made with a B-handshape in neutral space and repeated forearm rotation) by twisting Noel’s forearm back and forth. Examples of molding at a later age took place as Katie, almost 24 months old, and her mother recited the manual alphabet. As the two went through the alphabet, Katie’s mother molded Katie’s handshape for six letters.

This change in what is molded, from molding movement early on to molding handshapes later on, could reflect a change in the mother’s expectation of how the child will sign. As we know from the literature on child sign language acquisition, children have trouble with handshapes early on (see Meier 2006 for a review), and a realistic mother probably should not expect accurate handshapes from her one-year-old. However, by the time Katie was almost two years old and learning to produce the manual alphabet, in which the handshape carries almost the entire meaning, she was expected to start getting the handshapes right.

4. Conclusion

This study has replicated a number of others on various sign languages in describing the kinds of modifications that parents make in child-directed signing. We have found some evidence of an increase in the quantity of parental signing as the child gets older; it is not entirely clear from our data whether sign modifications decrease in frequency by the time the child is two years old. With regard to our
question of the role of attention and gaze, our findings are mainly negative; specifically, repetition and lengthening may have as much to do with prosodic and discourse factors as with the child’s ability to shift attention when required, and displacement and leaning, while showing more effects of child gaze, may be strongly affected by the mother’s and child’s relative positions.

We did find some regularities as far as the kinds of signs that can undergo particular kinds of modifications. Extreme cyclicity (repeating 4 or more times) appears to be limited to signs that are specified for repeated movement in the adult language, and displacement appears to be limited to signs not specified for contact or proximity to the head or torso. In contrast, signs produced on the child’s body are always signs specified for contact or proximity to the body. While this latter restriction is true by definition, the others are not inherently necessary. It is physically possible to move a sign specified for contact away from its place of articulation or to repeat a single-movement sign multiple times in a cyclic manner. While attending to the child’s gaze and level of comprehension, it looks as if parents are also attending to the phonological characteristics of individual signs as they choose how to modify their signing when addressing their young children.

References


Deixis, Anaphora and Highly Iconic Structures: Cross-linguistic Evidence on American (ASL), French (LSF) and Italian (LIS) Signed Languages

Elena Antinoro Pizzuto1, Paolo Rossini1,2, Marie-Anne Sallandre3, Erin Wilkinson4

1Istituto di Scienze e Tecnologie della Cognizione, Consiglio Nazionale delle Ricerche, Roma
2Istituto Statale Sordi, Roma
3UFR de Sciences du Langage, Université Paris 8 & UMR 7023, CNRS, Paris
4Department of Linguistics, University of New Mexico, Albuquerque, USA

1. Introduction

This paper explores typological, presumably modality-specific features affecting deixis and anaphora in signed languages (hereafter SL). Simplifying greatly for the sake of the present exposition, we define deictic-anaphoric structures as text cohesion devices which allow speakers or signers to introduce referents in discourse (deixis) and, subsequently, to refer back to them at later instants in time (anaphora) (Lyons, 1977; Lombardi Vallauri [2007], for a recent overview).

We focus on two major classes of deictic-anaphoric reference devices that have been described in SL. The first, hereafter referred to as the ‘standard’ class has been rather extensively investigated, and is realized through manual and visual indexes which establish marked positions in space, often called “loci”, where referents can be symbolically assigned (for overviews highlighting typological uniformity across SL with respect to this basic mechanism see, among others, Cuxac, 2000; Liddell, 2003; Lillo-Martin & Klima, 1990; McBurney, 2002; Rathmann & Mathur, 2002;
Thus, to introduce a referent in discourse, a signer can produce a standard (or “frozen”) manual sign\(^2\) for the referent, and deictically mark it in the signing space via a manual and/or a gaze pointing, and/or also via morphological alteration of the sign’s place of articulation (which may or may not be accompanied by visual indexes), thereby establishing a position in space (or ‘locus’) for the referent symbolized. Anaphoric reference is then made re-indexing roughly the same point in space via visual or manual pointings (see 1.1 for more details and one illustrative example).

However, as noted elsewhere (2007), deictic-anaphoric reference is also produced, in SL, via complex manual and nonmanual units which are neither pointing signs, nor are they listable as standard signs. These units exhibit highly iconic features and are marked by specific eye-gaze patterns which distinguish them from standard signs. Throughout this paper we will refer to these units as Highly Iconic Structures (HIS) or ‘Transfers’, after Cuxac (1985; 1996; 2000). Aside from specific eye-gaze patterns, HIS may be composed of: (1) manual forms encoding perceptually salient features of the referents/ referential relations, most frequently described in the SL literature with different terms such as “classifiers”, “productive morphemes”, “polysynthetic” or “polycomponential” signs; (2) marked facial expressions, and/or directional modifications of head, shoulders, whole trunk -- usually described in the literature as “role-shifting devices” but also with other terms (see section 1.1 below for more discussion). As we will illustrate shortly hereafter, different subtypes of HIS can be combined among themselves, or with standard signs, to simultaneously encode information on two (or even more) referents, hence allowing the specification of deictic-anaphoric reference in a multilinear fashion that appears to be unique of the visual-gestural modality.

Although the manual and nonmanual devices mentioned above have been described from different perspectives, and with different terminologies, there is little or no information on their use in deictic-anaphoric reference operations, and/or on how they interact with the ‘standard’ devices mentioned above. Our study provides relevant evidence on this topic through a comparative examination of short narrative texts produced in three SL: American (ASL), French (LSF) and Italian (LIS). ASL and LSF are known to be historically related, while LIS has no certain relationship with either ASL or LSF\(^3\). The sample of language data we scrutinize thus allows us to

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\(^2\) Standard signs are defined here, as in most SL literature, as those signs that are commonly listed in SL dictionaries, and are often described as constituting ‘the frozen lexicon’. They are distinguished from the ‘productive’ highly iconic forms described shortly hereafter.

\(^3\) It must be recalled that, due to the absence of appropriate written documentation of SL and to the complex language transmission and variation phenomena proper of SL and of different communities of SL users (Cuxac, 2000; Fusellier-Souza, 2004; 2006), it is still very difficult to ascertain the historical links among SL using the same criteria that are applied in spoken/written language research. Thus, although there are no documented historical relationship between LIS, on one hand, and ASL/LSF on the other hand, we cannot exclude that, at some point in past or recent history, these SL have been in contact more than we are at present able to ascertain.
evaluate, albeit in part, the influence of language relations upon the phenomena investigated. If we were to find similarities only between ASL and LSF, this could be taken as evidence that the similarities identified can be attributed to the historical links between these two SL. If, however, we were to find that similar patterns hold across the three SL investigated, this evidence would suggest that similarities are grounded in more general features linked to the visual-gestural modality of language expression.

It is useful to clarify our theoretical framework and provide illustrative examples of the structures mentioned above.

1.1. Theoretical framework and illustrative examples of the structures we focus upon

The present study stems from, and brings together theoretical and empirical work independently developed, within our research groups, on SL morphology and on deixis and anaphora in SL as compared to spoken or verbal languages (Pizzuto, 1978; 2007; Pizzuto, Giuranna & Gambino, 1990; Wilkinson, 2002), and on the crucial relevance that iconicity has in shaping SL lexicon, grammar, discourse (Cuxac, 1985; 1996; 2000; Cuxac & Sallandre, 2007; Fusellier-Souza, 2004; 2006; Russo, 2004; Russo, Giuranna & Pizzuto, 2001; Sallandre, 2003; 2007). An appropriate discussion of these theoretical foundations cannot be conducted here. We will only sketchily outline some of the major points, especially with respect to the HIS mentioned above. Before doing so, it is useful to consider briefly the ‘standard’ mechanism for deictic-anaphoric reference, illustrated in Example (1) below with fragments taken from a LIS text reporting an ordinary event4.

\[ \text{Example (1)} \]

4 From the ‘Necklace theft’ corpus (Fabbretti, 1997).
The still videoclip in 1a shows a standard nominal sign meaning ‘colleague’ through which the signer deictically introduced in discourse this referent: the manual sign is dislocated at a marked position at the signer’s right, and accompanied by a gaze pointing in the same direction. Stills 1c-1e show how, at a later point in discourse, the signer anaphorically referred back to the same referent first via a manual index directed towards the same position in space previously marked (1c), then by a second instance of the sign ‘colleague’, this time articulated in an unmarked position in neutral space (1d, compare with 1a-1b), and then by a second index (meaning ‘he, the colleague, he.’).

This ‘standard’ mechanism for deictic-anaphoric reference in signed discourse interacts extensively with morphological modifications that different classes of verbs can undertake, altering their locations in space, which we will not consider here (Cuxac, 2000; Pizzuto, 2007). The point we wish to stress is that structures such as the above, described since early research on ASL (e.g. Friedman, 1975; Klima & Bellugi, 1979; Wilbur, 1979), appears to be very similar across several different SL of the world, and it seems plausible to assume that it is universal or nearly universal (McBurney, 2002; Rathmann & Mathur, 2002; Pizzuto, 2007).

We turn now to briefly illustrate HIS and the theoretical model within which they are framed. Based on extensive analyses of LSF discourse and grammar in a cross-linguistic framework, Cuxac (1985; 1996; 2000) has proposed that all SL are grounded upon, and exploit a basic capacity that signers have in iconicizing their perceptual/practical experience of the physical world. One of the effects of this iconisation process is to endow SL with an additional semiotic dimension compared to verbal languages. In SL, unlike in verbal languages, there are two ways of signifying: either by ‘telling and showing’, thereby producing HIS or ‘Transfers’ that are unique of the signed modality, or by ‘telling without showing’, using the standard lexicon and pointings, and producing structures that are more comparable to those found in verbal languages.
These two ways of signifying mirror two different intents a signer can deliberately choose for articulating his/her discourse: an illustrative and a non-illustrative one. The operations signers perform when choosing an illustrative intent (and the resulting structures they produce) are defined “Transfers”, and conceived as traces of cognitive operations whereby signers transfer their conceptualization of the real world into the four-dimensional world of signed discourse (the three dimensions of space plus the dimension of time).

The manual components of these complex structures are called ‘proforms’. ‘Proforms’ correspond to what, in most SL literature are defined as ‘classifiers’ (or with other terms previously mentioned - see Schembri, 2003 and the collected papers in Emmorey, for overviews). The difference between ‘proforms’ and ‘classifiers’, however, is not purely terminological but rather substantial: it is grounded on a linguistic model that attributes to iconicity a crucial, formal role in shaping SL discourse and grammar, on theoretical analyses showing the inadequacies of a ‘classifier-analysis’ for the elements under discussion, and on a detailed analysis of the distinctive formal and articulatory features that characterize the HIS within which proforms are embedded, most notably specific eye-gaze patterns (Cuxac, 1996; 2000). In contrast, analyses of these forms in terms of ‘classifiers’ focus primarily on the manual components, disregarding or underestimating the role that gaze patterns play in their specification.

Referring to Cuxac (1985; 2000) in this paper we distinguish three main types of Transfers (but see Sallandre, 2003 for a much more detailed classification):

1. ‘Transfers of Form and size’ (TF) describe objects or persons according to their size or form (no process or role involved). The object is described by means of proforms. Gaze is oriented towards the hands, and facial expression specifies the form.
2. ‘Transfers of Situation’ (TS) involve the movement of an object or character (the agent, specified by the dominant hand) relative to a stable locative point of reference (specified by the non-dominant hand). The situation is shown as if the scene were observed from a distance. The signer keeps his/her distance relative to what s/he is conveying. Gaze is oriented towards the dominant hand and facial expression specifies the agent.
3. ‘Transfers of Person’ (TP) involve a role (agent or patient) and a process. The signer ‘becomes’ the entity to which s/he refers reproducing, in the course of the utterance, one or more actions carried out or sustained by this entity. The entities referred to are usually humans or animals but can also be inanimates.

The third type of Transfers, TP, have been defined in the literature with different terms including “role taking”, “role shifting” (Padden, 1986) or also, in earlier work ,“Body and
Projected Body pronouns” (Kegl, 1976), “body markers” (Pizzuto & al, 1990), with a primary focus on the nonmanual features they present (marked facial expressions, gazes, body postures).

As noted, a relevant feature of HIS is that subtypes of Transfers can be combined among themselves, or with standard signs, to encode information on two (or even more) referents in a multilinear, simultaneous fashion that has no parallel in speech. This phenomenon is called ‘Double Transfer’ (DT) in Cuxac’s terminology (e.g. combining simultaneously a TP for specifying an agent, and a TS specifying locative information or also a second agent). Similar phenomena have been described from different perspectives and with different terminologies by several authors (e.g., among others, Dudis, 2004; Russo, 2004; the collection of papers in Vermeerbergen, Leeson Crasborn, 2007). In this paper we refer to these phenomena as “Multiple Reference” (MR) operations, and we assess their incidence in the signed narratives we analyzed.

Illustrations of these Transfer types are provided below. Examples (2) and (3) are taken from LSF narratives and highlight the differences between standard signs and HIS. Note how when producing the standard signs the signer’s gaze is directed towards the interlocutor. In producing HIS the gaze is directed away from the interlocutor, and oriented either towards the hands (when articulating TF and TS structures), or in different points in space reproducing the gaze of the entity represented (when articulating TP structures. Example (2) shows a standard signs and a TF, both encoding the same conceptual content: ‘tree’. The proform (handshape within the TF) describes the form of the tree.

Example (3) shows a standard sign (3a) and a TP (3b), both encoding the same conceptual content ‘horse’. In the TP structure, all the manual and non manual features (gaze, facial expression, body and the hands) reproduce those of the embodied entity.
Example (4) below illustrates three TS structures taken from, respectively, the LIS (4a), ASL (4b) and LSF (4c) narratives analysed for the present study. Both the LIS (4a) and the ASL (4b) example refer to ‘the falling of a dog out of a windowsill’. The LSF example (4c) describes ‘a horse jumping over a fence’. In all TS, gaze is towards the dominant, then the non-dominant hand. The dominant hand expresses the agent with the process (‘dog-falling’, ‘horse-jumping’), while the non-dominant hand expresses the locative, and the object implicated in the locative relation (‘windowsill’, ‘fence’). The facial expression is congruent with the process represented.

The examples in (5) illustrate two occurrences of MR taken from, respectively, the LIS (5a), and ASL (5b) narratives analysed for the present study. In 5a, the TP and TS structure produced allow the signer to anaphorically refer simultaneously to a ‘child holding a dog in his arm’ and to ‘the dog licking the child on his cheek’. In 5b, the same type of structures allows the signer to represent ‘a dog’ with ‘a jar’ around his neck.
1.2. Evidence from previous studies and questions investigated in the present study

Previous studies conducted on LSF have provided clear evidence on the extensive use of HIS in LSF texts of different genres. This has been shown in Cuxac’s (1996; 2000) analyses of large texts produced by a small number of LSF signers, and in more recent work conducted by Sallandre (2003) on a large corpus of short narratives and ‘prescriptive’ (cooking recipes) texts produced by 19 signers. Sallandre’s results also highlight important differences with respect to discourse genres: HIS are much more frequent in narrative (on average 70%) compared to prescriptive texts (30% on average). Disregarding terminological differences among authors, similar indications on the widespread use of HIS in different genres of signed discourse can be drawn from analyses and observations reported for LIS (Pizzuto, 2007; Pizzuto & al, 1990; Russo 2004; 2005; Russo & al, 2001; Wilkinson, 2002), for BSL (Brennan 2001), ASL (Emmorey & Reilly 1998; Emmorey, 2003), DSL (Engberg-Pedersen, 1993; 2003).

No study that we are aware of, however, has explicitly addressed the question we aimed to clarify with the present, cross-linguistic study:

1. How frequently are HIS used for performing deictic-anaphoric reference operations?
2. Are HIS more or less frequently used, for deictic-anaphoric reference purposes, compared with ‘standard’ signs and manual pointings?
3. In performing deictic-anaphoric reference operations via HIS, what is the incidence of MR, i.e. how frequently does the use of HIS allow signers to simultaneously introduce or re-introduce in discourse two (or even more) referents?
2. Data used for the present study

The data we used for the present study were drawn from more extensive corpora of signed discourse of different genres that have been collected in France, Italy and USA on a fairly large number of native and non-native ASL, LIS and LSF signers (Wilkinson, 2002; Sallandre, 2003; 2007; Pizzuto, Rossini, Russo & Wilkinson, 2005). In the present work we analyze short narrative texts elicited through two different pictured stories that have been widely employed in much research on both SL and spoken languages. The LIS and ASL narratives were elicited through the same story, “Frog where are you?” (Mayer, 1969). The LSF narratives were elicited through “The Horse” story (Hickmann, 2003).

In the book version we used as elicitation material, the ‘Frog’ story is made of 24 pictures. It tells the adventures of a boy, his dog, a frog. The boy (main protagonist) finds a frog, brings it home, puts it in a jar placed in his bedroom, then goes to sleep with the dog. During the night, while the boy and the dog are sleeping, the frog jumps out of the jar and escapes. The next morning, the boy wakes up and finds out that the frog has disappeared. The boy and the dog then start searching everywhere for the frog.

The ‘Horse’ story is made of 5 pictures, hence much ‘shorter’ than the ‘Frog’ story. It narrates simple actions performed by a horse, a cow and a bird within the space of a lawn divided by a fence. The main protagonist is the horse, who gallops happily over one side of the lawn and is observed by the cow and the bird positioned, respectively, on the other side of the lawn, and on a picket of the dividing fence. At one point the horse jumps over the fence to join the cow on the other side, but in doing so the horse bumps on the fence, and falls on the other side, landing on its back and hurting one of its legs. The cow and the bird then come to help the horse: the bird brings a first-aid kit which is then used by the cow for bandaging the horse’s leg.

These pictured stories were presented to all signers by deaf interviewers who are fluent in each of the SL examined, and with whom the signers were well familiar. All signers were allowed to familiarize themselves with the stories, with no time constraints, and then asked to retell the stories from memory.

For the present study we selected from the larger corpora mentioned above, for each SL, the productions of three native signers of comparable ages (young deaf adults, age range: 19-23 years) and socio-cultural background (middle-class, high school degree, or attending the first years of university). We focused our analysis on text sequences of comparable content (functionally similar episodes involving animate and inanimate referents), and duration in time (approximately 1’ of signed productions). The ASL and LIS data consisted of portions of ‘Frog Story’ narratives corresponding to the sequence going from the beginning of the story through the episode in which
the dog falls from the windowsill, then the boy takes the dog in his arms, and the dog licks the boy on his cheek. The LSF data corresponded to complete narrations of the ‘Horse Story’.

The reader may wonder why we used portions of the ‘Frog Story’ for our ASL and LIS data, and a different story, ‘The Horse’, for our LSF data. Our choice was in part motivated by indications provided by previous work, but also influenced by practical reasons. Research independently conducted on ASL and LIS ‘Frog stories’ (Wilkinson, 2002), and on LSF ‘Horse stories’ (Sallandre, 2003) indicated the relevance that semantic features such as animacy vs. inanimacy, and human vs. not-human may have for a clearer understanding of deictic and anaphoric devices in signed narratives. Both the stories we analysed include animate and inanimate referents, but slightly differ with respect to the ‘human’ vs. ‘non-human’ feature of their protagonists: the ‘Frog’ story has a human character (the boy) as the main protagonist, while in the ‘Horse’ story all characters are animals, hence not-human. This difference between the two stories can thus provide information on the role that the human vs. not-human feature may have (within the category of reference to animates) in the choice of deictic-anaphoric reference devices in narratives.

When we planned the research reported here, we intended to expand our data base in order to perform our analyses on both “Frog” and “Horse” stories produced in the three SL we examined. However, time and funding constraints did not allow us to pursue this objective. The present comparative study was thus re-designed, and should be intended, as a first exploration of the topic we focus upon. We acknowledge that a more comprehensive analysis will require more data based on the same language elicitation materials across languages.

2.1. Data transcription, coding and analysis

The transcription methodology, and the analytic categories we used for coding were agreed upon among all co-authors on the ground of theoretical work and empirical analyses of signed discourse as described in Cuxac (2000), Sallandre (2003) Cuxac & Sallandre (2007), Pizzuto (2007), Pizzuto et al (2005).

All signed productions were transcribed and coded in a common format on excel files by signers that were fluent in each of the national SL we considered. We used so-called ‘glosses’ for annotating in, respectively, written English, French and Italian the basic meaning of the linguistic units we identified in the ASL, LSF and LIS narratives. This ‘gloss’ notation was integrated, in the
excel transcripts we produced, with information on the timing of each unit singled out, and on relevant formal and articulatory features of such sign units (e.g. coding each unit as a standard sign or a HIS of the TF, TS or TP type, the presence/absence of spatial dislocation, the hand/s engaged in producing the manual components of the sign units).

All transcripts realized were subsequently exchanged among all co-authors (along with the original data recorded on DVDs) for cross-checking the uniformity of our transcription and coding methodologies.

The analyses focused upon the referential expressions that were used in the text to introduce (deictically) and to keep track (anaphorically) of the animate and inanimate referents symbolized in the narratives. We distinguished all referential expressions in two major classes: (a) standard signs (b) HIS.

The first class (hereafter std) included: (1) all content-loaded signs that are most commonly listed in SL dictionaries (e.g. the standard signs for ‘frog’, ‘house’, ‘jar’); (2) manual pointings used to position referents at marked locations in the signing space.

The second class included all HIS, distinguished in the three major types of TF, TS and TP, as described in section 1.1 above. Note that for the purposes of the present paper, in the description of our findings to be provided below, the TF and TS subtypes of HIS were grouped in a single category (TF/TS).

We distinguished a third type of deictic-anaphoric productions that included ‘mixed’ (hereafter ‘mix’) combinations of HIS and std signs (e.g. a TF produced with one hand vehiculated the meaning of ‘jar’ accompanied by a manual pointing produced with the other hand pointed to mean ‘this jar’).

In examining the distribution of std signs vs HIS in deictic and anaphoric reference operations we explored possible differences linked to the animate vs. inanimate status of the referents that were symbolized in discourse. Finally, we examined the incidence of MR (as defined and described above - see examples [4] and [5]), computing their proportion in the texts as follows. We grouped together all occurrences of deictic-anaphoric reference operations produced, and then divided the number of cases in which a MR was realized by the total number of deictic-anaphoric reference operations produced.

3. Results: the prominence of HIS as deictic-anaphoric devices in signed narratives

The major results of our study are summarized in Table 1 and in Figures 1 through 5 below. In the table as in the Figures individual signers are indicated by their language and distinguished by numbers (e.g. LIS-1, LIS-2 and LIS-3 indicate the three LIS signers). Table 1 shows the number (and relative percentages) of all tokens of deictic and anaphoric reference devices (grouped together) identified in the texts produced by each signer, distinguished in standard signs, HIS, and mixed productions consisting of standard signs and HIS.

<table>
<thead>
<tr>
<th>Language / Signers</th>
<th>Number of tokens</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STD</td>
<td>HIS</td>
</tr>
<tr>
<td>LIS-1</td>
<td>26</td>
<td>77</td>
</tr>
<tr>
<td>LIS-2</td>
<td>23</td>
<td>96</td>
</tr>
<tr>
<td>LIS-3</td>
<td>27</td>
<td>118</td>
</tr>
<tr>
<td>ASL-1</td>
<td>28</td>
<td>96</td>
</tr>
<tr>
<td>ASL-2</td>
<td>38</td>
<td>105</td>
</tr>
<tr>
<td>ASL-3</td>
<td>26</td>
<td>100</td>
</tr>
<tr>
<td>LSF-1</td>
<td>5</td>
<td>41</td>
</tr>
<tr>
<td>LSF-2</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>LSF-3</td>
<td>8</td>
<td>62</td>
</tr>
</tbody>
</table>

Looking at the total number of tokens on the left side of Table 1, it can be observed that, although all the signed texts we analyzed were of comparable time length (1’), the ‘Horse’ stories produced by the LSF signers contained a smaller number of deictic-anaphoric reference tokens (between 46 and 71) compared to the larger number of such tokens found in the ‘Frog’ story sequences by the LIS and ASL signers (between 103 and 146, i.e. approximately twice as much). This shows that, not surprisingly, the specific story used, most likely the different ‘length’ of the stories in terms of number of pictures of which they are made, influences language production, at least from a quantitative standpoint.
Examining the distribution of the different types of deictic-anaphoric devices in the three languages examined, the relative percentages in the right side of Table 1 highlight that across languages HIS are by far the most frequent device used for deictic-anaphoric reference purposes. They are in fact represented in similar, very high proportions in LIS (75% to 81%), ASL (73% to 79%), and LSF (78% to 89%). In contrast, the category of std signs are represented in markedly smaller proportions (from 11% to a maximum of 25%), while mixed productions constituted an overall negligible proportion, ranging from 0 to 2%.

Figures 1 through 5 below provide a more detailed description of the regularities we identified across languages. Figure 1 focuses on deictic reference to both animate and inanimate referents (grouped in a single category), showing the distribution (relative %) of std signs, HIS and mixed productions.

The data in Figure 1 highlight that in all three SL, with only one exception, standard signs were the preferred means for the first (deictic) introduction of animate and inanimate referents in discourse (ranging from 50% to 83%), while HIS were less frequent, albeit still in appreciable proportions (17% to 45%). One signer (LSF-1) did not follow this pattern, and used much more frequently HIS (83%) rather than standard signs. Mixed productions were also represented in the texts of two signers (LIS-3 and LSF-3), in small proportions.

Figure 2 shows the distribution of HIS vs. standard signs in anaphoric reference to animate and inanimate referents. The data evidence strong cross-linguistic similarities: HIS appear to be by far the prevailing means for carrying out anaphoric reference, in proportions ranging from 76% to as much as 95%. With respect to the use of standard signs, it is of interest to note that a very small proportion of anaphoric reference was performed only via manual pointings. These were absent in the production of the LSF signers, and very poorly represented in the texts by the ASL (1% to 3%) and LIS (5 to 7%) signers.
Figures 3a and 3b provide a more analytic view of deictic reference operations, taking into account the animate/inanimate variable, and distinguishing the subtypes of HIS that signers employed (i.e. TP and TF/TS as previously described). It should be noted that, due to the structure of the stories we examined, the number of referents that were introduced in discourse, hence the number of tokens of deictic reference operations performed, was limited to: (a) only three animate referents (the boy, dog and frog for the LIS and ASL signers, and the horse, cow and bird for the LSF signers), and: (b) a small number of inanimate referents (from 4 to 10 depending upon the language and the individual signer).

The data in Figure 3a show different patterns for LIS and ASL, on one hand, and LSF on the other hand. In both LIS and ASL, signers’ first reference to the three main, animate protagonists of the ‘Frog’ story is performed exclusively via standard signs (the names for these referents). In contrast, LSF signers’ first reference to the three animate referents of the ‘Horse story’ is done either via standard signs (in one or two over three possible cases, depending upon the signer), or via HIS, and precisely via TP (in the remaining cases). It is of interest to recall that while the ‘Frog’ story includes a human animate referent (the boy) in addition to two animal referents, the ‘Horse’ story has all animal animate referent. We cannot exclude that the LSF signers’ use of TP structures for deictic reference (in addition to standard signs) was at least in part influenced by this property.
of the referents they talked about. We also found that all three LSF signers used a TP structure to introduce the ‘cow’ referent of their story, articulating very similar manual components or ‘proforms’ within such structures. This suggests an interaction between semantic properties and formational properties of manual signs for the referents that needs to be further investigated.

Figure 3b illustrates the use of standard vs. HIS as deictic devices for inanimate referents.

Looking at the figure, it can be seen that the HIS employed in this case belonged to the TF/TS categories. Major crosslinguistic similarities across the three languages can be noted. In all signers but one (LSF-1), inanimate referents are introduced frequently via standard signs (in proportions ranging from 43% to 78%), but HIS are also well represented either by themselves (from 22% to 50%), or also in combinations with pointings (in the ‘mixed’ category). The use of TF/TS structures is magnified in the production of LSF-1 (89%), suggesting that individual variation also needs to be carefully assessed for a clearer understanding of the topic we are exploring.

Figures 4a and 4b focus on anaphoric reference to, respectively, animate and inanimate referents, and clarify the major trends, and cross-linguistic similarities highlighted in Table 1 and in Figure 2 above.

Figure 4a - Anaphoric reference to animate referents: distribution (%) of standard signs (std) and HIS (TP, TF/TS) in the texts of the LIS, ASL and LSF signers
Figure 4a shows that in all three SL the re-introduction in discourse of animate referents was performed primarily via HIS, most frequently of the TP type. In the production of 8 out of 9 signers anaphoric TP were represented in proportions ranging from 48% to 93%, while in one signer (ASL-2) TP were in smaller but still remarkable proportion (33%). Almost all signers also used anaphoric TF/TS structures: these were on average in smaller proportions (between 2% and 27%) except in the production of ASL-2 signer, who used anaphoric TF/TS more frequently (39%) than anaphoric TP (33%). The use of standard signs for anaphoric reference was markedly less frequent (e.g. between 22% and 26 % in the LIS and ASL signers, from 7% to 10% in the LSF signers).

Figure 4b - Anaphoric reference to inanimate referents: distribution (%) of standard signs (std), HIS (TF/TS), and mixed productions (mix) in the texts of the LIS, ASL and LSF signers

Figure 4b illustrates that basically the same pattern held for anaphoric reference to inanimate referents: in all three SL we observe a very extensive use of HIS, most notably of the TF/TS type. The very high proportion of anaphoric TF/TS structures (from 73% to 100%) is in sharp contrast with the markedly more limited use of standard signs. These were absent from the production of three signers (ASL-3, LSF-1 and LSF-3), and ranged from 3% to 27% in the remaining signers.

3.1. The incidence of multiple reference operations

Figure 5 illustrates how frequently the use of HIS allowed signers to produce what we defined ‘multiple reference’ (MR), i.e. a multilinear organization of information whereby two or even more referents can be simultaneously specified, and/or maintained in time and space in a fashion that appears to be unique of SL (see examples in section 1.1).
Figure 5 - Proportion of multiple reference (MR) deictic-anaphoric operations performed via the use of HIS in the texts of the LIS, ASL and LSF signers

The data in figure 5 show that MR was realized in all three SL, albeit in variable proportions: it was markedly more frequent in LIS signers (from 31% to 51%), relatively less frequent in ASL (17% to 31%) and in LSF signers (11% to 23%). Although individual, and also language differences are noted, it seems unquestionable that MR is a relevant phenomenon that deserves to be taken fully into account in analyses and descriptions of signed narratives.

4. Concluding remarks

Recalling the questions we formulated, the data we have described evidence clear cross-linguistic similarities among the three SL we examined. These data show that HIS are the most frequent device for realizing anaphoric reference in signed discourse, using primarily TP structures for animate referents, and TF/TS structures for inanimate referents. It was of interest to find that HIS can also be employed for the first, deictic introduction of animate referents (via TP, as noted only in LSF signers), and of inanimate referents (via TF/TS structures, as found in variable but appreciable proportions in all three SL).

Our data also show that in all three SL (in variable but again appreciable proportions), HIS allow MR deictic-anaphoric operations, a unique feature of signed discourse that has been highlighted, from different perspectives, in several recent and less recent studies (Dudis, 2004; Pizzuto & al, 1990; Russo, 2004; Russo & al 2001; Vermeerbergen & al, 2007, among others).

The cross-linguistic similarities we identified appear to be linked more to features proper of the visual-gestural modality rather than to a specific language. In fact, beyond individual differences, we found globally similar patterns not only in ASL and LSF, two languages that are known to be historically related, but also in LIS, a language that has no documented links with either ASL or LSF.

More extensive cross-linguistic research is certainly needed before more conclusive statements can be made on the generalizability of the patterns we found. It will be necessary to
collect and analyze more data on historically unrelated, geographically distant SL, and to examine different genres of signed discourse. Sallandre’ (2003) analyses of different types of LSF discourse has already demonstrated that the frequency with which HIS are used is significantly influenced by discourse types. As noted, HIS are much more frequent in LSF narratives than in ‘prescriptive/descriptive’ texts such as cooking recipes. Comparable findings have been reported for LIS, using a different terminology, in Russo’s work comparing LIS poetic texts with expository texts (Russo, 2004; Russo & al, 2001). Although these studies, unlike the present one, were not specifically concerned with the deictic-anaphoric functions of HIS vs. standard signs, they clearly indicate that discourse genre is an important variable that needs to be taken into account.

Recalling the theoretical framework outlined in section 1.1, the following can be noted. The evidence we have discussed questions the more or less widely shared view that establishing ‘loci’ in space is the primary or ‘standard’ way for performing deictic-reference operations in SL. As noted, in the narratives we analysed, this strategy was never used by the LSF signers, and rather infrequently used by the ASL and LIS signers.

Our data are more consistent with, and support formal models that attribute a key structural role to iconic features in shaping signed discourse at different levels of analyses (Cuxac, 1985; 1996; 2000; Cuxac & Sallandre, 2007; Pietrandrea & Russo, 2007; Pizzuto, 2007; Russo, 2004; Russo & al, 2001; Sallandre, 2003; 2006; 2007; Sallandre & Cuxac, 2002). Insofar as deictic-anaphoric operations are conceived as a universal function of human language for realizing text cohesion, the pervasive use of HIS in such operations is an additional indication of the relevance of iconic properties for a clearer understanding , and description, of SL grammar.

References


[http://umr7023.free.fr/Downloads/Sallandre_these_tabmat.html]


Bilingual acquisition of German Sign Language and written German: Developmental asynchronies and language contact

Carolina Plaza-Pust,
J. W. Goethe, Universitaet Frankfurt am Main
Knut Weinmeister,
Humboldt-Universitaet zu Berlin

Research into the acquisition and use of two or more languages shows that the human mind is well equipped to deal with contact situations and that bilingual individuals skilfully exploit their linguistic resources (Auer 1998; Muysken 2004; Myers-Scotton 2002; Tracy 1996, 12). While language contact phenomena like code-switching or the mixing of elements of two distinct languages in bilinguals’ productions have often been regarded as evidence of a linguistic confusion there is a consensus today in the area of bilingualism research that these phenomena reflect a sophisticated interaction of two distinct grammars in the productions of bilingual speakers/signers. In the domain of developmental linguistics, the study of language contact phenomena in the productions of bilingual learners provides further insights into the structures available and the learners’ metalinguistic awareness about their bilingualism (cf. Lanza 1997, Tracy & Gawlitzek-Maiwald 2000 among others).

In sign bilingualism research, there is a general agreement about the positive effects deriving from an early exposure to sign language for the acquisition of literacy in young deaf signers in the sense of Cummins’ Interdependence theory (Dubuisson et al., to appear, Hoffmeister 2000, Niederberger, to appear, Strong & Prinz 2000; for a strong critique of the use of this model see Mayer & Wells 1996). However, only few studies have been dedicated to the investigation of the interaction of both languages at the level of grammar. As theories about second language and bilingual language acquisition have been refined over the last three decades, they shed a new light on this topic. If, as is currently assumed, language mixing occurs as a developmentally constrained phenomenon that affects specific linguistic properties during specific phases in the bilingual
development of two spoken languages, the question arises as to whether this would equally hold in the acquisition of two languages of different modality. In order to answer this question, we investigated the role of language contact in the bilingual acquisition of German Sign Language (DGS) and written German by deaf students attending the Berlin bilingual education programme. This study is part of a broad longitudinal investigation into the bilingual development of these students.

The paper is organised as follows. We will begin by looking at bilingualism and language contact in somewhat general terms before summarising the main assumptions about language mixing in the bilingual acquisition of two spoken languages. This section is followed by a brief presentation of our study and the participants of the Berlin bilingual education programme. Subsequently, we will look at the results obtained. This section is divided into two parts: the first is dedicated to the development of DGS, the second to the development of written German. With respect to language contact phenomena in the signed and written narratives we will seek to determine what is mixed and whether the mixing is developmentally constrained (i.e. does it change over time?). Finally we will summarise the main conclusions that can be drawn on the basis of the evidence gathered and briefly sketch some of the issues that remain to be tackled in future studies.

1. Bilingualism and language contact

Many myths abound in relation to the alleged "exceptional" status of bilingualism and its potential negative effects on the cognitive and linguistic capacities of bilinguals. It is not without irony that such myths persist, despite the wellknown circumstance that bilingualism rather than monolingualism constitutes the norm worldwide (cf. Ann, 2001; Baker, 2001; Grosjean, 1982; Romaine, 1996; Siguán, 2001). In fact, following current estimates there are about 5,000 – 6,000 languages worldwide and about 200 independent states. Even though the languages are not equally distributed over these states, it is safe to assume that the majority of the world population uses two or more languages in their everyday life.

Whether bilingual individuals choose to use one language or the other or a combination of both depends on diverse factors, such as the interlocutors themselves, their knowledge of the two languages, the situation, the topic of the conversation, and the function of the linguistic interaction (cf. Fontana 1999; Grosjean 1982, 1992, 1998a, 1998b, Romaine 1996; Winford 2003). This holds equally of bilingual signers, although limitations in the perception and production of the spoken language condition its choice as a base language.
With respect to language contact phenomena, the greater part of the research has been dedicated to the investigation of situations in which two spoken languages are in contact. However, studies on language production in bilingual signers have provided intriguing evidence of the complexity of cross-modal contact phenomena, i.e. contact phenomena that involve two languages of distinct modality, e.g. a signed and a spoken language (Boyes Braem & Sutton-Spence 2001; Brentari 2001; Emmorey et al. 2003; Kuntze 2000; Lucas 1989). It is important to note that these situations of contact involve the spoken language and the written language, artificial signed systems, and the use of the manual alphabet (fingerspelling).

While the possibility of a simultaneous production of manual and spoken elements as in examples (1) and (2) certainly marks an important difference to mixed spoken utterances, the range of the contact phenomena observed and the functions they may fulfil reveal important similarities to other contact situations (for a more detailed discussion see Plaza-Pust 2005).

<table>
<thead>
<tr>
<th>(1)</th>
<th>\textit{DSGS*}</th>
<th>\textit{SAGEN},</th>
<th>BITTE</th>
<th>RUHIG</th>
<th>BLEIBEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouthing</td>
<td>sagen</td>
<td>bitte</td>
<td>bleibe</td>
<td>ruhig</td>
<td></td>
</tr>
</tbody>
</table>

\textit{*}(Deutschschweizerische Gebärdensprache, \textit{Swiss German Sign Language})

<table>
<thead>
<tr>
<th>English gloss for manual component</th>
<th>\textit{SAY},</th>
<th>PLEASE</th>
<th>QUIET</th>
<th>STAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouthing translation</td>
<td>say</td>
<td>please</td>
<td>stay</td>
<td>quiet</td>
</tr>
</tbody>
</table>

(Boyes Braem 2001: 104)

<table>
<thead>
<tr>
<th>(2)</th>
<th>\textit{FINGERSPELLING}</th>
<th>N-I</th>
</tr>
</thead>
<tbody>
<tr>
<td>mouthing</td>
<td>\textit{national insurance}</td>
<td></td>
</tr>
</tbody>
</table>

(Brennan 2001: 73)

1.1. \textit{What does the study of cross-modal contact phenomena reveal?}

Firstly, at the descriptive level, it becomes apparent that contact phenomena involve different linguistic elements (including abstract features, lexical items, clauses) and different linguistic levels (ranging from the lexicon to the more abstract level of morpho-syntax). Consequently, it seems that, much like in other situations of contact between two oral languages, there are different degrees of
integration of linguistic knowledge (Brentari & Padden 2001). The range of contact phenomena is commonly referred to in terms of "contact continuum".

Secondly, cross-modal language contact phenomena, like inter-modal language mixing also reflect the social factors that determine language use in bilingual signers. Due to the socio-political situation of signed languages and deaf communities, cross-modal contact phenomena have been subject to a controversial debate, in particular, concerning the language change in signed languages that might induced by the influence of the majority languages (spoken languages) (Turner 1995).

At the level of individual signers, the evidence gathered suggests that bilingual signers use code-switching and other types of language mixing as an additional resource in specific communication situations. Indeed, code-switching or mixed utterances can be used with specific communicative functions such as to signal distance to the interlocutor or the provision of a clarification (Brennan 2001, Lucas & Valli 1989).

Finally, with respect to the organisation of multilingual knowledge, contact phenomena provide evidence of language interaction across different modalities of expression (Emmorey et al. 2003) which leads us to the question about language contact phenomena in the bilingual development of deaf learners.

So far, only little is known about the potential interaction of both languages at the grammatical level. The studies conducted with the bilingually educated deaf students in Hamburg remain an exception (Günther 1999; Günther & George 1999; Günther et al. 2004; Schäfke 2005, cf. also Leuninger et al. 2003 and Vorköper 2005 for a discussion of language transfer in the written language of a native signer). While these studies did not primarily tackle the formal aspects of the learner languages, the data gathered provided evidence of a pioneering role of DGS reflected in temporary borrowings from this language into the written language. These findings are compatible with current hypotheses about language contact phenomena in the areas of child and adult second language acquisition summarised in the following section.

2. Language contact in child bilingual and adult second language acquisition

One of the main conclusions that can be drawn on the basis of the evidence gathered in more than two decades of research is that the language faculty is well equipped to deal with the development of two or more languages. Bilingualism per se does not negatively affect children's development (Tracy & Gawlitzek-Maiwald 2000).

Another issue that has been settled in the last years concerns the question of the separation or fusion of the two language systems in the course of the bilingual development (one system vs.
separation hypothesis, Meisel 1989). After a longstanding debate, the available evidence today indicates that both languages develop separately early on. The assumption is based on the following evidence. At the pragmatic level, children are able to appropriately choose the language according to their interlocutor at the early age of 2 years (Lanza 1997). At the grammatical level, the studies also show that the children develop two distinct grammatical systems. Longitudinal studies into the acquisition diverse language pairs (cf. De Houwer 1995 for Dutch-English; Genesee 2002 for French-English; Lanza 1997 for Norwegian-English; Meisel 1989, 1994, 2004 for German-French and Tracy 1994/5 for English-German children) show that the "course of the development in each of the languages of bilingual children does not differ qualitatively from the acquisition of the respective languages by monolinguals" (Meisel 2004: 100, cf. also Petitto et al 2001, Petitto & Holowka 2002 regarding the bilingual acquisition of LSQ (Langue des Signes Québécoise)-French in hearing children).

The assumption of a separate development of the two languages, however, does not exclude the possibility of their interaction in the course of the bilingual development. Following current assumptions, learners may "pool their resources" and use language mixing as a relief strategy in the course of the bilingual development (Gawlitzek-Maiwald & Tracy 1996, Hulk & Müller 2000, Genesee 2002, Müller et al. 2002). By way of illustration of what is meant by this "pooling of resources", we will look at two examples of mixed utterances in the productions of a child and an adult learner respectively. The first example (3) is an utterance of an English-German bilingual child, Hannah, reported in Tracy and Gawlitzek-Maiwald (2000: 524):

(3) ich hab ge-climbed up
I have PAST-PART.-...

What is interesting about this utterance containing English and German lexical items is that it reflects the child's competences in both languages at the time. The structure available to her in English was a bare verb phrase, while more sophisticated grammatical structures (i.e. constructions with modal and auxiliary verbs) were already available to her in German. The mixed utterance thus shows how the child "pools her resources" by merging both structures. It is interesting to note that the frequency of this type of mixing decreases after the child's acquisition of English modals and auxiliaries.

Structural borrowing in (1) is easy to detect because the child uses lexical material of both languages. However, language mixing may not involve all linguistic components (contact...
as becomes apparent in example (4), an utterance of an Italian adult learner of L2 German.

(4) aber ich brauch vergessen meine sprache für lernen die deutsch

*but I need to-forget my language for learn the German*

(Plaza-Pust 2000, 177)

Notice that the utterance contains only German lexical items but involves the borrowing of the Italian word order (SVO) (in target German, the object would appear inside the verb bracket).

While structural borrowing is a useful strategy in second language acquisition to the extent that learners can resort to the available structure in their L1 in the L2 structure-building process, learners are eventually confronted with the task of restructuring their learner grammar toward the target. It is important to note that the reorganisation of the L2 grammar is typically reflected in the alternative production of target (L2) and target-deviant (L1) properties prior to the eventual implementation of the target option. This type of intra-individual variation is illustrated in examples (5)-(6) produced by the Italian learner of L2 German in the same recording file. The examples illustrate the coexistence of alternative options regarding verb-complement order (VO-OV).

(5) oweh wir haben schon gehabt viele fragen

*oh-dear we have already had many questions*

'Oh dear, we had many questions already.'

(6) in akzehn jahren hast du nicht gute freunde gehabt

*in eighteen years have you not good friends had*

'For eighteen years you did not have good friends.'

(Plaza-Pust 2000: 183)

Notice, additionally, that such “chaotic phases” in the organisation of learner grammars have been observed not only in second language acquisition but also in child monolingual and bilingual language acquisition (cf. Plaza-Pust 2000, Karpf 1990, 1993, Zangl 1998 for second language acquisition and Hohenberger 2002 for monolingual language acquisition).
2.1. What does language mixing in learners’ productions reveal?

The evidence gathered in the research on different types of bilingual development of two spoken languages allows for the following conclusions regarding language contact phenomena. Firstly, evidence of language mixing in learners’ productions shows that they pool their resources. Crucially, the sophisticated combination of two distinct grammars in mixed utterances indicates that bilinguals know, by virtue of their innate language endowment (i.e. UG), that grammars are alike in fundamental ways.

Secondly, the available evidence indicates that language mixing in the bilingual development changes over time. Language mixing predominantly occurs during specific phases in the bilingual development, in particular, during reorganisation phases. Moreover, learners may resort to lexical and structural borrowings in the case of a developmental asynchrony between both languages. The more advanced language may thus fulfil a pioneering function in terms of "bilingual bootstrapping" (Gawlitzek-Maiwald & Tracy 1996). The data also show that once the target structural properties are established, language mixing may serve other, i.e. pragmatic functions (code-switching). Both aspects are important for our understanding of why language mixes in learner languages affect specific properties at specific points in the development.

2.2. Acquisition of L1 DGS and L2 written German: Hypotheses

The bilingual acquisition involving DGS and written German involves two languages that differ in their modality of expression which raises the critical question whether similar processes like the ones described above also hold in this acquisition situation.

One possible assumption would be that the modality difference serves as unambiguous cue for a strict separation of both language from the beginning. Following this assumption, no contact phenomena are expected to occur in the learner data.

Alternatively, we may assume that learners of a signed and a written language know about the equivalences between languages at an abstract level and, like other learners, use their linguistic resources in the course of their development.

As mentioned previously, the studies on the Hamburg pilot bilingual education programme provided evidence supporting the assumption that cross-modal language mixing in the written productions of bilingual deaf students is developmentally constrained: the overall frequency of language mixing was found to be low and the authors remarked that incidence of mixing decreased as learners advanced in their acquisition of the target L2 written language. On the basis of these
findings it seems plausible to assume that the difference in the modality of expression does not lead learners to the conclusion that they are dealing with completely different systems.

As for language separation in bimodal bilingual development, it seems plausible to assume that the modality difference serves an additional cue for the differentiation of the languages involved, as does person differentiation in case the parents choose the so-called partner principle (also “one person-one language principle”) as the language policy adopted in the family or the domain specific use of the languages.

With these issues in mind we will now turn our attention to our study of the bilingual acquisition of deaf learners.

3. The study

The study presented here is part of a broader longitudinal investigation into the bilingual acquisition of DGS and written German by deaf students attending the Berlin bilingual education programme.

3.1. Key aspects of the bilingual programme

All participants attend the Berlin Bilingual Education Programme allocated at a special school for the deaf in Berlin. The children are being instructed in DGS by a deaf teacher and in spoken and signed German by a hearing teacher. In this programme, the bilingual team teaching method is applied; during 15 hours per week, the children are taught by the two teachers present in the classroom. Secondly, DGS and Deaf Studies are being taught as a separate subject.

3.2. The participants

The number of students participating in this programme is 9: 5 boys and 4 girls. All participants are children of hearing parents. Two boys with additional learning problems are not included in the study presented here. One girl left the school in April 2005. Information about the children's age at enrolment in the educational institutions (kindergarten, preschool and bilingual programme), the vehicular languages or communication systems used in these institutions, and the language(s) used at home is provided in table 1. As we can see, the age of the children at the beginning of the bilingual programme (1st year primary school) ranged from 6-7 years. Some of them had attended a kindergarten in which either Signed German (i.e. LBG, Lautsprachbegleitendes Gebärdensprachleben) or DGS was used as the vehicular language. With the exception of Luise, all of them had attended the
preschool allocated in the school of the bilingual programme in which DGS was used as the vehicular language. With respect to their home language, we can see that some of the children have a non-German background (e.g. Arabic, Turkish). Some parents have learned DGS or Signed German which they use in the communication with their children. Two children have deaf siblings.

<table>
<thead>
<tr>
<th>Kindergarten (vehicular language)*</th>
<th>Preschool (vehicular language: DGS**)</th>
<th>Primary school / bilingual programme</th>
<th>Home language(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamida 3 (LBG)</td>
<td>4;02</td>
<td>07;00</td>
<td>Arabic, German (parents use German in interactions with Hamida) (Hamida has two deaf siblings)</td>
</tr>
<tr>
<td>Muhammed 2,5 (DGS)</td>
<td>3;02</td>
<td>06;02</td>
<td>Turkish, home-sign</td>
</tr>
<tr>
<td>Simon 4 ***</td>
<td>4;04</td>
<td>07;04</td>
<td>LUG with mother, DGS with deaf sister</td>
</tr>
<tr>
<td>Lilli 2 (DGS, LBG)</td>
<td>06;03</td>
<td></td>
<td>LBG and DGS with mother and sister</td>
</tr>
<tr>
<td>Maria 2 (DGS, LGB)</td>
<td>6;05</td>
<td>07;07</td>
<td>German, DGS and LBG with mother</td>
</tr>
<tr>
<td>Christa 2 (DGS, LGB)</td>
<td>3;00</td>
<td>06;00</td>
<td>DGS, LBG, German</td>
</tr>
<tr>
<td>Fuad 2;2 ***</td>
<td>4;11</td>
<td>07;03</td>
<td>Farsi, German (Fuad was CI implanted age 3;7)</td>
</tr>
</tbody>
</table>

(*in years, **LBG used in specific activities, *** no information on vehicular language available)

Table 1. Participants' profiles.

3.3. Method

The data collection began in May 2004 and will continue until summer 2007. Recordings are scheduled every 5-6 months. Signed and written narratives are elicited on the basis of the picture story "Frog, where are you?" (Mayer 1969) which has been used in a broad cross-linguistic study of narrative development (Berman & Slobin 1994; Strömqvist & Verhoeven 2004; Morgan 2006).

In our longitudinal investigation, we are looking at the children's bilingual development at different linguistic levels, that is, the narrative, morphosyntactic and lexical levels. All data are entered into a data base that permits analyses of error frequency and distribution (including deviances at the lexical, morphological and syntactic levels).

The study presented here covers the signed narratives recorded in files 1-3 and the written narratives of files 1-5. In our analysis, we focused on the development at the levels of morphology and syntax and aimed at answering the following questions, (1) do the narratives contain evidence
For this purpose, we established developmental profiles for each participant which contain information about the developmental path in either language and the range of variation encountered, including contact phenomena (for a detailed discussion of the written language data see Plaza-Pust, to appear). The qualitative analysis of the data is based on (a) a descriptive framework of the contrasting grammatical properties of DGS and German, and (b) a descriptive framework of the major developmental milestones both of which we will briefly summarise in the next sections.

3.4. **DGS - German: Sketch of the relevant areas of contrast**

The following description of the areas of contrast between DGS and German is not comprehensive but is restricted to the areas which are relevant for an appropriate understanding of the findings discussed below.

**Word order:** The basic word order of DGS is SOV (7) (Hänel 2005; Happ & Vorköper 2005; Pfau 2001). Sentence types are distinguished through the use of non-manual components. With the exception of the final position of the verb, the order of the other constituents in the sentence can vary following diverse grammatical and spatial requirements, as, for example, the figure-ground principle (8), or other discursive requirements.

(7) FRAU KUCHEN SÜSS BACK.  
*WOMAN CAKE SWEET BAKE*  
'The woman bakes a sweet cake.'  
(Happ & Vorköper 2006: 85, our transl.)

(8) WAND₁ JACKE ICH HÄNG_AN₁ (Leuninger 2000, 238, our transl.)  
*WALL₁ JACKET I HANG_ON₁*  
'I hang the jacket on the wall.'

German is a verb second language (V2). The finite verb obligatorily appears in second position in main clauses (9) and (10). At the level of verb-complement order, German instantiates the head-final, OV option. Non-finite verb forms (participles, infinitives, separable prefixes) appear in sentence-final position (see example (9)) (for a more detailed discussion of the descriptive accounts of German sentence structure see Plaza-Pust 2000). Main and embedded clauses differ
with regard to the placement of the finite verb. In complementiser-introduced embedded clauses the finite verb appears in sentence-final position (see example (11)).

(9) Die Frau setzt den Hut nicht auf.
the woman puts the hat not on

(10) Gestern hat die Frau den Hut nicht aufgesetzt.
Yesterday has the woman the hat not put-on

(11) (ich weiß), dass die Frau den Hut nicht aufgesetzt hat.
(I know), that the woman the hat not put-on has

**Predication:** There is no copula in DGS. The combination of a subject and a predicative adjective or other complements requires the use of a determiner, e.g. DET\_LOK (also: DORT, there) to express location (12). The determiner DET\_EXISTENZ (also: DA, there) is used to express existence, presence or possession (13).

(12) BAUM\_A \[DET\_LOK\]AUF-A VOGEL.
TREE\_A \[DET\_LOC\]ON-A BIRD
'The bird is on the tree.'

(Vorköper & Happ 2006, chapters 4-5, our transl.)

(13) PROFESSOR\_1 \[DET\_EXISTENZ\]1 WÖRTERBUCH.
PROFESSOR\_1 \[DET\_EXISTENCE\]1 DICTIONARY
'The professor has a dictionary.'

(ibid: 114 our translation)

**Morphosyntax:** DGS and German are characterised by a rich inflectional morphology. However, DGS and German differ with respect to the predominant mode of organisation which is linear in German and simultaneous in DGS. Moreover, both languages differ with respect to the information which is morphologically encoded.

Inflectional suffixes in German provide information about person, number, tense, and mood.

Following current assumptions, DGS verbs are not overtly marked for tense (Happ & Vorköper 2006: 117f). Instead, temporal adverbials like ZUKUNFT (future), GESTERN (yesterday), and EBEN (now) are used to express the time of an event or activity. These adverbials always appear sentence-initially and are not repeated in the course of the narrative or dialogue. With respect to agreement, DGS distinguishes between plain and agreement verbs (cf. Happ & Vorköper 2005 for a detailed discussion). Only the latter are overtly marked for agreement, whereby some
agree only with the object and others with both subject and object. For example, a verb like GEBEN (give) (see (14)) is a subject-object agreement verb.

\[
\begin{align*}
(14) & \quad \text{BUCH} \quad \text{ICH} \quad \text{[GEBCL]} \quad \text{DIR} \\
& \quad \text{BOOK} \quad \text{I} \quad \text{[GIVECL]} \quad \text{YOU} \\
& \quad \text{‘I give a book to you.’}
\end{align*}
\]

In constructions with plain transitive verbs, agreement is marked via PAM (for Personal Agreement Marker, also often notated as AUF (on)) (cf. (15)).

\[
\begin{align*}
(15) & \quad \text{HANS} \quad \text{1PAM} \quad \text{MARIE} \quad \text{MAG} \\
& \quad \text{Hans} \quad \text{PAM} \quad \text{Marie} \quad \text{like} \\
& \quad \text{‘Hans likes Marie.’}
\end{align*}
\]

3.5. Developmental highlights

Following the assumption of the gradual development of syntax (structure-building or weak continuity hypothesis) (Clahsen et al. 1994, Fritzenschaft et al. 1991, Vainikka & Young-Scholten 1996), we assume that learners start out with a minimal structure which they expand upon the evidence encountered in the input. This means that for both DGS and German we expect the developmental progress to reflect the implementation of grammatical processes and expansion of the available structural format.

Within the generative paradigm, this development is commonly described in relation to the absence viz. availability of functional categories (FCs). However, because of the circumstance that the description of the structural properties of DGS is still ongoing, our analysis will be restricted to a broad differentiation of two developmental stages with regard to the presence viz. absence of grammatical phenomena and related structures as has been documented in the available literature on ASL and BSL (cf. Baker et al. 2005: 49 for an overview of the developmental stages in signed language acquisition based on the research into the acquisition of ASL and other European signed languages). The assumption that this development reflects the implementation of FCs is corroborated by Hänel (2005a,b) who investigated the acquisition of DGS agreement on the basis of the principles and parameters model.

Table 2 provides a sketch of the development in DGS and German regarding the grammatical processes considered in the present study.
Table 2. Structure-building in the development of DGS and German.

<table>
<thead>
<tr>
<th>Stage I</th>
<th>DGS</th>
<th>German</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• elementary structures</td>
<td>• elementary structures</td>
</tr>
<tr>
<td></td>
<td>o no evidence of grammatical</td>
<td>o no evidence of grammatical</td>
</tr>
<tr>
<td></td>
<td>processes</td>
<td>processes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage II</th>
<th>DGS</th>
<th>German</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• complex structures</td>
<td>• complex structures</td>
</tr>
<tr>
<td></td>
<td>o referential indexes</td>
<td>o verb raising / V2</td>
</tr>
<tr>
<td></td>
<td>o verb agreement</td>
<td>o subject-verb agreement</td>
</tr>
<tr>
<td></td>
<td>o complex clauses</td>
<td>o complex clauses</td>
</tr>
</tbody>
</table>

DGS: With respect to signed language development, our hypothesis about the gradual development of syntax is based on the findings of Hänel (2005a, b) regarding the acquisition DGS and the results obtained in other studies on the acquisition of ASL and BSL in which it was shown that grammatical processes are productive after an initial phase in which learners typically produce short, isolated sentences (Lillo-Martin 1999). At stage I, referential indexes (pronouns) and verb agreement are absent. Learners fail to establish spatial loci and refer to these; agreement verbs are produced in their citation form (cf. Meier 2002, 2006). In fact, most scholars agree in that these grammatical processes take a long time to be fully mastered (Morgan 2000, Morgan et al. 2006).

With respect to the use of referential indexes, two phases are commonly distinguished (following an initial stage in which these devices are lacking). During the first phase, referential indexes are used to refer to present referents; in a second step, children also refer to non-present referents (Lillo-Martin 1999, Morgan 2000). Following Hänel (2005 a, b), however, it is plausible to assume that the grammatical mechanisms relating to verb agreement are in place already during the first phase, i.e. as soon as children use indexes to refer to present referents.

Typically, word order in the early productions is unmarked. Some authors have pointed out that early sequences follow a rigid linearisation pattern; other researchers have provided support for variable order at this stage (cf. Lillo-Martin 2006 for a detailed discussion). Interestingly, the variation observed patterns with the findings obtained for spoken language acquisition. According to Radford (1990) and Ouhalla (1991), this variation comes as no surprise as grammatical processes.
relating to functional categories are missing\(^1\). In addition, studies on the acquisition of German (Fritzenschaft et al. 1991, Gawlitzek-Maiwald et al. 1992) have provided ample evidence of variation among children with respect to their preferred word order.

Thus far, the development of complex structures in signed languages has received relatively little attention in the literature. Some studies on the acquisition of ASL have focused on the development of non-manual markers in diverse constructions including conditional and interrogative clauses (Reilly & Anderson 2002, Schick 2002); others have been dedicated to the acquisition of referential shift in quotation environments (Emmorey & Reilly 1998). There is a general agreement that these constructions with non-manual markers are acquired late. What is interesting is that prior to the productive use of non-manual markers in the respective constructions children produce conditional or interrogative clauses with lexical elements (Reilly & Anderson 2002). However, as we have not analysed the use of non-manual markers in the study presented, we will not take these grammatical processes into consideration in our discussion on the development of DGS.

To the best of our knowledge the acquisition of other complex clauses, such as constructions with modal and psychological verbs or rhetorical question-answer pairs remains unexplored thus far.

**German:** As for the acquisition of German, learners' early word combinations reflect the availability of an elementary structural domain (see Plaza-Pust 2000, Vainikka & Young-Scholten 1996 for adult second language acquisition, Siebert-Ott 2001 for child second language acquisition, and Fritzenschaft et al. 1991, Gawlitzek-Maiwald et al. 1992 for the monolingual acquisition of German). Most scholars agree in the observation of a preference for the verb final order (SOV) by children acquiring German as their mother tongue, although, as mentioned previously, some researchers observed a higher degree of variation in other child L1 learners. The position of the verb in the early utterances of child and adult L2 learners of German, in contrast, reflects the order of their respective L1 languages.

With respect to the expansion of the basic structure, research into the acquisition of German has shown that learners may take different avenues or strategies in structure-building (D'Avis & Gretsch 1994, Gawlitzek-Maiwald 2003). The variation encountered points to the relevance of

\(^1\) Following current assumptions, the early constructions are categorial-thematic in that they express the predicate-argument structures specified in the lexicon (cf. Radford 1990, Berent 1996). As grammatical processes that would constrain word order in full blown grammars run vacuous in VP grammars the order of elements may vary (Ouhalla 1991, Tracy 1991: 402f.)
paying attention to the changes in the learner grammars that might conspire in structure-building, i.e. the inclusion of auxiliary and modal verbs, the establishment of subject-verb agreement and the raising of finite verbs to a position at the left periphery in main clauses.

A fundamental step in the acquisition of German word order concerns the establishment of a relationship between the different positions verbs may appear in. The availability of the positions at the left and at the right periphery is reflected in the production of sentences containing modal, auxiliary verbs or separable verbs. In many L1 learners of German, the productivity of V2 constructions goes along with the acquisition of the agreement paradigm and the target-like distribution of finite and non-finite main verb forms in the sentence-initial vs. final positions (finiteness distinction). In some learners, however, these grammatical properties do not become productive at the same time.

Other developmental highlights concern the production of embedded clauses with finite verbs in final position and target-like question formation.

4. Results

In general terms, the analysis of the signed and written narratives of the bilingually educated deaf children provides support for the hypothesis of a gradual development of syntax in this bilingual acquisition situation.

It is important to note that although the development of grammatical processes is delayed for DGS (in comparison to the development of children exposed to sign language from birth), the developmental pattern observed corresponds roughly with the generalisations described in section 3.5. This observation holds equally of the students’ development in L2 written German (for a detailed discussion see Plaza-Pust, to appear).

Further, the individual developmental profiles sketched for either language provide evidence of variation at the inter-individual level (participants vary as to how far they advance which indicates that their development proceeds at a different pace), and also at the intra-individual level: the inclusion of new target-like grammatical features does not always occur to the immediate exclusion of the previously available target-deviant ones with the effect that alternative grammatical options might temporarily coexist. The conflicts that result from the coexistence of competition of alternative representations can be assumed to be one of the driving forces of language development (cf. Hohenberger 2002, Tracy 1991, 2002, for language acquisition in childhood and Plaza-Pust 2000 for adult second language acquisition).
In the following sections, we will try to determine what intra-individual variation reveals about the underlying language learning processes and the role of language contact in the organisation of the multilingual knowledge. For this purpose, we will discuss the range of variation, including potential candidates of language mixing, at different developmental stages.

4.1. DGS

With respect to the development of DGS and language contact phenomena in the signed language productions of the bilingual learners, the data reveal the following. First, the signed narratives (files 1-3) reflect the increasing complexity of the participants DGS learner grammars over time. Secondly, a comparison of the individual learner paths shows that participants differ as to (a) the knowledge of DGS at the beginning of the recording time and (b) how far they advance in the acquisition of DGS during the time span covered by files 1-3. Thirdly, at the level of intra-individual variation, we observe that the implementation of new target DGS properties typically involves their use in specific contexts first (for instance, referential indexes are used first to refer to present referents before they are used to refer to non-present referents). Finally, for some participants, the range of variation displayed in the signed narratives includes sentential patterns that are potential candidates of borrowing from German. Crucially, the type of constructions mixed changes as learners proceed in their development of DGS.

4.1.1. DGS development

With respect to the development of DGS, the data provide support for the assumption of a gradual development of syntax which can be described in terms of two broad developmental stages (cf. table 3).

<table>
<thead>
<tr>
<th>Stage I</th>
<th>Stage II</th>
</tr>
</thead>
<tbody>
<tr>
<td>elementary structures</td>
<td>Complex structures</td>
</tr>
<tr>
<td>- simple clauses (no embedded</td>
<td>- complex clauses (e.g.</td>
</tr>
<tr>
<td>clauses, unmarked word order)</td>
<td>embedded clauses)</td>
</tr>
<tr>
<td>- plain verbs,</td>
<td>- agreement verbs</td>
</tr>
<tr>
<td>agreement verbs in citation</td>
<td></td>
</tr>
<tr>
<td>form</td>
<td></td>
</tr>
<tr>
<td>- no referential indexes</td>
<td>- referential indexes</td>
</tr>
</tbody>
</table>

Table 3. DGS development.
The narratives produced at stage I reflect the availability of elementary structures. Learners typically produce simple clauses with an unmarked word order (cf. example (16)). There is no evidence of complex constructions with subordination or rhetorical question-answer sequences. At this stage, learners do not produce referential indexes (cf. example (17)).

(16) DANN HIRSCH CL:"läuft" DANN JUNGE CL:"fällt” Muhammed, file 1
THEN DEER CL:"run” THEN BOY CL:"fall”
’Then the deer runs, then the boy falls.’

(17) DANN FROSCH MÖCHTE RAUS DANN FROSCH NACH-HAUSE
THEN FROG WANT OUT THEN FROG GO-HOME
’Then the frog wants to get out (of the glass), then the frog wants to go home.’
Fuad, file 1

The data do not allow for a conclusion regarding verb agreement at this stage. The target-like production of agreement verbs is observed at a later stage. It is interesting to note, however, that overall participants rarely produced this type of verbs which, by assumption, is an effect that can be attributed to the peculiarities of the frog story used to elicit the children’s narratives.

The progression of the participants toward the target-like grammar (stage II) is reflected in the production of complex structures, including embedded clauses (cf. (18)) and rhetorical question-answer sequences (cf. (19)). The use of agreement verbs is illustrated in example (20) and that of referential indexes in example (19).

(18) DANN MUSS SPRING WEIL TÜR ZU
THEN HAVE-TO JUMP BECAUSE DORR CLOSED
’Then (the dog) has to jump (out of the window) because the door is closed.’
Muhammed, file 3

(19) DANN PLÖTZLICH WAS CLF:"Glas" I IX1
THEN SUDDENLY WHAT CLF:"glass" I IX1
FROSCH MÖCHTE NICHT CLF:"Glas"
FROG WANT NOT CLF:"glass"
WARUM NICHT DA WASSER
WHY NOT THERE WATER
’Then suddenly, guess what, the frog doesn’t want to stay in the glass, because there is no water inside.’

(20) (RS:Hund) MÖCHTE ich-HELP-du
(RS:dog) WANT rHELP-you
’I want to help you.’
Maria, file 2
4.1.2. Language contact phenomena in the DGS narratives

Turning now our attention to the evidence of language contact phenomena in the signed narratives, we can summarise the results of our analysis as follows (for further illustration see also table 4 which provides an overview of the different types of contact phenomena observed in the narratives of Maria, Hamida, Fuad, and Muhammed). Firstly, there is individual variation with regard to whether or not learners make use of structural and lexical borrowings from German in their signed narratives. Secondly, the range of contact phenomena observed includes the borrowing of German word order (SVO and V2 (XVS) structures), the use of the copula (expressed through a signed German element), the sequential expression of spatial and temporal relations and code-switching (DGS-Signed German) for narrative purposes. Thirdly, from a developmental perspective, we can conclude that language mixing changes over time (i.e. the elements involved in and the functions of language mixing differ).

<table>
<thead>
<tr>
<th></th>
<th>Maria</th>
<th>Hamida</th>
<th>Fuad</th>
<th>Muhammed</th>
</tr>
</thead>
<tbody>
<tr>
<td>File 1</td>
<td>---</td>
<td>• copula</td>
<td>• V2 word order (e.g. SVO, XVS)</td>
<td>---</td>
</tr>
<tr>
<td>File 2</td>
<td>---</td>
<td>• copula</td>
<td>• V2 word order (SVO)</td>
<td>• V2 word order (SVO) • code-switching</td>
</tr>
<tr>
<td>File 3</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>• code-switching</td>
</tr>
</tbody>
</table>

Table 4. Language contact phenomena in the signed narratives.

For one participant, Maria, no evidence of language contact phenomena was found. We will see below that this student either produces mixed utterances in her written narratives. It is important to note that individual variation with regard to whether or not learners produce mixed utterances has also been observed in the research on the bilingual acquisition of two spoken languages (Genesee 2002).

Further, our data also reveal that the range of lexical and syntactic phenomena mixed changes over time.

In Hamida's narratives, for example, we found evidence of a mixing of the copula, particularly in file 2, a phenomenon, however, that was not observed in file 3. As explained in section 3.4 there is no copula in DGS. The borrowing of the German copula in examples like (21)
involves the use the artificial sign “IS” which is part of the LBG (i.e. Signed German) vocabulary used in the teaching of the German grammar.

(21) DA IST ZWEI FAMILIE MUTTER VATER FAMILIE
    THERE IS TWO FAMILY MOTHER FATHER FAMILY
    'There are two, a mother and a father, a family.' Hamida, file 2

It is interesting to note that the mixed signed utterances containing the copula typically occur in combination with the adverbial THERE (as is the case in example (21)) or with the wh-word (i.e. WHERE IS), i.e. two sequences that are recurrent in written narratives and are used by the children as “formulae” during their early narrative development. Furthermore, we observed that the sequence “WHERE IS” occurs in quotation environments relating to the scenes in which the boy is calling the frog which suggests that this type of mixing is pragmatically determined: the children aim at expressing how the boy calls the frog and therefore switch to the grammar of the oral language.

The analysis of Fuad's narratives reveals language mixing at the level of word order. Particularly in file 1 we observe the use of "V2 orders" which are characteristic of German (i.e. SVO, XVS structures) (cf. example (22)). The number of these structures decreases in file 2. No evidence for language mixing was found in file 3.

(22) DANN SCHLAF JUNGE UND HUND Fuad, file 2
    THEN SLEEP BOY AND DOG
    'Then the boy and the dog sleep.'

Finally, we found no evidence of SVO orders or other types of language mixing in Muhammed's file 1. In file 2, however, he produces some V2 orders (SVO). Additionally there are some instances of code-switching which are, as explained previously, typically produced in quotation environments. The sophistication of this type of code-switching used for narrative purposes is illustrated in example (23) in which the Signed German sequence is followed by a DGS sequence including the fingerspelling of the frog’s name.

(23) L-A-W SAG WO IST FROSCH
    L-A-W SAY WHERE IS FROG
    Law says: „Where is Frog?“ He shouts: „Max, Max, Max“
    Muhammed, file 2
This type of pragmatically determined code-switching continues to be produced in file 3, in which we observed no further instances of mixing at the level of word order.

After this discussion of the main results concerning development and mixing in DGS we now turn our attention to the development of written German.

4.2. **German**

In general terms, the analysis of the written productions allows for the conclusion that participants "climb up" the structure tree like other L2 learners of German (for a detailed discussion see Plaza-Pust, to appear). However, the comparison of the developmental profiles reveals that participants differ as to how far they advance in the acquisition of the L2. Additionally, at the level of individual learner grammars, the data show that the implementation of new target L2 properties is typically preceded by a reorganisation phase in which alternative grammatical options "coexist".

For some participants, the range of variation displayed includes sentential patterns that are potential candidates of borrowing from DGS.

Crucially, the type of constructions mixed changes as learners proceed in their development of German which provides further support for the assumption that language mixing is developmentally constrained.

4.2.1. Development of written German

Learners first establish an elementary structural domain. The structures produced during this phase (see example (24)) pattern not only with basic sentential formats of L1 learners but also with the basic constructions of L2 learners which shows that the task of structure-building is common to learners in different acquisition situations (Diehl *et al*. 2000, Fritzenschaft *et al*. 1991, Plaza-Pust 2000a, Siebert-Ott 2001, Vainikka & Young-Scholten 1996).

(24) Paul *klettern*       Muhammed, file 1
    *Paul climb*

In file 5, we observe the availability of target V2 (see example (25)) (notice the integration of sentence-initial non-subjects into the V2 format and the target-like distribution of finite and non-finite verbs forms in sentence-second and final position respectively). In this file, too, Muhammed
produces a series of complex clauses, however, with main clause word order. Thus, the restructuring of the order for embedded clauses remains a task to be accomplished by the end of the recording time considered here.

(25) Am Abend haben Max und Paul ein Frosch geschaut.  
\textit{at.the evening have Max and Paul a frog looked.at}  
'In the evening Max and Paul looked at the frog.'  
Muhammed, file 5

(26) … weil Max wollte denken wer ist es.  
\textit{because Max wanted think who is it}  
'… Max wanted to know who they are.'  
Muhammed, file 5

As mentioned previously, the analysis of the data reveals that there is variation at the intra-individual level. Typically, during reorganisation phases, alternative grammatical options "coexist". Target grammatical processes are available (verb raising, agreement, V2), but are not applied across the board. For some participants, the range of variation displayed includes sentential patterns that are potential candidates of borrowing from DGS. Crucially, the type of constructions mixed changes as learners proceed in their development of German.

In what follows, we will look at the potential candidates of language mixing at the different developmental stages outlined previously.

4.2.2. Language mixing at the level of elementary word combinations

\textbf{Copula drop:} At this stage, participants produce a series of combinations of elements that have a propositional meaning but lack a verb form. Typically, these include predicative constructions that would require the copula in target German (see example (27)).

(27) Da ein veil Frosch.  
\textit{there a many frog}  
'There are many frogs.'  
Fuad, file 1

However, two observations lead us to conclude that DGS cannot be the sole factor concerning the drop of the copula in the early written narratives. For one, at this stage of elementary word combinations, some elements might be dropped because rule based grammatical processes are not yet in place. Secondly, the available evidence of other acquisition situations in which German is the target language shows that the drop of the copula is also characteristic of early learner grammars.
For further illustration compare examples (28) and (29) produced by L1 and L2 learners of German respectively.

(28) da nase\  
     there nose
     L1 learner (Tracy 1991)

(29) Das Wasser kalt.  
     the water cold
     child L2 learner (Diehl et al. 2000)

**Word order:** Other potential candidates of language mixing are constructions in which the linear arrangement of the elements is reminiscent of DGS word orders. For example, learners produce constructions in which word order follows the figure-ground principle. The borrowing of this grammatical property of DGS is illustrated in example (30) which includes a finite verb in sentence-final position, as it would be required in that language, and the use of "da" to assign a location, i.e. the function INDEX (or DET-lok, often translated as “DA”) would fulfil in DGS.

(30) Junge deine Hand da Frosch sitzt  
     boy your hand there frog sits
     Hamida, file 1
     'The frog is sitting on the boy's hand.'

Further, the analysis of the data reveals that cross-modal language mixing may not only involve a relexification of DGS structural formats (e.g. figure-ground, SOV), but also loan translations of complex DGS meanings that would be simultaneously expressed in space in that language. A remarkable example of the borrowing of a DGS classifier construction is produced by Simon in file 3 (31). Note the sentence-final placement of the preposition "in" (in) to express the location of the THEME (= the head).

Such cross-modal translations are illustrative of the lexical and structural adaptations of the expressions borrowed which are determined by the properties of the recipient language as is known from other contact situations (Winford 2003, 42ff.). Given the predominantly sequential organisation of German, cross-modal borrowing involves the analysis of DGS constructions into meaning units or thematic roles that are mapped onto linearly arranged German lexical items. Notice additionally that the selected German "counterparts" produced by the students reflect the lexical and structural means available in their L2 German at the time. In other words, the mixed
utterances also provide important insights into the lexical and structural properties of the L2 learner languages.

(31) Der Hund Glas den Kopfen in. Simon, File 3
the dog glass the head in
'The dog puts the head into a glass.'

4.2.3. Language mixing in the reorganisation phase preceding the implementation of simple structures

Overgeneralisation of "auf": The transition between the phase of elementary word combinations and the establishment of a simple sentence structure involves a reorganisation phase during which verb raising to a position at the left periphery of the sentence (INFL) becomes available but is not yet applied across the board. Recall that verb raising is tied to the checking of the features relating to grammatical relations (agreement, case-marking) of the verb and its arguments. It is important to note that the participants' overt marking of subject verb agreement varies throughout the recording time.

With respect to the relation of the verb and its complement arguments, the data reveal that during this phase there is a remarkable increase of constructions with the preposition "auf" (on), including not only target-like constructions but also target-deviant ones. The overgeneralisation of this preposition to mark the relation between the verb and its complement is illustrated in the sequences produced by Fuad in file 3.

(32) Tom mag auf Frosch und auch Paul. Fuad, file 3
Tom likes on frog and also Paul
'Tom likes the frog and Paul, too.'

(33) Paul schusbe auf dem dünne Baum Fuad, file 3
Paul push on the thin tree
'Paul pushes the thin tree.'

Three phenomena conspire in the use of "auf" as a free morpheme to express the relation between transitive verbs and their objects, namely, (a) the borrowing of PAM, commonly translated as AUF (on), (b) the analysis of the morphological components of DGS agreement verbs, and
subsequent translation into German including the use of the German case-marking preposition "auf" (33), and the remaining gaps in the L2 case-marking and determiner systems.

While a detailed discussion of the acquisition of the case and determiner system is beyond the scope of this paper, it is worth mentioning that the data gathered show that this area, like the domain of verbal inflectional morphology, remains to be mastered by the end of the recording time. Participants use articles, but their choice seems to occur randomly given the errors regarding case and number. It seems plausible to assume that the overgeneralisation of "auf" to overtly express the relation of the verb with its complement is used to fill the gap regarding the target morphology. Thus, "auf" serves the function of an overt case marker much like the preposition "of" in English (compare "Poirot is envious of Miss Marple" in which the preposition assigns accusative case to Miss Marple, cf. Haegeman 1994: 173)2. Moreover, as "auf" is available in German, learners are easily tempted to overtly mark grammatical relations at this stage which is in line with the insights gathered in other acquisition situations in which learners temporarily make these relations transparent (A. Hohenberger, pers. communication).

Moreover, the partial overlap between both languages seems to reinforce this phenomenon which is reminiscent of other types of "indirect transfer" observed in the domain of the bilingual acquisition of two spoken languages (Genesee 2002). Notice, additionally, that the overgeneralisation of "auf" in the sense outlined previously was also remarked upon in another study on the acquisition of written German by bilingually educated deaf students in Hamburg (cf. Schäfke 2005: 273, Günther et al 2004: 241f.), which provides additional support for the assumption that patterns of mixing relate to the language systems bilingual children learn (Genesee 2002: 187). In other words, language mixing is not a random, but a systematic phenomenon.

**Lexical borrowing:** Participants produce a series of verbless clauses containing expressions like "Angst" (fear) or "bescheid" (information) which are indicative of language mixing at the lexical level:

(34) der Junge Angst
     the boy fear
     'The boy is frightened.'

(35) er bescheid auf Junge.
     he information on boy
     'He informs the boy.'

---

2 We are grateful to A. Hohenberger for pointing this out to us.
Both languages include lexical elements to express "to be frightened" or "to let sb. know". But the lexical overlap is only partial: German, unlike DGS, does not have a verb to express the meanings, but uses periphrastic verb-noun combinations instead (i.e. "Angst haben", "Bescheid geben"). The use of "Angst" or "bescheid" as predicates is thus indicative of the borrowing from DGS and the lack of the target idiomatic expressions.

It is interesting to note that this type of lexical borrowing is also observed in the written narratives of the students attending the Hamburg bilingual education programme analysed by Schäfke (2005: 271) and Günther et al (2004: 240f); compare the following example (36) of a narrative of a participant in their study, Thomas, who also draws on DGS. The example is remarkable in that "Bescheid" appears with the infinitive marker –en and is combined with the preposition "auf" (ibid.).

(36) Lambert beseiden auf andere Schaf: Meine Mutter hat Wolf geklaut.

Lambert information on other sheep: my mother has wolf stolen

4.2.4. Language mixing at the level of complex structures

Finally, the data reveal that once the target German structure is established, language mixing reduces to DGS-like idiomatic expressions. The only type of mixed grammatical property that continues to prevail is the overgeneralisation of "auf", a phenomenon that comes as no surprise given the continuing lack of the target agreement and case marking paradigms.

5. Conclusions

The study presented here is a small case study. Nevertheless, we believe that the results discussed bear important implications for our understanding of bimodal bilingualism. For one, our longitudinal investigation into the bilingual development of DGS and German provides evidence of both inter- and intra-individual variation. Crucially, we could see that intra-individual variation provides important clues about underlying language learning processes that "make the system move".

With respect to language mixing it is important to note that, all in all, the incidence of language mixing both in the signed and in the written productions of the bilingual students investigated is rather low. For one participant, Maria, no language mixing was observed in either
DGS or German. The data also show that language mixing is developmentally constrained: the type of constructions mixed changes as learners proceed in their development of DGS and German. In more general terms, we can conclude that the contact phenomena observed reveal how the learners skilfully exploit the linguistic resources available to them. As they progress in their development language mixing takes over other functions (code-switching).

While important insights have been obtained in this study, we are obviously still at the beginning of a long journey. So, we would like to highlight three issues that need to be tackled, at the level of research, and at the level of deaf education.

Most of the available studies on the bilingual development of deaf students, including the one presented here, are small-scale studies. In order to gain a more comprehensive picture it seems clear that more data are needed. Ideally, qualitative small-scale studies would be complemented with larger quantitative studies.

Because research into signed language acquisition is relatively new, the focus is obviously put on the common developmental sequence. However, as becomes apparent in the study of language contact phenomena, more evidence is needed with respect to the range of intra-individual variation in order to avoid jumping to conclusions regarding errors in bilingual signers’ productions.

Furthermore, it is important to note that research into the grammatical properties of sign languages is still ongoing. Progress in this respect will allow for more fine-grained analyses of the relevant areas of contrast and sign language development.

Finally, as bilingualism in most deaf children is crucially determined by schooling, didactic conceptions are required that would take the dynamics of language development, including language contact, into consideration.

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Back to back(wards) and moving on: on agreement, auxiliaries and verb classes in sign languages

Ronice Müller de Quadros
Universidade Federal de Santa Catarina

Josep Quer
Universiteit van Amsterdam

1. Introduction

The standard tripartite classification of sign language verbs (Padden 1983/1988) relies on the assumption that the agreement shown by spatial and agreement verbs is of a different kind: while the former display locative agreement (i.e. with the loci associated with locative arguments), the latter agree morphologically with subject and object arguments (that is, with the loci linked to their referents). Still, both spatial predicates expressing motion and agreement verbs resort to the same type of morphological element to realize the allegedly different sort of agreement: PATH (Meir 1998; DIR in Meir 2002). The semantic contribution of this morpheme in the two classes would be essentially the same: in spatial verbs the initial and final slots of PATH are aligned with locations and in agreement verbs they are aligned with subject and object loci. Since agreement verbs seem to denote transfer of a theme either in a literal or in an abstract sense, the semantic generalization is established that the slots of the directional PATH morpheme can be assigned the source and goal theta-roles in both classes of predicates (Fischer & Gough 1975). For spatial verbs, this is quite straightforward; for agreement verbs, source and goal are restricted to [+human], so they can be relabelled as agent and benefactive, respectively.

However appealing this picture might be, it also has to face some serious challenges. Probably the best addressed one is the problem posed by the subclass of agreement verbs called “backwards”: in such predicates, the path alignment is not with
subject and object, but with source and goal, which results in a path that goes from the object locus to the subject locus. Meir’s (1998) solution is to separate morphological agreement with source and goal from syntactic agreement with the object, which is overtly marked by facing of the hand in ISL.¹

Nevertheless, the received view on verb agreement in SL has to address further issues that have received little or no attention in the relevant literature. In this paper we review the guiding ideas in the different approaches and, then, we elaborate on some of them, thus contributing to a more accurate characterization of agreement, verb typology and so-called auxiliary predicates in SLs. In order to support the claims, fresh evidence is discussed from Brazilian Sign Language (LSB) and Catalan Sign Language (LSC).

2. Verb agreement and verb classes in SLs

2.1. Syntactic vs thematic agreement

There is a classical discussion in sign language literature about the status of agreement in this type of languages. The morphological realization of agreement is understood as the movement between two points associated with the arguments of certain verbs. Researchers like Kegl (1985), Padden (1983/1988), Janis (1992, 1995), Fischer (1996) and Mathur (2000) presented different analyses identifying agreement as something determined by syntactic and/or semantic motivations and granting a distinct status to syntactic and spatial agreement. On one hand, syntactic (and/or semantic) agreement is interpreted as a grammatical relation established with the subject and/or with the object arguments of the predicate (Fischer 1973) and it is morphologically realized by path movement and/or orientation.² On the other hand, spatial agreement is a locative relationship established with points in the signing space corresponding to locations. When these points constitute the beginning and the end of a movement, they are interpreted as locative arguments of the motion verb (SOURCE-GOAL). However, there is disagreement about this proposal. Kegl (1985), for instance, observed that both agreement and spatial verbs may agree with SOURCE-GOAL, a line of analysis developed in Meir’s (1998, 2002) work.

¹ Meir (2002) offers a more elaborate version of this line of analysis based on her original proposal.
² For the sake of simplicity, in this paper we put aside the issue of orientation (facing in Meir’s terms) as expression of morphological agreement on the verb.
The most common American Sign Language (ASL) verb classification follows Padden’s (1983/1988, modified in 1990:119) tripartite grouping: (1) plain verbs which do not inflect for number or person and do not take locative affixes either; (2) agreement verbs which inflect for person and number and do not take locative affixes, and (3) spatial verbs which do not inflect for number, person or aspect, but do take locative affixes. Note that Padden differentiated between inflection and affixation with agreement and spatial verbs, respectively (syntactic and morphological agreement).

According to Aronoff, Meir and Sandler (2005), syntactic agreement consists of copying referential indices freely under certain syntactic conditions (involving checking of features). Morphological agreement in SLs would amount to the overt realization of those syntactic indices. In the agreement relationship in general there is a controller and a target of the agreement. The first is the nominal from which the index is copied, while the second is the element onto which the index is copied. Usually the verb carries a marker that reflects certain morphological features of the subject controller. The specificity in sign languages is that the agreement is expressed through referential indices directly, that is, through copying of the R(eferential)-loci onto the corresponding morphological slots of the agreeing verb. Aronoff, Meir and Sandler analyze the specific case of morphological agreement in sign language verbs as having two open location slots that will determine the PATH of the sign à la Meir (1998). For agreement verbs, there is agreement with the grammatical arguments. For spatial verbs, there are locations in which the path of the verb is a direct representation of the trajectory of the moving object. Then, in the sense proposed by Meir (1998), the direction of the path with agreement verbs is determined by thematic roles of the arguments (SOURCE-GOAL arguments), while the facing of the hand is determined by the syntactic role of the object arguments. As for the semantic interpretation involved, agreement verbs denote TRANSFER and spatial verbs MOTION. From this perspective, verb semantics is what determines verb classes.

The terminology adopted for verbal classes in ASL is not universally accepted. Some researchers such as Loew (1984), Lillo-Martin (1986), and Emmorey (1991) align with Padden in her classification and use the term ‘agreement verbs’. Others, though, such as Supalla (1990), called these verbs ‘movement verbs’. Fischer (1973), Fischer & Gough (1978), and Baker & Cokely (1980) called them ‘directional verbs’. Padden (1983) initially named these verbs ‘inflecting verbs’, but after Padden (1990), she adopted the term ‘agreement verbs’ instead, recognizing that inflecting verbs include
agreement and spatial verbs, as well as any other kind of inflection that could be attached to any verb. Janis (1995) uses the terminology ‘locative agreement’ and ‘non-locative agreement’ to refer to locative inflection and agreement inflection, respectively. The reason for the proliferation of terms is probably related to the form that the inflection attached to the verb takes and also because of the status of the agreement itself. Also, there seem to exist fuzzy verbs that do not strictly fit into the tripartite classification, since their thematic and grammatical properties can fall in more than one class. Kegl (1985:35) notes that the need to appeal to thematic notions such as agent, patient, source and goal “arises from the fact that in languages like English there is no fixed correlation between semantic/thematic roles and grammatical relations”. This caveat is an important one, as it also applies to sign languages.

2.2. Thematic agreement: incorporating backward verbs into the picture

The status attributed to agreement by Meir (1998, 2002) is restricted to semantic relations established by the PATH. Meir (1998) shows that directionality must be singled out because of the existence of backward verbs. Backward verbs are agreeing predicates in which the starting position of the sign is the location of the object and the final position is that of the subject, contrary to other agreement verbs. In Meir’s analysis, “the direction of the path movement marks the semantic (or thematic) relations among the arguments of the verb while the facing of the hand(s) marks the syntactic relations between the arguments of the verb” (Meir 1998). Meir (1998) argues that directionality is not the relevant phonological element for characterizing grammatical relations of arguments, but rather, it is the facing of the hands. Facing is the direction towards which the palm (and/or fingertips) are oriented in agreement verbs, determined by the referential locus assigned to the object argument of the verb.

Backward verbs are the most appropriate examples in support of Meir’s argument. In such predicates, the direction of the movement does not initiate in the position associated with the grammatical subject and terminate in the object position but the other way round. Still, the facing of the hand towards the object location is preserved. Therefore, Meir proposes the existence of double marking, that it is, thematic path agreement (SOURCE-GOAL) and syntactic agreement (facing towards the object). Some of her example verbs following this backward pattern both in ASL and ISL (Israeli Sign Language) are COPY, INVITE, TAKE or TAKE-ADVANTAGE-OF.
Her analysis differs crucially from Padden’s account for backwards, which offers a syntactic approach only, that is, backward verbs show reverse agreement with the subject and the object. A strong argument offered by Padden in favor of this approach is agreement marker omission in ASL, whereby subject marking can be optionally omitted across regular and backward verbs. This would be unexpected under a thematic approach like Meir’s, as we should specify that in regular agreeing verbs the optionally omitted argument is the one bearing the SOURCE, while the missing agreement in backwards verbs is the one associated with the GOAL argument.

### 2.3. Syntactic vs. Locative agreement

Padden provides three tests that are intended to discriminate between the syntactic and the locative nature of agreement in cases where the superficial similarity of the morphemes involved might lead to an identification of the two sorts. She distinguishes between ‘person agreement’, in which person morphemes differentiate between first and non-first-person, and ‘spatial location’, in which what is referred to is any physical point on or around the signer’s body.

First, with spatial verbs the interpretation of agreement is locative, as it gets interpreted as movement between specific location in space (1b); syntactic agreement implies person interpretation of the vectors involved in the movement, that is, the initial and final points of the movement correspond to the positions associated with the subject and object arguments (1a).

(1) a. 1-GIVE-2
    ‘I give you.’

b. a-CARRY-BY-HAND-b
    ‘I carry it from here to there.’

Padden claims that in the first example, there is agreement with the subject; that is, the first person is marked through the initial position of the sign that involves a location near the signer’s body. In the second example, the starting point is also near the signer’s body. However, in the second case there is a locative morpheme instead of person agreement with the first person, even though it may look like person agreement. She shows this difference by listing the possible variations in (1b): I carry it from here (near
my chin) to here, I carry it from here (near my chest) to here, I carry it from here (near of the lower part of my body) to here. However there are not any meaningful variations for (1a), i.e., (1a) will be always understood as having first person as the subject of the sentence without changes in the location of the sign.

Second, distributive marking (also known as exhaustive marking) can only appear with person agreement (2a). A similar form occurring with a spatial verb yields a locative interpretation (2b).

\[(2) \quad \begin{align*}
\text{a. } & \quad \text{1-GIVE-3dist} \\
& \quad \text{‘I give it to (each of) them.’} \\
\text{b. } & \quad \text{PUT-a PUT-b PUT-c} \\
& \quad \text{‘I put them there, there and there.’}
\end{align*} \]

Third, reciprocal marking only occurs with agreement verbs (3a). Analogous forms with spatial verbs receive a locative interpretation (3b).

\[(3) \quad \begin{align*}
\text{a. } & \quad \text{a-GIVE-b/b-GIVE-a} \\
& \quad \text{‘They gave something to each other.’} \\
\text{b. } & \quad \text{a-PUT-b/b-PUT-a} \\
& \quad \text{‘I put one in each other’s place.’}
\end{align*} \]

Rathmann & Mathur (in press) provide some additional syntactic tests that are argued to tease agreement and spatial verbs apart, which amounts to distinguishing between syntactic and locative agreement.

First, no SOURCE XP surfaces with agreement verbs (4a), while that is possible with spatial verbs (4b).

\[(4) \quad \begin{align*}
\text{a. } & \quad \text{*PAPER JOHN-i BILL-j MARY-k j-GIVE-k} \\
& \quad \text{‘John gave paper from Bill to Mary.’} \\
\text{b. } & \quad \text{PAPER JOHN-i HOME-a SCHOOL-b a-BRING-b} \\
& \quad \text{‘John brought paper from home to school.’}
\end{align*} \]

Second, agreement verbs cannot modify the path, while spatial verbs can. According to these authors, interrupting the movement halfway with an agreement
verbs yield and ungrammatical result (5a), whereas the same modification on a spatial path simply gives a different interpretation (5b).

(5) a.  *PAPER JOHN-i MARY-j i-GIVE-j (halfway)  
    ‘John gave paper halfway to Mary.’  

    b.  PAPER JOHN-i SCHOOL-a BRING-a (halfway)  
    ‘John brought paper halfway to school.’  

Third, the argument bearing the GOAL theta-role in agreement verbs cannot be questioned by WHERE (6a), while in spatial verbs it can (6b).

(6) a.  WHO/*WHERE JOHN-i i-GIVE PAPER  
    ‘Who/*where did John give paper to?’  

    b.  *WHO/WHERE JOHN-i BRING-a PAPER  
    ‘*Who/where did John bring paper to?’  

Later on we will return to some of these empirical arguments, either to question their validity or to use them in defense of the proposal put forth in this paper.

Rathmann and Mathur (in press) analyze verb agreement in signed languages as the result of a linguistic innovation that allows the interaction of linguistic properties of agreement verbs with gesture: if a verb selects for two animate arguments, it can participate in agreement with the subject and the object in person and number features. It is important to note that this position reduces verb agreement to agreement with animate arguments, thereby excluding person agreement with inanimate ones. As we will see below, this proposal faces the empirical challenge of accounting for so-called agreement verbs that agree with an inanimate argument. This aspect will become crucial in the further elaboration of our proposal.

In this respect, Janis (1992, 1995) adopts a significantly different view in the sense that she disposes of verbs classes and establishes that agreement is SLs is actually case agreement, controlled by the case that the argument of the verbs bear and not by their thematic role. Agreement is either with locative case or with direct case (non-locative, grammatical agreement), the former having prominence over the latter in the ranking of controller features. Janis (1992:192) observes that the generally accepted analysis of ASL verb distribution cannot predict what a verb will agree with, nor what
form of agreement a verb will have in all situations. From this perspective, she considers the case of verbs like COPY or ANALYZE in ASL and suggests that the agreement displayed with animate and inanimate objects correlates with direct and locative case agreement and that it is not necessary to postulate two different lexical entries for the two agreement options: it simply depends on the case of the argument that functions as controller of verb agreement. Her position is in this respect very much germane to the proposal put forth in this paper.

2.4. Consequences for verb classes and the syntactic/locative agreement divide

The divide between agreement and spatial verbs is kept relevant for syntactic reasons, since these verbs have different features to be checked in Agreement Phrases (cf. discussion by Janis 1995). However, we show in this section that the verb classification proposed by Padden is not always appropriate, at least if understood as defining mutually exclusive classes: in the data we find plain verbs with some kind of locative features, as well as agreement verbs with locative agreement, and spatial verbs with some person feature agreement.

There are different variant of verbs classification in the literature that reflect the fuzzy borders between verbal classes in sign languages such as ASL. An example is an earlier verbal classification proposed by Fischer and Gough (1978), in which three aspects are identified as corresponding to verbal inflection for person: directionality, reversibility and locationality.

The directional verb class as analyzed by Fischer and Gough includes verbs which physically move toward the argument or arguments established in space. In this sense, this class is much more general than the agreement verb class as classified by Padden (1983/1988), since directional verbs include verbs like GIVE, LEAVE, BRING, BITE, HIT, HURT and BLEED that agree with NPs (personal pronouns) as well as with PPs (for example, locatives). These verbs are either agreement or spatial verbs, following Padden’s classification. Perhaps Fischer and Gough had already captured the idea that we will develop in our analysis: there are reasons to consider both classes as instantiations of a fuzzy classification, even though there may be other, independent reasons for distinguishing them.

According to Fischer and Gough, reversibility is a process that is partially related to directionality. Verbs like MEET, FLATTER and FREQUENT are clearly
reversible, i.e., there is a change in the orientation of the hand in addition to the direction of the sign. These verbs are considered agreement verbs in recent analyses (Padden 1990, Baker and Cokely 1980). However, in this class Fischer and Gough also included verbs such as KICK and BITE, which are not generally analyzed as agreement verbs. These verbs may be signed toward the location that they refer to, or they can be signed in a neutral position. In the first case, they seem to have inflection and in the second case they seem to be plain. This kind of example reflects again the fuzzy borders of the classification mentioned earlier.

The last characteristic of verbal inflection for Fischer and Gough is locationality. They give WANT as an example of a locational verb, in which the sign can be articulated either near the subject location or near the object location. Padden (1990) analyzes WANT as a plain verb that can bear a locative clitic.

It is interesting to note that Fischer and Gough give examples in which there are possible combinations of the directional, reversible and locative qualities; e.g., FLATTER, FOOL, FREQUENT, HIT, and PAINT. Also, verbs such as HATE, BORROW, LOOK and FEED can be both directional and reversible, while, LOCK, OWE and PITY can combine reversal and locational aspects. These are examples that still lack a clear analysis in sign languages, if one follows a rigid classification.

Concerning plain verbs, Fischer and Gough (1978) described them as exceptions. For instance, verbs such as HEAR, LISTEN, LOVE, EAT, DECIDE, PRAISE, DANCE, ASSOCIATE, JOIN and TEASE are mentioned as exceptions because they do not present agreement inflection. Nowadays, it is generally agreed that these verbs form a class in sign languages different from verbs that have overt agreement.

As we saw in section 2.3 above, Padden (1990) shows evidence for the difference between spatial location affixes to spatial verbs and person and number agreement for agreement verbs.

It is crucial to observe that even though spatial location is clearly different from person agreement, there must be subject person agreement in an ASL example like (1b), since it allows a null subject pronoun (cf. Quadros 1999:105-106 for LSB). In an LSB example like (7) a null subject argument must be posited as well:

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3 A comparable case was discussed by Padden (1983/88) for spatial verbs (see above): even if sometimes the locus of the source or goal of the movement can coincide with a person locus, this does not mean that the predicate agrees in person with that locus, according to her.
(7)  \(<a+1>\text{CARRY} <b>\>

‘I carry it (from here) (to there).’

Such an example would not be possible if the spatial location \(a\) were signed in a location that is not associated with a person, as in the next ungrammatical example from LSB:

(8)  \(*<a>\text{CARRY} <b>\>

‘(He) carries it from here (a place that does not coincide with the subject) to there.’

Sentence (8) could be grammatical only if the subject were pronounced. (7) is possible because phonologically, the agreement and the locative have the same form expressed at the same point, and as a consequence, the null pronoun for the subject is allowed and the sentence is grammatical. Null pronouns are allowed in languages such as ASL and LSB because they are pro-drop (Lillo-Martin 1986, Quadros 1995). In both languages, there are restrictions that apply to sentences that license null pronouns. The basic restriction concerns the information carried by the verb, i.e., if the verb includes agreement information related to person, it allows null arguments (external and/or internal).

Therefore, as mentioned before, it seems that the combination of locatives associated with spatial verbs can be combined with non-locative agreement, but they must be pronounced at the same location to allow a null argument associated to the non-locative argument. If they are not pronounced at the same point and there is a null non-locative argument, there is a kind of morphological restriction in signs that rules out the sentence.

This proposal differs from Padden (1990), which excludes agreement with the subject with spatial verbs. Padden (1990) follows Supalla (1986) and Liddell (1984) in assuming that agreement morphology cannot co-occur with locative morphology. Padden’s conclusion is that the space around the signer has different dimensions at each level of analysis (phonological space for contrastive locations; morphological space for
agreement, and syntactic space for indexing and anaphora). Considering the facts in (3) and (4), it seems that there are possible combinations among these different levels when the sentence is produced, contra Padden’s analysis.

Kegl (1985:108) discusses one kind of verb that does not fall under the GIVE category (agreement), neither under the CARRY-BY-HAND category (spatial), but falls “truly midway between both verb types”: it is the HAND-OVER kind of example. This verb has one location associated with a location (SOURCE) and the other with a person (GOAL). In this example, the sign can be interpreted with or without the transference notion of possession. Kegl’s analysis is very insightful since it shows a different way to approach the verb distribution in ASL that accounts for this fuzzy distribution that we are addressing in this paper. Her analysis establishes that GIVE is an extension of CARRY-BY-HAND to the possession class and that INFORM is an extension of GIVE to the cognitive class. What makes the difference among these verbs are the diverging forms that the handling classifier takes with each instance.

Quadros (1999), like Janis, adopted only one division between verbal classes, the ones with agreement markers and the others without them, non-plain and plain verbs, respectively, in her terminology. Her argument is motivated syntactically, since the syntactic structure has a different form in sentences associated with non-plain and plain verbs. There is no evidence in terms of syntax to maintain the division between agreement and spatial verbs; however, the author recognizes that semantic relations play a role to distinguish verbs that are spatial or person agreement. But, what Quadros also noticed is that is not so clear which class a verb belongs to. A standard agreement verb can behave as standard spatial verb; a plain verb can look like an agreement or spatial verb.

Janis (1992) notices a relation between spatial and agreement verbs which is similar to what Kegl (1985) analyzed as a metaphorical relation between the two groups. Instead of entertaining a synchronic analysis as in Kegl, though, Janis proposed an account in terms of historical relationship: nonlocative (agreement) verbs would be lexicalized forms of classifiers predicates.

Janis (1992) observed that the lexical proposal made by Padden correctly predicts that all agreement markers on a verb will necessarily be of the same type (subject/object or locative). However, as noted above, some of the verbs can appear with more than one agreement type, since they are truly different verb occurrences, that is, the analysis must say, for instance, that there are two verbs TEACH, one a member
of the agreement class and the other a member of the spatial class. Consequently, the verb will be listed twice in the lexicon. This is clearly not desirable. Moreover, the verb class analysis cannot predict when a particular agreement form will occur.

3. Problems for the existing alternative views

Next to the empirical problems just mentioned for a static tripartite classification of verbs and a strict separation of syntactic vs. locative agreement established in Padden’s widely accepted proposal, we need to address other difficulties with the alternative views discussed above.

The thematic approach, as put forth in Meir’s work, essentially reduces sign language agreement to spatial agreement with the locative thematic roles born by the arguments involved in a transfer relationship. This reduction, though, has to face several counterarguments:

(i) The empirical generalization that agreement verbs in SL is the realization of a path morpheme linked to an underlying transfer interpretation is falsified by the fact that such transfer meaning is not always readily available. This becomes especially perspicuous with agreement verbs that are pure transitives, and not ditransitives, and thus display agreement with direct object, not with the indirect object. The predicates in (9) are examples of this in both LSB and LSC.

(9) CHOOSE, SUMMON (LSB, LSC)

(ii) Linked to the previous problem, it must be noted that the thematic role of the second agreeing argument in an agreeing verb is not always GOAL, but it is often a THEME, too. In LSB and LSC we find transitive verbs (both regular and backwards) where the second agreeing argument is a THEME:

(10) PRESS, INVITE (LSB, LSC)

(iii) The strongest counterargument to the thematic approach comes from the fact that in SLs that have an agreement auxiliary (AUX), AUX agrees with grammatical
subject and object, not with the thematic SOURCE and GOAL. As noticed independently in Mathur (2000) and Pfau & Steinbach (2005) for DGS, Smith (1990) for TSL and Bos (1994) for SLN, this dissociation of syntactic agreement becomes apparent only when an auxiliary co-occurs with a backwards verb: the direction of the path of the AUX is the usual subject-object one, which is the opposite of that realized by the lexical verb:

(11) a. IX-1 CHILD 3-TAKE-1 1-AUX-3 (LSC)  
b. GIRL 2-AUX-3 TAKE-3 (LSB)

These data have not been taken seriously into the discussion about SL agreement, despite its enormous relevance. They constitute rather solid counterevidence not only against a thematic approach to agreement verbs but also against Liddell’s account of agreement as deixis (see for instance Liddell 2003). Such an agreement AUX never surfaces with clear spatial verbs agreeing with locations or with inanimate arguments. In addition, AUX surfaces with psych predicates in LSC, which are typically statives involving no transfer interpretation at all.

Next to the objections raised to the thematic approach to SL, we should mention further problems for Rathmann and Mathur’s animacy approach. According to them, agreement is limited to animate arguments, but it is a fact that we also find agreement with inanimate objects. In their framework, this would require additional assumptions and maybe the need to postulate a two-entry analysis, which does not seem desirable at all.

(12) a. IX-1 BOOK 3-BUY-1 (LSC)  
b. NOTES IX-1 3-COPY-1 (LSB)

In addition, the tests offered in Rathmann and Mathur (in press) in order to distinguish between agreement and spatial verbs turn out not to hold in LSB and LSC.

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4 As shown in Pfau & Steinbach (2005) and Steinbach (2005), a significant number of SLs have items that can be labelled as auxiliaries. Different sorts have been identified both cross- and intralinguistically. In most cases, such an auxiliary only marks syntactic subject and object agreement and does not instantiate other grammatical features like aspect. We concentrate here on the most “grammatical” kind discussed, which is realized as an index handshape that moves from the subject to the object locus, glossed as AUX for convenience.

5 This might be partly due to the fact that ASL, like other SLs, does not appear to have such an agreement auxiliary.
First, the SOURCE argument can co-appear with the personal THEME of an agreement verb, against their prediction:

(13) AIRPORT MARIA IX-2 2-PICK-UP-3
    ‘You pick up Maria from the airport.’

Second, both THEME and SOURCE can be questioned exactly with the same verb, as illustrated in the following LSB data:

(14) a. <WHERE IX-1 1-PICK-UP-3 WOMAN WHERE>wh
    b. <WHO PERSON IX-1 1-PICK-UP-3 AIRPORT WHO>wh

Third, the modification of the path both in spatial and agreement verbs has aspectual interpretation. The reading obtained is that of unrealized inceptive in the case of the agreement verb, as in (15a); next to the purely locative one, this aspectual reading is also possible with spatial verbs, as in (15b).

(15) a. BOOK JOHN-i MARY-j i-GIVE-j (halfway)
    ‘John almost gave the book to Mary.’
    b. BOOK JOHN-i SCHOOL-a BRING-a (halfway)
    ‘John almost brought the book to school.’

With all the evidence discussed so far and the discussion of the arguments offered in the literature, it seems clear that we can no longer cling to a mutually exclusive partition of verbs into three morphosyntactic classes, as usually assumed. What we have observed is that verbs sometimes display a hybrid behaviour, at least between the agreement and spatial classes, and that syntactic and locative agreement are not always incompatible in the same verb form. Moreover, we have pointed out some crucial inadequacies of the thematic approach to agreement. Among other counter-evidence, we have claimed that AUX elements in LSB and LSC are pure instantiations of syntactic agreement. This becomes clear with backwards verbs. However, the question arises what path is realizing in those verbs, if it is not syntactic agreement. In the next section the relevant issues are recapitulated and a tentative answer is offered.
4. **What is agreeing in backwards verbs?**

A generalization over backwards verbs that usually remains unmentioned is that, unlike “regular” agreement verbs, most backwards verbs are not ditransitive. This can easily be observed in the lists of backwards verbs in ASL and ISL provided in Meir (1998):

(16)

**ASL:** COPY, EXTRACT, INVITE, MOOCH, STEAL, TAKE, TAKE-ADVANTAGE-OF, TAKE-OUT, GRAB, LIE-TO

**ISL:** COPY, TAKE, CHOOSE, INVITE, TAKE-ADVANTAGE-OF, ADOPT, INHERIT, IMITATE, SUMMON, IDENTIFY-WITH

In the inventories for LSB and LSC the majority of backwards verbs is clearly not ditransitive:

(17)

**LSB:** TAKE/GET/PICK-UP, CHOOSE, COPY, IMITATE, PERCEIVE, EXPLOIT, INVITE, SUMMON // ASK-FOR, BORROW, STEAL

**LSC:** TAKE/BUY, CHOOSE, GET/GUESS, SUMMON, COPY, INVITE, UNDERSTAND // ASK, STEAL, TAX

Surprisingly, these predicates only have one obligatory internal argument, which is assigned a THEME theta-role, and not a SOURCE one. This difference is not a trivial one for the accounts that base the reverse path of backwards verbs on thematic properties. Against the claim in Meir (2002), the only internal argument should receive accusative marking, not dative.

We argue that the interaction of auxiliaries with backwards reveals crucial properties of this class. As mentioned above, when an auxiliary co-occurs with a backwards verb, the path goes from subject to object and this is the opposite with respect to the one realized by the lexical verb. Unlike in LSB, where AUX only surfaces
with backwards verbs, in LSC it can co-occur with both backwards and regular agreement verbs.⁶

(18) IX-x IX-y x-AUX-y y-TAKE-x  

(19) a.*GRAMMA-x GRAMPA-y x-AUXY-y x-TAKE-CARE-y (agreement verb)  

b. IX-x IX-y x-AUX-y (y)-PICK-UP (backward verb)  

Interestingly, in LSB these are the only instances where an auxiliary can co-occur with an inflected verb in an unmarked context. Moreover, the presence of the auxiliary licenses an alternative form of the backwards verb which has no path, but which can display orientation/facing towards the locus of the internal argument.

(20) a. IX-x IX-y x-AUX-y (y)-PERCEIVE (backward verb)  

b. IX-x IX-y x-AUX-y TALK (plain verb)  

Our solution to this puzzle is to remove backwards verbs from the class of agreement verbs and to treat them as handling verbs with path, where the path actually agrees with locations and not with syntactic arguments. This is supported by the fact that the object can be sometimes inanimate but the subject must always be animate, as in handling classifier predicates. From this point of view, the path agreement shown by backwards verbs with the object (the THEME argument) is not syntactic, but locative. This seems rather straightforward when we observe backwards predicates whose meaning involves a handling operation in their core interpretation, such as TAKE:

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⁶ The AUX elements do not display identical properties in LSB and in LSC. In LSB, AUX can be argued to only serve as the spell out of subject and object agreement features. It cannot co-occur with agreement verbs when they are inflected, but in ellipsis contexts and structures of verb focus it can surface together with an uninflected agreement verb. Moreover, its syntactic distribution is highly restricted in the clause. The LSC counterpart of AUX appears to behave more like a main predicate devoid of semantic content, closer to a light verb than to a pure auxiliary. It displays more freedom of position in the clause. Still, it marks subject and object agreement, but unlike most instances of AUX described for other SLs, the LSC AUX can inflect for aspect. In addition, it can co-appear with inflected agreement verbs in order to express emphasis. Nevertheless, these differences are tangential to the argument put forth in the text with respect to the nature of the agreement displayed by these elements.
Nevertheless, in some cases a metaphorical transfer must be assumed from a literal handling operation to an abstract one, as in COPY (22). Another good instance of this is the verb UNDERSTAND in LSC (23), which like its English counterpart ‘grasp’, links the mental operation of understanding to a manual handling movement. In other cases like INVITE the metaphorical transfer can be less obvious, but we claim that it is at the basis of its etymological origin.

Although the details of such a proposal remain to be worked out further, the conclusion is clear: backwards verbs do not actually belong to the class of “pure” (syntactic) agreement verbs, but fall into the class of (highly lexicalized) handling verbs, a subclass of transitive spatial verbs.

This would also explain why certain transfer verbs like PHONE in LSB/LSC? which were originally plain developed into agreement verbs by morphologization of the agreement affix into the lexical verb. Interestingly, no such cases are attested for backwards verbs, as far as we know.

5. Back to agreement and verb classes

Having questioned the classical view on verb classes and agreement in SLs as well as the most prominent alternative in terms of thematic agreement, we must proceed to sketch what the proper characterization of agreement and verb classes should be on the basis of the insights gained in this discussion.

In line with de Quadros’s terminology, verbs in SLs should be classified as agreeing (non-plain) or non-agreeing (plain). Agreement is morphologically realized as path\(^7\) and path agreement can either be with locations (spatial features) or R-loci (person and number features). Most of the time the surface realization of these two types of

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\(^7\) As said before, here we gloss over orientation as another morphological means to express agreement overtly, either in combination with path or on its own.
agreement is indistinguishable, but the evidence based on agreement AUX in LSB and LSC allows us to safely conclude that both types of agreement can be (and should be) teased apart. A crucial piece of evidence in this direction can be offered by testing the cooccurrence possibilities of AUX with backward verbs. As mentioned previously, the path of the AUX elements goes in the opposite direction of this type of verb, namely from the locus of the object to the locus of the subject. It was also pointed out that AUX only occurs when agreeing with animate subject and object. Since backwards verbs can take both animate and inanimate objects, it is predicted that AUX can appear only with the former and not with the latter. The prediction is borne out:

(24) *BOOK-x x-TAKE-2 2-AUX-x  (LSC/LSB)

(25)  
a. CHILD-3 3-TAKE-2 2-AUX-3  (LSC)
b. CHILD-3 2-AUX-3 3-TAKE   (LSB)

From this solid evidence we can conclude that only R-loci bearing person features enter into personal/syntactic agreement. On the basis of the evidence discussed here it becomes clear that only animate arguments can bear such features in SLs. The question remains as to what kind of agreement locative agreement is. Here we would like to tentatively suggest that it basically reduces to agreement with loci identified by arguments endowed with locative features. In this way, the possibility opens up naturally that one and the same path agrees with a personal argument and a locative argument in the same verbal form. We have seen that such instances are attested.

Another consequence of the approach put forth here is that thematic agreement cannot be maintained as the underlying factor explaining the grammar of path across the traditional classes of agreement verbs (both regular and backwards) and spatial verbs. Maintaining the SOURCE-GOAL analysis proves empirically incorrect, as many instances of agreement verbs are not ditransitives but simple transitives with a THEME/PATIENT object. Moreover, if thematic structure were the underlying motivation for the expression of agreement, we would not expect variation across languages or within the same language. Such counterexamples are found in LSC and in

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8 An interesting exception to this generalization that we cannot address here is AUX agreement with the inanimate CAUSE argument in psychological predications. The crucial factor is that such arguments can never have a locative interpretation.
LSB, where the same lexical conceptual structure has been lexicalized with respect to directionality in opposite ways in the two languages:

(26) a. ASK (LSB: regular vs. LSC: backwards)
    b. ASK-FOR (LSB: backwards vs. LSC: regular)

At the same time, the same lexical conceptual structure in the same language can show agreeing and non agreeing lexical forms:

(27) BORROW (LSC)⁹

With all this evidence at hand, it appears no longer possible to maintain the simple view of agreement and verb classes as proposed in Padden’s or Meir’s approaches. The impressive results of those works have served us as useful tools to understand the phenomena under study, but we face new challenges in the analysis and it seems time to move on towards a more compound account.

6. Conclusions

After the discussion offered in this paper the picture that emerges about agreement and verbs classes in SLS is significantly modified with respect to current assumptions on these topics. It can be maintained that non-plain verbs (“spatial” + “agreement”) in general can agree either with locative arguments (spatial agreement), with personal arguments (person agreement) or with both. Auxiliary predicates can only agree with personal/animate arguments (person agreement) and they point to the fact that backwards are lexical handling verbs whose path is determined by spatial agreement, not by person agreement.

As mentioned above, agreement with person and locative features is often indistinguishable on the surface. Still, the argument structure of each predicate will impose certain requirements on the licensing of arguments, as discussed around (7) and (8), for instance, where the subject argument of a handling predicate must be licensed by a person feature. Still there in an issue of ambiguity of locus as location or R-locus

⁹ This is actually a case of a predicate that seems to have gone from agreement verb to plain verb, although both forms coexist across speakers simultaneously.
(e.g. TELL with person agreement vs. TELL with locative agreement on the GOAL argument) and further research is needed in order to determine to what extent a locus assigned to an animate referent can be ambiguous between a person locus or a spatial locus.

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References


The Semantics, Syntax and Phonology of Adverbial Nonmanuals in Austrian and American Sign Language

Katharina Schalber* Donovan Grose°
*Vienna, Austria °Purdue University

Abstract

This paper analyzes two types of adverbial nonmanual mouth gestures in Austrian and American Sign Languages, termed Posture nonmanuals (P-NM) and Transition nonmanuals (T-NM). These nonmanuals differ in their semantic, phonological and syntactic behavior. We argue that these nonmanuals are adverbial in nature and sensitive to the underlying event structure of the predicate.

1. Introduction

This paper explores two morphologically and phonologically distinct types of adverbial nonmanual behaviors (NM), produced on the lower face in two different sign languages: Austrian Sign Language (ÖGS) and American Sign Language (ASL) ¹. We claim that these NM are adverbials, and thus are sensitive to distinct components of the predicate that they modify. Our analysis is presented here only briefly, however, the fact that this analysis is based on two geographically separated and historically unrelated sign languages suggests that it may be applicable to other sign languages as well.

The current study includes nonmanual postures or movements of the lower face, which are produced with the mouth, lips, cheeks, tongue and jaw. We exclude nonmanuals commonly termed 'mouthings', which have their origins in mouth patterns of spoken languages, and lexicalized nonmanuals, which are obligatory components of predominantly manual signs. It is also necessary to make a distinction between the analysis proposed here, and the 'echo-phonology' analysis proposed by Woll (2001). An echo-phonological analysis addresses only the phonology of the co-articulated manual and nonmanual forms. We will show that the behavior nonmanuals included here cannot be predicted based solely on their co-articulated manual forms.

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The types of nonmanuals analyzed here are: Posture NM (P-NM), composed of a facial posture, such as the pursed lips and cheek and mouth corner tension illustrated in (1), and Transitional NM (T-NM), composed of a single abrupt change of aperture, such as an opening or closing of the mouth, illustrated in (2):

(1) P-NM from ÖGS:

(2) T-NM from ÖGS:

We claim that both of these NM types are adverbial, and each contributes morphemically to the predicate as a whole. P-NM function as modifiers of manner and degree, this includes indicating the internal state of a participant, or indicating how or to what degree a participating entity undergoes or experiences the predicate. T-NM adverbials indicate the achievement of a transition, either the inception or completion of the event. Crucially, neither type of NM included in the current study is an obligatory nonmanual component of the manual forms with which they are co-articulated, thus they are not lexical. Both types of NM are optional parts of the predicate. The frequency of occurrence and the choice of a particular NM is up to the signer. Rather than discussing the forms and meanings of specific T- and P-NM, we focus on the morphosyntactic and phonological behaviors of these adverbials as classes, including the components of the underlying event structures they modify.

P-NM adverbials modify the dynamic component of the event, for example how an entity moves along a path, but not the entity’s initial or final locations. Consistent with this function, the phonological domains of P-NM include these components of the predicate. These phonological domains correspond to the syntactic scope of the adverbial. P-NM may include multiple manual forms within their phonological domains. These morphosyntactic ‘spreading’ domains, we claim following Seidl (2001), are derived from syntactic phases (Chomsky, 2001). Specifically, for P-NM the relevant phase is the V-phase, which includes the entire predicate, but importantly excludes the subject of the clause.

In contrast, T-NM are segmental adverbials, and serve to mark the transitions between the static and dynamic components of the predicate. This includes the transitions between an initial state and the dynamic event, or the dynamic event and final state. The nature of T-NM restricts
them to single syllables, and the nonmanual changes of aperture or other changes in the configuration of the lower face are generally timed with various components of the co-articulated manual form, such as changes of manual aperture, orientation and movements to points of contact. The reason for this, we argue, is because T-NM are sensitive to the same transitions in the underlying event structure marked manually in these ways.

This paper is organized as follows: Section 2 briefly provides some theoretical background, including an overview of previous work on nonmanuals of the lower face, event structure and a discussion of the phonological model assumed here. Our methodology is described in Section 3. Section 4 presents the analysis of T- and P-NM with examples from both languages and some discussion of the interfaces between semantics, syntax and phonology. The paper ends with a conclusion in Section 5.

2. Theoretical Background

2.1. Nonmanuals of the Lower Face

Previous research has identified several types of nonmanuals produced on the lower face, including nonmanual adverbials (Anderson and Reilly, 1998), some of which are identical in form and function to the NM of the current study. The phonological domains of these adverbial nonmanuals correspond to the scope of the adverbial within the clause. Other types of lower face nonmanuals, including so-called 'mouthing' which mimic some or all of the shapes that appear on the mouth and lips when producing spoken words, have been recruited into the grammars of various sign languages and are either lexicalized components of manual forms, or serve to disambiguate otherwise identical manual forms (Ebbinghaus and Heßmann, 1996, for example). In addition, there are lexically associated nonmanuals that are not historically derived from the mouthing patterns of spoken languages. Examples include the abrupt opening of the mouth or 'mouth pop', which is an obligatory component of the ASL sign glossed 'PAH!' (Anderson and Reilly, 1998). The current analysis includes only adverbial nonmanuals, and excludes mouthing and nonmanuals that are obligatory components of lexical forms.

Woll (2001) identifies what is termed 'echo-phonology' in British Sign Language (BSL), in which the phonological features, such as a change of aperture of a manual form, spread to a nonmanual articulator, and are co-articulated with it. Many of the T-NM included in the current study share phonological features with their co-articulated manual forms, and thus appear to be instances of echo-phonology. However, in other cases, the features of the T-NM are distinct and do not echo those of the manual form, for instance, when the manual form includes a movement to a
point of contact and the co-articulated T-NM is a change of aperture (illustrated in the ASL example (9)). Thus, the T-NM included here cannot be analyzed purely as echo-phonology, since a phonological account does not address the morphosyntactic functions of T-NM and their sensitivity to the underlying event structure. However, we assume here that the current analysis and an echo-phonological analysis are not inconsistent with each other. In terms of syllable structure, sonority and the relative timing of the nonmanual and manual components, Woll's analysis of nonmanuals in BSL similar to the T-NM included here, is generally supported by our data from ASL and ÖGS.

It is important to note that all of these types of previously identified nonmanuals of the lower face, including the P- and T-NM of the current study, are linguistic elements, distinct from emotive facial expressions. In some cases, nonmanuals, such as the affirmative head nod (Neidle et al., 2000) and the negative headshake (Veinberg and Wilbur, 1990), seem to have been recruited from the gestural into the linguistic system. In these cases, the phonological domains, including onset and offset times, are conditioned by linguistic factors. This may apply to some of the nonmanuals included here, but these issues are beyond the scope of this paper.

2.2. Event Structure

We argue that T- and P-NM are adverbials that modify specific components of the internal structure of the event denoted by the predicate. The term 'event' is used here to refer collectively to both telic and atelic events, and the term 'event structure' is used to refer to the internal structures of both static and dynamic events, or all types of 'situation aspect' (Smith, 1997). Research has demonstrated that predicates are made up of two components: a lexical/conceptual component made up of one or more morphemes that provide the idiosyncratic meaning, and the event structure that forms the structural semantics of the predicate. Event structures may be represented in different ways, but it is clear that these structures must be analyzed separately from the lexical/conceptual components of predicates (Levin and Rappaport Hovav, 2005; Pustejovsky, 1991; 1995; Tenny and Pustejovsky, 2000).

Here, event structures are decomposed into one or more subevents. Following Pustejovsky (1991), we recognize two types: static (S) and dynamic (D). The simplest event structures are composed of a single S or D subevent, these include States and certain types of Activities. Other, more complex event structures contain multiple subevents, ordered relative to each other. Non-identical subevents within the same event structure are ordered in transitional sequential relationships. A transition from S to D (S⇒D) represents a transition from an initial state to a dynamic state, or the inception of an event. A transition from D to S (D⇒S) represents telicity, the
transition to a final state. Traditionally, two types of telic events, termed Achievements and Accomplishments, are recognized. These telic events both contain a telic transition (D⇒S), and are generally distinguished from each other in terms of duration. Since, for our purposes here, duration is not relevant, we can treat these two types as a single class. Likewise, the notion of causation, represented as subevents of the same type oriented simultaneously with each other, represented (D ⇔ D), can be ignored here.

We focus on transitional relationships, and restrict our analysis to the following types of events: non-inceptive Activities (D), in which the initial state is not lexically specified, inceptive Activities (S⇒D), telic events (D⇒S), and inceptive telic events (S⇒D⇒S). We do not include States or the notion of causation in the current analysis. These event types are distinguished following the principles of the Event Visibility Hypothesis (Wilbur, 2003; 2007), presented briefly below.

### 2.3. The Visibility of Events

Our analysis of event structure assumes the basic framework of the Event Visibility Hypothesis (EVH), proposed by Wilbur (2003; 2007; Grose et al., 2007). The EVH argues that telic and atelic events are phonologically contrastive in ASL, as well as ÖGS (Schalber 2004). These event types are contrastive because the underlying event structures are 'transparent' or 'visible' in the surface morphology of these two languages.

The EVH identifies three phonological features in the surface forms of telic events: a) changes of handshape (aperture); b) changes in the orientation of the hand; and c) movement to a point of contact with the body or a plane. Further elaboration of the EVH (Grose et al., 2007) argues that the inception of events is also phonologically marked in ASL, with a movement from a point of contact with the body or a plane. This observation appears to apply to ÖGS as well.

Specific claims of the EVH apply to ASL and ÖGS, but these sign languages are not unique in terms of the transparent representation of underlying event structures on the surface. Similar claims have been made for certain types of predicates in Dutch (Van Hout, 2000), and overt markings of telicity have been reported in Modern Hebrew, Finnish and Russian (Borer, 2005). What appears to be unique in these sign languages, however, is how different event structures are represented in the surface phonology.
2.4. Phonology

Currently, the internal phonological structure of nonmanuals is still poorly understood, but it is possible to proceed without a detailed analysis of these structures at this point. The phonological framework assumed here is the Prosodic Model of sign language phonology (Brentari, 1998). Forms are represented in this analysis in a feature geometry dominated by a single [root] node, corresponding roughly to a prosodic word. The [root] node dominates the Inherent Feature [IF] and Prosodic Feature [PF] nodes, representing the static and dynamic components of the signal respectively. In the interests of space, we will discuss only those components of the Prosodic Model that are directly relevant to the current analysis. We refer the reader to Brentari (1998) for a detailed discussion. The relevant structure is presented in Figure 1:

![Figure 1: Relevant components of the Prosodic Model](image)

Under the [IF] node is the [Articulator] node, which dominates the [Manual] node and the [Nonmanual] node. Substructures of features under the [Manual] node represent specific configurations of selected fingers and joints, and under the [Nonmanual] node, presumably equivalent nonmanual features. The [POA], or [Place of Articulation] node dominates substructures representing places of articulation on the body, as well as the x, y and z planes. The phonological domain for a set of [IF] features is the entire [root] node but it is through the [PF] node that a [root] maps onto the abstract timing slots (x), the minimal units of the prosodic structure.

The EVH argues that in atelic events, the [PF] specifications which map onto the two timing slots of a monosyllabic form are non-contrastive, producing movements such as [tracing] and [trill]. Telicity and inception are marked with contrastive specifications for these timing slots, including changes of aperture, orientation and [direction] movements to and from points of contact.
The [root] node, as shown in Figure 1, corresponds to a monosyllabic prosodic word. The [root] node also represents the interface between the phonology and the morphosyntax. The phonological [root] node corresponds to at least one, but often multiple, morphemes. Regardless of the number of morphemes mapped onto a single [root], the [root] represents the phonological domain of the [IF] features it dominates. In those cases in which a P-NM spreads over multiple [root] nodes, we will argue it is necessary to propose a larger phonologically relevant constituent, derived indirectly from the syntactic phase.

2.5. Syntax and Phases

In the framework we assume here, an event is composed of one or more verb phrases (VP) (Tenny, 2000; Ramchand, in progress; Borer, 2005,). In ASL and ÖGS, each sequentially ordered subevent corresponds to a morpheme in the head (V0) of a VP (Grose et al., 2007; Ramchand, 2003). For convenience, we will refer to all of these phrases as VPs, distinguished by subscript letters representing their associated subevents (e.g. VSP, VDP). As we see in the examples (3) and (4) below, transitions between subevents, either (S⇒D) or (D⇒S), correspond to pairs of VPs headed by non-identical subevents. An inceptive transition syntactically corresponds to the structure in (3). Example (4) represents a telic structure:

(3)  [ VSP ] [ VDP ]...

(4)  [ ...[ VDP ] [ VSP ]]  

The VP headed by the first subevent in the transition dominates and c-commands the VP headed by the second subevent. Thus, the temporal ordering of the subevents in the event structure is reflected in the hierarchy of the syntactic structure as well as in the linear order of the constituents in the surface form of the predicate.

3. Methodology

The current analysis is based on previous work on NM and event structure in ASL and ÖGS, (Schalber, 2004; Grose et al.2007) and includes previously collected data, and new data collected specifically for this project. Our subjects include 2 ÖGS and 5 ASL Deaf native and near native signers. Each subject watched the seven part Canary Row cartoon in its entirety, and then watched the cartoon again, episode by episode. After watching each individual episode, the subjects were asked to describe the episode they had just seen. These productions were recorded on digital videocassettes, and imported into computers and compressed. The responses were transcribed using the transcription program ELAN.
Given the nature of the elicitation material, the vast majority of the utterances produced by our participants, from both languages, included classifier predicates (CLP), either in predicates composed solely of CLP or in structures that contained lexical verbs as well. As CLP, these structures are relatively restricted in term of their possible semantics, to change-of-state, specifically size and shape, and path and manner predicates, however this also means that the components of the underlying event can be easily identified. Since CLP are not lexical signs, we can eliminate the possibility that the T- and P-NM included here are lexically associated.

4. The Analysis

4.1. Posture Nonmanuals (P-NM)

P-NM are composed of a continuous facial postures which are co-articulated with manual predicates. In ÖGS and ASL the NM may be physically and semantically different, but are consistent with the analysis. For instance, in examples (5) from ÖGS and (6) from ASL below, the P-NM is composed of tension in the muscles at the corners of the mouth, and a protruding lower lip. In the ÖGS example this P-NM also includes muscle tension in the cheeks. The manual forms these P-NM are co-articulated with are also similar, and refer to the same part of the story.

(5) ÖGS

protruding lips
CAT bentV:pacing back and forth
‘The cat is pacing back and forth.’

(6) ASL

‘scowl-face’
CAT V:walking B/B:hands.on.hips.V:pace.back&forth V:look-up V:walk
‘The cat paces back and forth, frustrated, and looks up...’
The P-NM in the ÖGS example (5) modifies the manner of motion, in contrast the P-NM in the ASL example (6) modifies the internal state of the subject, the cat, and how the subject engages in the event. Manner adverbials of these types have scope over the dynamic component of the event, the D subevent. Syntactically, the P-NM scopes over the VDP, represented in (7). The line above the relevant syntactic components indicates the scope of the adverbial, as well as its phonological domain.

\[ (7) \quad [\text{V}_5\text{P} \quad [(\text{P-NM}) \text{V}_D\text{P}]] \]

It has been known for some time that the phonological domains of nonmanuals of this type may include multiple manual forms. This is illustrated in the ASL example (6), in which the P-NM extends over multiple classifier predicate forms. We argue that the phonological domains of adverbial P-NM are derived from syntactic V-phases, which represent the morphosyntactic input into the phonology, but not syntactic structures themselves. This is illustrated in Figure 2:

![Figure 2: The V-phase as a phonological domain](image)

In this representation, the V-phase represents the phonological domain of the P-NM, a morpheme composed of [IF] features, but lacking [PF] features. T-NM, in contrast, contain [PF] features, and thus, have different phonological domains and behavior.

### 4.2. Transition Nonmanuals (T-NM)

T-NM are composed of a single abrupt change in a nonmanual articulator of the lower face. For the purposes of this study, we provisionally treat all T-NM as changes of aperture, although it is not clear at this point whether or not 'aperture' is the appropriate term for all of these changes. In any case, T-NM are associated with transitions between subevents in the underlying structure, either \((S \Rightarrow D)\) or \((D \Rightarrow S)\), and serve to mark the achievement of the transition. This includes marking the
'completion' of a telic event, as in (8) and (9), or the inception of an event, as shown in (10) and (11):

(8) ÖGS

(mouth)closed ⇒ open
BIRD 5-5: hold.ball ⇒ throw.ball.in.pipe
'The bird throws a bowling ball into the rain pipe'

(9) ASL

(mouth)open ⇒ closed
CAT Vbent:fall.down ⇒ to.ground
'The cat falls down to the ground.'

(10) ÖGS

(mouth)closed ⇒ open
CAT Vhold: swing ⇒ swing
'The cat starts swinging'

(11) ASL

(mouth)closed ⇒ open
CAT Vbent:launched.upwards.
'The cat gets launched up into the air...'

Syntactically, T-NM, as markers of transitions, are located between the verb phrases headed by the two subevents that make up the transition. This location in inceptive transitions such as (10) and (11) above is represented in (12) below:

(12) \[ V_S P \ [ (T-NM) V_{D P} \ ...] ]

When marking a telic transition, as in (8) and (9) the T-NM is located between the penultimate and final verb phrases, as shown in (13):

(13) \[ ...[V_{D P} \ [ (T-NM) V_S P] ]\]

We have already seen in (6) that a single P-NM can extend over multiple events. Due to the distinct functions of T- and P-NM a single predicate may contain both types of NM, including T-NM in both of the locations illustrated in (12) and (13) above, marking inception and telicity, as well as a P-NM (14).

(14) \[ V_S P \ [ (T-NM) (P-NM) V_{D P} \ [ (T-NM_2) V_S P] ]\]

The T-NM may be separate forms, or they may represent the onset and offset of the P-NM. Example (15) from ASL shows a T-NM, glossed ‘tongue-flick’ marking a telic change-of-state, specifically a change of shape, following a P-NM.

(15) ASL

\[
\begin{align*}
pursed & \Rightarrow \text{tongue.flick} \\
\text{CAT S:object.hit.head FLATTEN B-Oflat:head.squished} \\
\text{B-Oflat:head.squished} \\
\text{‘The cat's head is squished flat by the falling weight.’}
\end{align*}
\]

Example (16) from ÖGS shows two events, one of hitting a wall, followed by another of sliding down the wall. The first event includes a T-NM, timed with the manual form expressing the impact of the cat hitting the wall. This T-NM is then followed by a P-NM, modifying the slide down the wall.
In both (15) and (16) the events encoded in the utterances are sequential, and T- and P-NM function within the individual CLP consistent with the syntactic analysis discussed above. It is interesting to contrast this behaviour with the P-NM in (6), which extends over multiple CLP and modifies the internal state of the participant in the events. If this is the case, then within the category of NM we have identified as P-NM, there may be differences in behavior depending on whether the adverb is a subject-or-agent-oriented or a manner-of-motion adverbial. We leave this question open to further research.

5. Conclusion

The analysis presented briefly here identifies two phonologically and morphosyntactically distinct nonmanuals produced on the lower face in ÖGS and ASL. T-NM are analyzed here as segmental elements marking transitions in the underlying event structure, co-articulated with manual marking of the same transitions. P-NM, in contrast, modify dynamic subevents, and may have phonological domains that include multiple manual forms. These findings are presented in Table 1 below.

Previous analyses have derived the phonological spreading domain of what we identify here as P-NM through direct reference to syntactic structure, specifically c-command. We derived these domains indirectly, without requiring syntactic notions like c-command to be visible to the phonology, by adopting the Minimal Indirect Reference (MIR) account (Seidl, 2001).

<table>
<thead>
<tr>
<th></th>
<th>Phonology</th>
<th>Semantics</th>
<th>Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture</td>
<td>Continuous facial posture</td>
<td>Manner adverbial</td>
<td>Scope over dynamic VP [(P-NM)VP,P]</td>
</tr>
<tr>
<td>P-NM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td>Single abrupt change of</td>
<td>Marks achievement of</td>
<td>Located between VPs [VP [(T-NM) VP]]</td>
</tr>
<tr>
<td>T-NM</td>
<td>articulator</td>
<td>transitions (e₁⇒e₂)</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Characteristics of P-NM and T-NM
In the MIR, syntactic phases, derived from the head of certain phrases and their complements, are relevant phonological domains. The relevant phase for P-NM is the V-phase (V^0 +Comp). Other phases include the C-phase (C^0+Comp), corresponding roughly to the entire clause, and the D-phase (D^0+Comp), corresponding to DP/NPs. These phases may or may not match prosodic constituents, and deriving the necessary domains without requiring the phonology to directly reference the syntax has important advantages over direct reference accounts, as Seidl (2001) discusses in detail. Future research may identify other NM with these phases as phonological domains. For example, the domain of the brow furrow in ASL appears to correspond to the C-phase.

Transitional NM are analyzed as segmental elements, with phonological domains restricted to single [root] nodes or single syllables. Thus, the phonological domains of T-NM form a useful contrast with those of P-NM in developing analyses that are able to account for the domains of these and other types of NM. The fact that two unrelated and geographically distant sign languages contain two types of NM with such similar phonological forms and morphosyntactic behavior suggests that NM such as these may be cross-linguistically frequent in other sign languages as well.

The behaviors of the types of NM included in the current study are only predictable with reference to the event structure and morphosyntax. However, these NM may serve secondary prosodic domain and boundary marking functions as well. Sign languages, like other natural languages, have rich intonational and prosodic systems as well as morphological and syntactic systems (Sandler and Lillo-Martin, 2006 and others). Unlike spoken languages, the phonological domains of supra-segmental phenomena, whether purely prosodic or derived from syntactic domains, are much easier to identify. Thus, research into nonmanual behaviors in sign languages may have implications for linguistic theory.

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Sign Language Archeology: Integrating Historical Linguistics with Fieldwork on Young Sign Languages

Ted Supalla
University of Rochester

1. The Current State of Theory and Practice

The nature of our understanding of sign languages of the world rests on our specific history of sign language research. The 40-year history of modern sign language research includes both impressive achievements which have advanced our knowledge and research agendas which have narrowed our focus and limited our knowledge. During this time, sign language genesis and evolution has remained a domain largely outside of our focus of interest. Its neglect can be traced to the belief that evolving sign languages were often “contaminated” by oppressive pedagogical practices which attempted to shape sign language to match the spoken majority language. In addition, lexical items from foreign sign languages were often imported as new schools were established in developing countries. This notion of resulting “impure” sign languages meant that historical linguistic researchers were confronted with the fact that “natural” historical processes were likely obscured or destroyed by linguistic imperialism. However, such a view incorrectly denies the natural nature of language contact in human history worldwide. The study of language genesis and evolution is “flying blind” if such natural human interactions are not factored into historical linguistics research.

Research such as comparative linguistic reconstruction in sign language is not only possible, but valuable for supporting the aims of deaf people worldwide. This complex research requires multi-disciplinary sources of documentation and careful interpretation of the language and thoughts of deaf people in the context of the deaf community/society of the time. In time, trained Deaf sign

1 Acknowledgements. I am grateful to my collaborators for their important contributions to the work reviewed on ASL history, young sign languages and International Sign, particularly past and present members of the Research Team at the Sign Language Research Center: Aaron Brace, Patricia Clark, Merrie Davidson, Markku Jokinen, Donald Metlay, Doug McKenney, Elissa Newport, Erin Sigmund, Annie Senghas, Marie Coppolla, Wanette Reynolds, Yutaka Osugi and Rebecca Webb. Thanks also to Betsy Hicks McDonald for assistance with writing and editing of this paper. This research was supported in part by NIH grant DC00167 to Elissa L. Newport and Ted Supalla, and two NEH Fellowship Awards to Ted Supalla.
language specialists and a growing body of knowledge in this field will support efforts toward beneficial linguistic and pedagogical planning for deaf people around the world.

Modern sign language research began with the work of William C. Stokoe and his colleagues on the linguistic validation of American Sign Language (ASL). Compiling lexicographic data, Stokoe and his team identified and documented aspects of individual signs which were structured in ways similar to spoken languages. As research continued, work shifted from validation to the exciting possibility that the manual/visual modality was a “proving ground” for linguistic universals: those formal and substantive language tendencies contained in the theory of Universal Grammar. Many scholars have contributed to the current linguistic model of a multi-tiered, layered process of co-articulation of autosegments expressed by different parts of the signer’s body and surrounding space. However, in the ongoing pursuit of this goal, we have seen this agenda dictating the “interesting” domains and details of linguistic data within a community. Work as a “sign language researcher” has come to mean research in this narrowly-defined area of language history and structure.

Within the broader field of sociolinguistics, the study of human communities and geographical and social mobility and contact are part and parcel of historical research. Within historical sign language research, however, the varied patterns of experiences of deaf individuals striving to shape their lives in society remain unfamiliar to the research community. At times, this is due to a notion that social thought and response to political conditions among deaf people has been uniform across time. Thus the history of interaction among deaf and hearing people is fragmented, being assumed rather than documented, although it is a force which shapes sign language evolution and growth. Also, not yet fully appreciated is the robustness of the maturation process of sign language, even while undergoing cycles of reanalysis triggered by both interventional efforts and the diverse nature of the deaf community, in which only 5% of the community are indigenous members at birth, ideally situated to pass the language along to a following generation. Given these facts, it is clear that the fabric of the deaf community is woven of social bonds among individuals using a common sign language. Such a social infrastructure can be affected by polarization among competing signed and spoken linguistic forces. Moreover, such forces are not necessarily uniform across time, waxing and waning in the history of the community. Researchers have often failed to incorporate patterns of deaf interaction (or lack of it) in their research, proceeding on assumptions and drawing incorrect conclusions about, for example, the age of the signing community and the capacity of deaf communities for full language evolution.

In spite of its complexity, historical linguistic research has a great deal to offer the study of the genesis and evolution of sign languages. It is fortunate that many school archives have stored
historical records, journals and films, thus making it possible to trace the history of signing communities and languages. The integration of linguistic tools and visual, narrative and print resources and documentation can result in a scientifically-informed analysis of the history of a language. Such techniques will be beneficial when applied to both established regional sign languages and newly-emerging and evolving languages. As we view natural processes in action today in young languages, we will be able to resolve gaps in the history of older sign languages.

2. ASL Sign Language Archeology and Historical Linguistics

Recent broad-based interdisciplinary research into the history and evolution of ASL has helped to re-shape our perception of historical materials and processes. Armed with the reconstruction tools of historical linguistics, we have uncovered natural linguistic processes and important language planning efforts in the NAD Gallaudet Lecture Films (Supalla, 2001, 2004; Supalla and Clark, in press). These ASL historical documentary materials were thought to be “impure” as a result of importation of French Sign Language (LSF), educational interventions, and ASL-English bilingual knowledge and practices. However, after re-viewing the films and conducting additional historical research on the individuals and organizations involved, we have uncovered the existence of a “Classic Register” of ASL which no longer exists.

Historical literary research reveals the function of this register as classic oratory of the time, practiced by elite signers passing on the traditional signing of the early Hartford, Connecticut Institute for Deaf Mutes. In the course of at least seven cohort generations of ASL transmission, archaic forms originating at this school have disappeared, with only the oratory texts recorded on film remaining to tell the tale. Research reveals as well the motive of preserving this register on the part of the National Association of the Deaf. Our research creating a full database of the film text corpora, lexically cross-referenced both with other lecture films and historical (early) dictionaries, has provided us with a rich source for tracing linguistic forms, literary and polyglossic practices, and metalanguage of the time. As we became familiar with early ASL structure and pedagogy through this work, we were able to shed light on the gap in ASL history caused by the Dark Epoch of oral pedagogy for Deaf people. We have conducted diachronic and synchronic linguistic comparisons, both within the era of the films and with subsequent and earlier epochs, and we have interpreted the metalanguage of various epochs in the light of this new understanding. Finally, we re-forged a link in the chain of ASL history by considering the protogrammar of ASL as a dynamic form incorporating contact with LSF and Home Signs.
Our new broadened research model has enabled us to widen the scope of inquiry and to reinterpret existing historical documentation. Early metalinguistic descriptions were merely hidden, not lost, during the Dark Epoch. Historical research into the metalanguage of pedagogy shows that early educators considered natural discourse as the educational springboard for young deaf children coming to school with a Home Sign system. Artificially devised sign languages, such as “Methodical Sign”, were deemed meaningless for such children and were only incorporated briefly into educational efforts. “Improved Sign” at school was a standardized natural discourse promoted during this era. One important aspect of “Improved Sign” was the use of syntax for the expression of abstract concepts. In numerous examples, the sign language lexicon was expanded via standardized “word-phrases”

In a sense, we can view Home Sign as a proto-grammar of this “Improved Sign”, with its sequential gestures as the precursor of the Word Phrase. The natural semantic bond among adjacent gestures and groups of gestures is reinforced by the discourse context. Within Sign Language discourse, these word-phrases functioned as a single constituent. As a single unit, they were used continuously in the same order and in the same environments, undergoing natural linguistic processes of reduction and re-analysis, such as compounding, a phenomenon which has been well-described in the field. Within the notion of compounding, however, a further distinction has been overlooked. In some cases, these processes of restructuring and reanalysis gave rise to grammatical paradigms, by triggering a process of cliticization where one component becomes specialized for a specific grammatical category, such as gender. The growth of additional grammatical functions for specific gestures in word-phrase paradigms gives rise to polysemy as an independent lexical item and an emerging grammatical particle share a form. Thus, forms originally independent are converted into bound morphology, in a unidirectional trend of grammatical change, much like that described in historical linguistics and grammatical change in spoken languages (Hopper and Traugott, 2003). This occurred when the positioning of lexical items lacking internal morphology for generative recursion was re-analyzed as a grammatical relation between a host and a secondary particle. In ASL, such processes gave rise to a system of gender in kinship terms. Early ASL word phrases incorporated gender in these terms, as shown below:

**FEMALE, LIFT-BABY** “Mother”
**MALE, LIFT-BABY** “Father”
**MALE, ROCK-BABY** “Son”
**FEMALE, ROCK-BABY** “Daughter”

Imported lexical items from French Sign Language contributed the raw material for many of these word-phrases. Historical research using the Gallaudet Lecture Films has enabled us to uncover
intermediate forms, thus filling in a gap in ASL research between Early ASL forms and modern ASL, where the MALE and FEMALE morphemes have been reduced to mere locations, as part of a systematic kinship paradigm of gender affixes.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Relationship</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>Feminine</td>
<td>PARENT</td>
<td>“Mother”</td>
</tr>
<tr>
<td>Masculine</td>
<td>PARENT</td>
<td>“Father”</td>
</tr>
<tr>
<td>Masculine</td>
<td>OFFSPRING</td>
<td>“Son”</td>
</tr>
<tr>
<td>Feminine</td>
<td>OFFSPRING</td>
<td>“Daughter”</td>
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</table>

Such grammaticalization proceeds from syntactic juxtaposition of content words, to cliticization of the word judged to be “dependent”, to a productive process of affixation, in some cases. Cliticization refers to a phenomenon where a word particle that frequently occurs only in combination with another word becomes dependent on this paradigm, such as the clitic “’m” in “I’m” in the English language. This syntactic dependency triggers diachronic phonological processes, such as the natural reduction of redundant elements found in the second position of the constituent. In signed languages, this second element is often reduced to a mere location, movement, or handshape feature. Examples of the result of this process are the two contrasting location features, one at the forehead area and the other at the lower cheek area, appearing regularly in initial segment of a wider gender-sensitive kinship paradigm. A clitic may evolve into an affix when it becomes a systematic morpheme, used productively in inflectional processes or to generate derived lexical items.

The ASL systems of agency and negation also have undergone this process. Similar to the earlier word phrases for kinship terms, a search of earlier forms reveals regular syntactic phrases using the sign BODY to signal a person involved in a particular activity, such as MOUSTACHE, STEAL, BODY=THIEF. The BODY morpheme has come to be re-analyzed as a particle meaning AGENT, and is now a semi-regular morpheme with limited scope. In earlier ASL negation as well, an archaic form of NOT, in which one or both hands were “waved away” to express negation, appeared in the final VP position, as in: WANT NOT and evolved into a re-analyzed particle, which was then incorporated in a limited way into specific frequent lexical items (cf. DON’T-WANT). The general function of negation was taken over by pre-verbal NOT. Thus, in several ASL paradigms, we see the historical pattern of development shown below (cf. Hopper and Traugott, 2003, for the overall pattern, and Supalla and Clark, in press, for a more detailed description of these examples and the process in ASL).

Thus historical linguistics has provided us with a scientific approach to Sign Language Archeology. While the origin and history of signs in ASL has often been explained through folk
etymology, such as the notion that the sign for “girl” represented the tracing of a bonnet string along the lower cheek, we now have an alternate set of tools and an alternate explanation for current forms, given our “excavation” of Sign Language. It is clear, as in spoken languages, that processes in natural gestural discourse lead to syntax and finally to bound morphology and we are able to see both productive processes and unproductive or opaque remnants of this evolution in modern ASL.

At the same time, our Archeology must also recognize that there exist in signed languages other types of bound forms which are present early in the life of the language and which appear in many sign languages studied thus far. Such forms common throughout the history of sign languages may arise not from widespread linguistic processes of change, but perhaps from the nature of sign languages alone. These forms include spatial pointers, direction of movement of the verb as an agreement marker, and the use of classifier hands. In an overview article “Sign Language Research at the Millenium”, Newport and Supalla (2000) discuss the tendency toward such structures in young sign languages, sign language pidgins, and even home sign systems. I recently surveyed 15 sign languages which have arisen naturally in different parts of the world. This cross-linguistic comparison shows that all use location and movement through space in common ways to mark grammatical agreement with subject and object. “Investigators have also noted classifier structures in verbs of motion of many sign languages. Presumably because of such similarities among unrelated sign languages, speakers of mutually unintelligible sign languages are able to develop a signed pidgin (called International Sign) which retains these morphological structures, and which is thus unexpectedly more complex than spoken pidgins (T. Supalla and Webb, 1995; Webb and T. Supalla, 1995).” (Newport and Supalla, 2000, p. 12) Thus, in historical and comparative research, we see both processes of divergence and convergence across signed languages internationally, and both processes common to all languages and those specific to signed languages.

3. The TISLR9 Theme

Current integration of historical linguistics research and field studies directly affect work relevant to our TISLR9 conference theme: Sign languages: spinning and unraveling the past, present and future. These studies enable us to revisit and revise assumptions about the known past which may be incorrect. Moreover, new tools and data will result from future work on emerging sign languages. The various types of sign language communities and varieties each have a place and a natural role to play in Sign Language Archeology, as shown by our recent analyses of ASL sign language history. We have seen the contributions to an evolving sign language from the home sign
systems of Deaf isolates, young sign languages in new communities, and cross-linguistic contact registers. In this model, work can proceed beyond a single sign language, such as ASL, in understanding the social and linguistic dynamics of language contact and in reconstructing sign language histories and proto-grammar. Missing links in sign language genesis and evolution can be re-forged, and observations on sign language typological variation and universals of Sign Language change will naturally emerge. It is possible that such research will ultimately link sign language research with the even broader research on human gesture, language origins, and species capability for language. This current and future work directly supports the TISLR 9 objectives to “situate the development of sign language studies over time” and “establish international relations between those who study sign language,” thus “creating opportunities for comparative analysis.”

TISLR participants and the World Federation of the Deaf also have broader aspirations for Deaf people and communities worldwide. Visibility and legitimacy for indigenous signed languages are key goals for both TISLR and the WFD. The 1990 WFD report on the Status of Sign Languages described the dissatisfaction of the majority of survey respondents with the level of sign language used in schools. Responding to this clearly felt need, the WFD issued a list of priorities for promoting sign languages around the world, and followed through with membership in the coalition of world organizations which drafted the “Convention on the Rights of Persons with Disabilities”. This statement is a first step in building world-wide infrastructure for sign languages. As we move forward, we will face challenges in designing ideal access to sign language for Deaf people. How will rights such as the right to a signed language and the right to education be implemented in ways which avoid oppressive practices and respect the practices and capability of indigenous communities? How will community signed languages be fostered when most profoundly deaf children are born to hearing parents, and may have no access to education in 80% of developing countries; and when education exists, a role for sign language is rarely advocated? How are we to treat the Home Sign systems which we encounter in such situations?

Historical linguistics research which encompasses the human ecology of Deaf history, such as interaction patterns and cross-linguistic contact, promises the foundation and a “road map” for building an infrastructure for Sign Language in society. The application of research lends credibility and visibility to existing indigenous sign languages. Moreover, research in a broad-based archeological paradigm will provide guidelines for sign language planning and monitoring around the world. As research proceeds, we will become familiar with specific sorts of contact situations, be able to identify similar situations which have occurred earlier in the history of world sign languages, and be able to judge the likely effects of a variety of “imported” languages and
language planning strategies from our knowledge of the past. This familiarity will help us to answer questions and concerns such as the following from Deaf people and national leaders:

- To what extent should we promote cross-linguistic contact in emerging communities?
- What is the most beneficial sort of support to promote a natural transition from home sign systems?
- What are the effects of adopting an outside superstrate sign language if no history or community exists for a developing deaf community?

Such a research paradigm not only aligns with and supports the agenda of Deaf people worldwide, it also widens the scope of research itself and the profession of “the sign language specialist”. The concept of such a resource person has been introduced to schools in industrialized societies to supplement language and speech pathologists from the field of Hearing and Speech science. Additional sign language research careers will become feasible within the “global deaf village”. An appropriately-trained sign language specialist could apply knowledge of research in the following areas:

- The structure and history of sign languages around the world
- Sign language acquisition and the effect of the age at which sign language is learned
- Psycholinguistic processing of Sign language
- The representation of sign language in the brain

Bridges will be built to other fields in the sciences and humanities with the multi-disciplinary research mandated by this broad archeological model. To be sure, the research challenges are many, in areas such as the lack of tools for sign language assessment and resource data for sign language planning and monitoring. In assessment, we are unfamiliar with the full range of sign language variation and interaction. We do not yet have typological classifications for signed languages. Finally, we only have developmental milestones for native sign language acquisition. In our “bank” of resources for sign language planning, we lack extensive data on sign language genesis and history, and have not yet adequately documented patterns of change in signed languages. Nevertheless, “the way forward” clearly lies in broadening research to embrace the reality of the diverse Deaf World and its robust natural sign language systems.

**References**


In this paper I will show how the themes and language used in sign language poetry construct and show Deaf Culture and the identity of Deaf people as a collective visual people. I will use two poems in British Sign Language (BSL), *Five Senses* by Paul Scott and *The Staircase* by Dorothy (‘Dot’) Miles, to explore the images of deafness constructed and presented by two sign language poems.

In *Five Senses*, the poet asks each sense in turn to explain what it is and what it does. The senses of Touch, Taste and Smell are able to oblige by showing the poet what they do. However, Hearing is unable to do this alone. When Hearing is accompanied by Sight, the two senses work together to explain their importance to a Deaf person for perceiving the world. Dot Miles’ poem *The Staircase* was first performed in 1987 at the graduation ceremony of the first British Deaf people to be awarded a qualification in British Sign Language teaching from a British university. The course they had followed was led by Deaf people and taught in sign language. The poem was composed to praise and celebrate the achievement of not only the graduates but also their lead tutor. The English translations of these two poems may be found at the end of this paper.

Sign language poetry, like poetry in any language, uses a heightened form of the language (“art sign”) for aesthetic effect (Sutton-Spence, 2005). Enjoyment is an important element of BSL poetry, and it is an increasingly popular form of language entertainment in the British Deaf Community. However, the poetry also empowers Deaf people. Empowerment may occur simply through using the language, or through the message carried by the language.

Using sign language in a poetic genre is an act of empowerment in itself for Deaf people as members of an oppressed minority language group. For a long time, Deaf people were taught to believe that English was the language to be used for high status situations and that "deaf signing" was low status and only to be used for social conversation. Hearing and Deaf people thought poetry should only be in English, because of its status. Referring to American Sign Language, Alec Ormsby has claimed that before the 1970s, "No poetic register existed in ASL because poetic register was socially inconceivable, and as long as it remained socially inconceivable, it was linguistically pre-empted." (1995, 119) The same is true for BSL. However, changes began in the
1970s to allow sign language poetry to become conceivable and a reality. The slow emergence of "Deaf Pride" – first in America and later in Britain and other countries -, the increasing recognition of sign languages as real, independent languages, and the work of pioneering sign language poets such as Dorothy Miles created a major change in outlook. In this social, historical, cultural and political environment, every performance of a BSL poem, even today, is an act of empowerment, and an implicit expression of pride in a Deaf signer’s language.

The importance of sign language poetry can be understood with reference to the ideas of Deaflore (e.g. Rutherford 1993) and Deafhood (Ladd 2003). Deaflore is the collective knowledge of individual Deaf communities and the shared World Deaf community. At a language level it refers to the language knowledge that makes up the cultural heritage of Deaf communities and this includes knowing and valuing the language elements that form a good poem. Deafhood is the process through which Deaf people discover and develop their Deaf identity as members of a visual collective community. Whereas ‘Deafness’ is a state of being that is determined audiologically and may be construed fundamentally in a negative way, ‘Deafhood’ is an active process of belonging to a linguistic and cultural group and is ultimately a positive journey of discovery. In ‘doing’ Deaflore (including poetry), Deaf people are ‘doing’ Deafhood. Using poetry to empower members of the Deaf community by creating language forms to describe the positive images of the experience of Deaf people is a form of Deafhood.

Images of Deafness in sign language poetry may be considered in terms of a range of themes, including:

- Deafness as “loss”
- Oppression by hearing society and Deaf people fighting back
- The sensory experience of Deaf people
- Celebration of Deaf success and the Deaf community
- Celebration of deafness (Deafhood?) and sign language
- The place of Deaf people in the world

1. Deafness as a “loss”

I have included this category in discussion of images in sign language poetry, even though I have yet to find a sign language poem that focuses in a negative way on a sense of loss of hearing for Deaf people. This fact needs to be highlighted because it is notably different from some poetry that is written by deaf people using the language of the dominant hearing community, rather than in sign
language. In poetry written by some deaf people, loss of hearing may be an issue but using sign language seems to presuppose a sense of Deafhood, which means the idea of loss is not considered.

Paul Scott’s *Five Senses* directly addresses the issue of a Deaf person’s sensory experience, including the inability to hear, and yet there is no image of loss. There is a powerful sense of ownership in the poem, clearly expressing the poet’s identity as a visual person. While it is clear the sense of Hearing cannot function alone, loss is not an issue because vision is so satisfactory to the Deaf person’s experience. In Dot Miles’ *The Staircase*, there is no explicit mention of deafness at all, but the characters are simply assumed to be Deaf. At the start of the poem, the people are lost and afraid, but there is no intimation that this is because they cannot hear. Rather it is simply that they have never been given the opportunity and leadership they need to succeed. When these are offered, they are able to achieve their dreams. Loss of hearing is not an issue.

However, in contrast to these signed poems, some poetry written by deaf people in the language of the hearing majority may refer to a deaf person’s sense of loss. John Carlin’s *The Mute’s Lament*, written in 1847, is an example of a poem written by a deaf person that demonstrates this.

The opening lines run:

*I move, a silent exile on this earth;*  
*As in his dreary cell one doomed for life,*  
*My tongue is mute, and closed ear heedeth not;*  
*No gleam of hope this darkened mind assures*  
*That the blest power of speech shall e'er be known.*  
*Murmuring gayly o'er their pebbly beds*  
*The limpid streamlets, as they onward flow*  
*Through verdant meadows and responding woodlands,*  
*Vocal with many tones - I hear then not.*  
*The linnet's dulcet tone, the robin's strain,*  
*The whip-poor-will's, the lightsome mockbird's cry,*  
*When merrily from branch to branch they skip,*  
*Flap their blithe wings, and o'er the tranquil air*  
*Diffuse their melodies - I hear them not.*
2. Oppression by Hearing Society and Deaf people fighting back

Sign language poetry may address some of the issues of oppression by hearing society, but it is from the perspective that the problem lies with hearing society and that Deaf people can fight it to achieve equality. Sign language poems empower the Deaf community by writing about deafness and sign language in a positive way. They are optimistic and show Deaf people as people in control of their own destiny. They acknowledge problems faced by Deaf people, and some identify the role that hearing people have played in oppressing Deaf people, but they can show the strength of Deaf people living in a hearing world. In *The Staircase*, the people have clearly been oppressed by hearing society, as represented by the lion, the bog and the giant with his sword. But they overcome their fears of these three dangers, overcoming oppression by the hearing world, and set out to achieve their dream.

3. The sensory experience of Deaf people

The sensory experience of Deaf people features in many sign language poems. Sound and speech are usually irrelevant and, instead, ideas of sight are brought to the foreground, reaffirming the positive side of the Deaf experience of life and the existence of Deaf people as a visual people. Time and again, the ideas of looking, seeing, eyes and vision occur in sign poems. There are many occasions of "looking" that arise in signed poems because of the importance of vision and sight to the Deaf poet and the Deaf audience. Placing these images in the sign language poem empowers poet and audience, showing their visual identity and their Deafhood.

This visual perspective on the world is seen clearly in both *Five Senses* and *The Staircase*. Examples vary from explicit use of verbs of vision to everyday phrases that are especially significant in the context of the poems.

Lines from *The Staircase* demonstrate this very clearly:

"A **dark** forest. A figure creeps forward, **peering** ahead, …

… they see a **light** that **glimmers**,

**glimmers.**"

In the "Deaf" forest, the enticing image is light in darkness. For a society that values vision so highly, darkness must be avoided and light is sought. The sign used in the poem to show the glimmering light is formationally similar to the sign showing the whole group of people rushing towards their prize, and also to the sign APPLAUSE used at the end. Thus, the language used
shows the relationship between Deaf people and light, the collective identity of Deaf people and the celebration of both these aspects of Deafhood.

**Formationally similar signs: ‘Lights glimmering’, ‘People rushing forward’ and ‘Applause’**

In Paul Scott’s *Five Senses*, the senses of Touch, Taste and Smell all share the sense of Sight. Touch looks at the cold and hot objects and at his frozen and burnt hands; Taste looks carefully at the delicious (and not so delicious) food before and after eating it; and Smell also looks at the flower, the cheese and the delicious morsel. The use of the eyes is particularly powerful in this poem.

**‘Touch’, ‘Taste’ and ‘Smell’ all using their eyes**

Each sense “comes to life” when the finger straightens and the eyes open. At the end of its turn, the sense withdraws by closing the finger into the fist and closing the eyes. In fact, the eyes seem to lead us through this poem. The main problem with Hearing is not that it cannot hear, but that it cannot see. (Related to this is the fact that it cannot stand up straight. Phyllis Wilcox (2000) has observed that health and vitality are expressed metaphorically by upright forms, so the senses that are able to stand up tall are healthy. Hearing is not fully formed and independent and that finger cannot stand upright until it is joined by another finger representing Sight.)
‘Hearing’ unable to stand up straight or open its eyes

4. Celebration of Deaf success and success of the Deaf community

All sign language poems are implicit celebrations of sign language and the Deaf community, but some poems focus upon them explicitly. Some poems address the familiar dilemma faced by Deaf people: do they stay safe within an undemanding but limiting life or do they attempt to improve their situation, risking the security of their unchallenging world? This theme occurs in many Deaf poems including *The Staircase*.

The theme in *The Staircase* is one of Deaf people who are offered a challenge and the chance of winning great rewards. The challenge is not without risks and they need to decide whether or not to accept it. The poem describes how their fear of possible lions, swamps and giants leads them to refuse the challenge, but one member of their group encourages them to take the risk and climb to success. The way that the group achieves success is shown in an especially “Deaf” way in the poem. Firstly, the hero is not a typical hero in the “Superhero” mould. He is described as being “balding, spectacled and somewhat plump”, yet he is the one who leads them to their triumph. The important message here is that anyone in the Deaf community can be a hero. Secondly, the hero leads the people up the stairs step by step. Often, the only way for Deaf people to succeed in life has been to leave the Deaf world and join the hearing world. Such an image might have been shown in *The Staircase* by the hero running to the top of the stairs and then beckoning to the others to follow him. The distance between the top and bottom of the staircase would be too great, however, and the others would not be able to make the journey alone. Instead, he climbs the first step, checks that everything is safe and helps people up. They, in turn, help other people onto that first step until they are all united in their small advance. Such an approach to success in the Deaf community comes from an especially Deaf perspective.

5. Celebration of deafness, Deafhood and Sign Language

*Five Senses* celebrates the visual idea deafness and sign language. The language is deliberately used to bring key ideas to the fore. In BSL all handshapes with a single finger extended are legal, except for the single ring finger extended (see the figure in the preceding paragraph). This is the handshape
he uses to represent the bewildered, uncooperative sense of hearing. It does not occur in any signs in BSL and is physically very difficult to articulate, especially with the non-dominant hand (as it is used here). The final sign of the entire poem also uses an illegal handshape - all five fingers open and spread, except for the little finger, which contacts the ring finger. This sign summarises the senses for the poet and is highly creative and so marked that it requires considerable skill on the part of the performer to articulate on the non-dominant hand (indeed, some people find it physically impossible to do).

![‘Illegal’ handshape in the sign “This is me” showing the Deaf poet’s identity of Sight and Hearing fused](image)

Throughout the poem the characterisation has consisted of a single questioning character and the different senses, but in the poem’s coda, the poet/performer comes to the foreground of the performance and steps out of the expected role of narrator to say, "This is me". This is a strongly empowering moment, as the performer takes the boldly obtrusive step of explicitly "owning" the content of the poem. Although we normally expect the person who composed the poem to perform it, any Deaf signer could potentially perform *Five Senses*. However, if a hearing person were to perform it the meaning so powerfully conveyed by this final act of identification would be radically changed - perhaps to the point of meaninglessness. This shows that the poem is a particularly strong expression of self-identity by a Deaf person.

*Five Senses* also uses symmetry extensively. The balanced use of space and the symmetrical two-handed signs are very aesthetically appealing, so that it is simply a pleasure to watch. They also have symbolic value, carrying ideas of unifying polar opposites and the Deaf person’s sense of “rightness” that comes from sign language.

Much of the poem uses the device of keeping both hands in use, using different information on each hand. The non-dominant hand permanently produces information that is perceived simultaneously with the information from the dominant hand. For much of the poem, the non-dominant hand holds either the simple 'A' handshape representing the group of “sleeping” senses, or the handshape appropriate to the particular sense - the 'Å' for Touch, the 'G' for Taste, the 'middle
finger' handshape for Smell, the 'I' for Sight and 'BSL 7' for Sight & Hearing. This use of the non-
dominant hand focuses on the sense under discussion.

Å in Touch                          ‘G’ in Taste                  Middle finger in Smell

‘I’ in Sight                    Ring and little fingers
in Sight and Hearing

Five Senses uses three main ways of creating symmetry in signed poems: sequential
placement of one-handed or two-handed signs in opposing areas of space; simultaneous use of two
one-handed signs that are opposed symmetrically; and use of symmetrical two-handed signs
(Sutton-Spence and Kaneko, in press). The use of symmetrical space in the poem has a pattern, so
that for the first three senses, symmetry is mostly created through sequential location of signs in
opposing areas of space. This reflects the duality of the ideas shown in the poem, which are an
integral part of bilateral symmetry. For instance, with Touch the right hand reaches out to the right
to touch something cold and then withdraws before the left hand reaches out to the left to touch
something hot. The balanced, opposing use of space and hands reflects the opposing semantics of
hot and cold. This spatial representation of hot and cold creates symmetry in a way that merely
signing HOT (a one handed sign) and COLD (a two-handed sign) would not. For Taste, the actions
are all performed by the right hand but it first holds and eats a delicious ice-cream on the right, then
takes a scoop of something unpleasant-tasting from the left and finally takes a scoop of something
more pleasant-tasting from the right. With Smell, the nice scented flower is picked and smelled
from the right using signs made with both hands, then the less-nice smelly cheese is taken from the
fridge on the left (again using both hands), before the agreeable morsel (unspecified in the poem)
that is eaten and then sniffed appreciatively comes from the right. The balanced use of signing space creates a feeling of symmetry in which these semantic opposites are bound by the central plane of symmetry. As the central plane is occupied by the personified form of the sense in question (achieved through active embodiment of the sense using personification) each sense “vignette” is shown as a complete and unified experience.

In the fourth stanza, where Sight and Hearing work together, the symmetrically balanced one-handed signs are replaced by entirely two-handed symmetrical signs. The symmetry thus changes from being sequentially produced to being simultaneously shown. Using two hands to produce single signs parallels the senses of Sight and Hearing which are, themselves, combined into one. In this stanza are the signs EYES-OPEN, INFORMATION-THROUGH-EYES (there is no ready English equivalent term for this idea of "hearing through the eyes") INFORMATION, SPEED, COLOURS, MOVEMENT, LEARN and finally TAKE-EVERYTHING-IN-THROUGH-EYES. The signs are all symmetrical across the vertical plane, which is the natural bilateral symmetry for the human body.
In *The Staircase*, the language is also used symbolically to express Deaf identity. Here, symmetry and balance are used to signify the togetherness and collective nature of the Deaf community. In *The Staircase*, the same sign is often articulated on the left and the right hand sides. There is important symbolism behind this, because a central theme of this poem is “unity”. Keeping both sides of signing space balanced shows the unity of the group climbing the staircase to reach their goal. Although the individuals are separate people, they are bound together partly through the unifying device of spatial symmetry, which shows a collective sense of identity.

Proform signs that are used to represent the actions of numbers of individuals can create symmetry. Where there is an even number of individuals, half of them can be shown on each hand. This occurs in *The Staircase*, creating symmetry in the opening lines as the people wander, lost, through the forest. The English lines run:

*A dark forest. A figure creeps forward, peering ahead,*
*Then comes another and another.*
*They draw together in uncertainty, then in a line,*
*They advance.*

This may be glossed in BSL as follows, with the glossed signs placed left, right and centrally on the page to represent how they are placed in space:

FOREST
DARK
PEOPLE
HAVE
ONE-PERSON-MOVES-FORWARD
ONE-PERSON-MOVES-FORWARD
TWO-People-Move-Forward
TWO-PEOPLE-MOVE-FORWARD
EIGHT-PEOPLE-(2x4)-MOVE-FORWARD
MANY-PEOPLE-(2x5)-MOVE-FORWARD

The signs are placed symmetrically across the central vertical plane. As the numbers in the group grow, there is initially some asymmetry as one of the handshapes changes to reflect the increased number, but symmetry is restored each time as the numbers shown on each hand balance out. This pattern of asymmetry followed by symmetry occurs again in the poem when the hero helps the group up the stairs. Once he is on the first step, he signs COME-ON to the left-hand side of signing space and the next sign may be glossed as HELP-PERSON-UP. This is then repeated, using the other hand, to the other side of signing space, creating symmetry in the poem. The next proform sign PERSON-CLIMBS-ONTO-STEP is then made with the left hand to the left and then with the right hand to the right, so that both sides are balanced again. This maintenance of symmetry despite occasional shifts to asymmetry is an important part of the poem, which uses "unity in change" as a central theme.

6. Conclusion

This paper has only considered two poems out of a large potential canon of BSL poetry. However, any number of other BSL poems could be used to demonstrate similar examples of the images of deafness and ways of creating those images. Creating positive images of the Deaf experience through the use of deliberately creative and aesthetically satisfying language contributes greatly to a positive identity that may be seen as an expression of Deafhood.

Acknowledgements:

I am very grateful to Paul Scott, Don Read and the BBC for their permission to use the images here. Several of Paul Scott’s poem, including Five Senses, may be viewed at www.deafstation.org (please register for deafstation, then enter deafstation, go to main menu, entertainment and choose poetry, then Paul Scott. http://www.deafstation.org/deafstationDev/getAllPC.do;jsessionid=4D62D8B004B1619F5288DE87047E743A?preferredClientId=1&preferredClipId=3&PCCotentIt emMasterId=6033

Paul’s poems may also be bought in a DVD format from Forest Books at www.forestbooks.com
THE STAIRCASE – AN ALLEGORY

A dark forest. A figure creeps forward, peering ahead,
Then comes another and another.
They draw together in uncertainty, then in a line,

They advance.
But they come to a wall.
They retreat, gazing upwards - what is it?
Ah, it's a huge staircase.

Suddenly at the tip they see a light that glimmers, glimmers.
They are drawn to it and look at each other - who will climb up first?
Perhaps the one who climbs will face a lion's claws.
Or sink into the ground.
Or meet a giant with a sword and lose his head.

They back away and turn to go.
Then one of them, balding, spectacled, somewhat plump - says No;
Goes forward, climbs, looks around, sees all is well;
Beckons them on and heaves up those on either side of him,
Who then heave others, until all are in line on the first step.
On his left is a woman, short-haired and spectacled too,
Eager to give support.
He moves on again, climbs up, beckons and hoists…
Again the line is straight.
So up and up they go, stair after stair,
And see that the glimmering light now glows around
What looks like a sword embedded in a stone,
Such as a king once drew and held aloft.
They press forward and someone reaches to grasp the sword's hilt - Lo and behold, it's a certificate!
One by one in a line they each get one.

But where's the man, balding, spectacled, somewhat plump?
He's sitting, looking on, applauding them, then rises and leaves.

And the woman - she takes up her certificate like a flag,
And leads the onward parade.

(Translation by Dot Miles)

**Five Senses**

Excuse me, but who are you?
Who am I? Come with me and see.
Feel your arms tingle at my embrace.
Reach out - oh, that's cold!
Reach out - oh, that's hot!
So, now you know me.

Excuse me, but who are you?
Who am I? Come with me and see.
A lick of ice-cream - mmm
A scoop of that - yuck!
A scoop of this - yum!
So, now you know me.

Excuse me, but who are you?
Who am I? Come with me and see.
Pick a flower and sniff - lovely!
Take some cheese from the fridge - whiffy!
Pop this tasty morsel in your mouth,
Yes, and it smells good too.
So, now you know me.

Excuse me, but who are you?
Excuse me?

Excuse me, but what's wrong with him?
Oh, we're together.
Together?
Yes, come with us and see.
Eyes wide open, seeing and understanding.
Information and learning,
Colours, speed, action.
Learning and drinking in the world through the eyes.
So now you know us.

And now you know me.

(Translation by Rachel Sutton-Spence)
Is Hong Kong Sign Language a discourse-configurational language?

Felix SZE,
University of Bristol, Chinese University of Hong Kong

0. Introduction:
Findings from previous studies show that constituent order in sign languages is to a large extent determined by discourse factors such as topic and focus. ASL, BSL and ISL are claimed to be topic-prominent languages (Janzen 1995, 1999, Deuchar 1984, Rosenstein 2001). Wilbur (1997), on the other hand, proposes that the surface word order of ASL is determined by what information is in focus. This paper presents the preliminary findings of an attempt to investigate the extent to which Hong Kong Sign Language (HKSL hereafter) can be considered topic-prominent and focus-prominent according to the notion of discourse configurationality defined by Kiss (1995, 1997, 2001). Within the framework of generative grammar, Kiss proposes that a language is discourse-configurational if it links either or both of the discourse-semantic functions topic and focus to particular structural positions: topic-prominent languages encode the topic function structurally whereas the focus-prominent languages encode the focus function structurally. With elicited data from and intuition of four HKSL native deaf signers, I would like to argue that HKSL is probably not a topic-prominent language owing to the fact that the difference between thetic and categorical judgment is not clearly reflected syntactically as in other topic-prominent languages. My data, however, provides preliminary evidence that HKSL is focus-prominent because assigning the focused constituent to a post-verbal position is one of the ways identification focus can be manifested in the grammar.
1. **Topic prominence**

1.1. **Topic, Categorical vs Thetic Judgment and Topic prominence**

According to Kiss, ‘topic’ is the function of the constituent which is predicated about in the sentence. Observations within and across languages show that the topic function is most frequently carried out by the grammatical subject, the constituent bearing the most prominent theta role in a sentence. The reason behind this correlation is that a human topic is preferred to a non-human one, and a subject more often has the feature [human] than a non-subject. The most common instantiations of topic constituents include proper names, definite NPs, specific indefinite NPs, and generic NPs.

Nonetheless, not all sentences contain a topic. A sentence contains a topic only if it expresses predication about an individual. Whether a sentence expresses a predication about an individual is captured in the logical theory by Marty (1918, 1965), which was later adopted by linguists such as Kuroda (1972-3) and Sasse (1987). According to Marty, judgments can be classified into two major types: categorical and thetic. Categorical judgment consists of two acts: the act of recognition of that which is to be made the subject of predication, and the act of affirming or denying what is expressed by the predicate about the subject. Categorical judgment has a notional subject – notional predicate structure: a constituent denoting an entity is being foregrounded and is then commented by a predicate. Two examples of categorical judgment provided by Kiss are shown below (1995:7):

1. Fido is chewing a bone.
2. The dog is a domestic animal.

Thetic judgment consists of a single act: the act of the recognition of the material of a judgment. A thetic judgment does not contain a notional subject/topic. Examples of thetic sentences include impersonal sentences, existential sentences, and sentences with non-specific indefinite
subjects (Kiss 1995:7):

(3) It is raining.  (impersonal sentence)
(4) There is a dog in the room.  (existential sentence)
(5) A dog came into the room.  (a sentence with a non-specific indefinite subject)

Sasse (1987) argues that the concepts of thetic and categorical judgment can be adopted to interpret the typological difference between topic and subject prominent languages proposed by Li and Thompson (1976). According to Sasse, this typological distinction can be seen as a reflection of the differences in the syntactic realization of categorical and thetic judgment in a language. Sasse claims that subject prominent languages, as in English, realize both categorical and thetic statement through grammatical subject-predicate constructions, and ‘dethematize’ the grammatical subject in thetic sentences only by phonological means. In contrast, in topic prominent languages such as Hungarian or Chinese, categorical and thetic statements are realized through different syntactic structures, which directly reflect the notional predication structures of the given sentences.

Following Sasse’s line of thought, Kiss (1995, 1997, 2001) defines topic-prominent languages as those in which the syntactic structure of sentences is the direct equivalent of their logical-semantic structure, that is, their categorical or thetic character. Subject-prominent languages, on the other hand, are those in which sentences invariably display a syntactic predication structure, whether or not they express predication on the logical-semantic level. Kiss (1997) makes use of two contexts to elucidate how categorical and thetic judgment are realized in different syntactical structures in topic-prominent languages:

- Context (a): Several girl-friends of yours were waiting for the bus. The bus arrived. *A girl got on the bus.*  (categorical judgment)
- Context (b): You were sitting in a bus alone at night, frightened. Luckily, *a girl got on the bus.*  (thetic judgment)
Swedish (topic-prominent language)

6a. En flicka steg på bussen. (categorical)
   a girl got on the-bus

6b. Det steg en flicka på bussen (thetic)
   there got a girl on the-bus

Turkish (topic prominent language)

7a. Bir kiz otobüs-e bin-di. (categorical)
   a girl bus-DAT board-PST

7b. Otobüs-e bir kiz bin-di (thetic)
   bus-DAT a girl board-PST

In the above examples from Swedish and Turkish provide by Kiss, the syntactic structures directly reflect the predication on the logical-semantic level. In both languages, the grammatical subjects of categorical sentences sentence-initially, whereas the subjects of thetic judgment remain inside the predication. Similar syntactic alternations can also be found in Cantonese, a Chinese dialect spoken by the majority of the hearing population in Hong Kong:

(8a) zau2-zo2     go3-hok6sang1    jap6lai4
    come-ASP    CL-student    inside
    “A student has come in.’ (thetic judgment)

(8b) go3-hok6sang1  zau2-zo2  jap6lai4
    CL-student     come-ASP    inside
    “The student has come in.’ (categorical judgment)
Example (8a) shows a thetic judgment in Cantonese, with the postverbal NP go3-hok6sang1 (a student) necessarily interpreted as indefinite. In contrast, the preverbal NP in the categorical sentence (8b) must refer to a specific and definite NP.

Given the crosslinguistic observations on the linkage between topic prominence and thetic/categorical judgment, the first research question in this paper is: does HKSL also exhibit syntactic alternations to differentiate the logical-semantic distinctions of thetic and categorical judgment as in other topic-prominent languages?

1.2. Research Methodology on Topic Prominence

Four native deaf signers of HKSL, two females and two males, participated in this study. They are all in their twenties and graduated from the same deaf day-school. All of them have deaf signing parents and sign language was their first language. Four contexts were designed to elicit thetic sentences from the signers. To ensure that the signing was natural, the informants worked in pairs, and they signed the sentences out as if they were having a conversation. The contexts were explained to them in signs by the author of this study. They were allowed to discuss the signing among themselves if they felt necessary before the recording took place.

The four contexts for the thetic judgments are listed as follows:

Context 1:

(A is working in the office. Looking out of the window, A sees a big crowd of people on the road and wonders what has happened. B then comes back from the outside.)

A: Why are there so many people looking at something on the road? What has happened?

B: A girl has just been knocked down by a car. (thetic judgment)

Originally, I intended to use similar contexts to elicit the corresponding categorical sentences. As I expected, however, the subject of a categorical judgment is either expressed as a pronominal or null argument due to its topical status in the preceding discourse. This makes direct comparisons with the full NP subjects of the thetic sentences difficult. In other spontaneous conversation data of my own research, activated subjects may appear in the form of a full NP in categorical sentences when there is a topic shift. Except for some sentences that involve right-dislocated subjects, the majority of these categorical sentences assume the canonical order of subject-predicate (SVO or SOV depending on verb types). Basing on this observation, I assume that the subjects of categorical sentences appear pre-verbally.
Context 2:
(A, B, and Jafi are discussing their research project in the office. A and B are both deaf but B can hear some sounds with the help of hearing aids. In the middle of the discussion, Jafi suddenly stands up and walks towards the door hurriedly. A wonders what has happened.)
A: Why did Jafi stand up and walk towards the door all of a sudden?
B: Someone has come and is knocking on the door. (thetic judgment)

Context 3:
A group of colleagues are having a retreat in a rented flat in the countryside. Having the hearing aid on, A hears some continuous noises and asks another colleague, B, who has relatively better hearing.
A: Can you hear some strange noises?
B: Don’t worry. Some dogs are barking. (thetic judgment)

Context 4:
You were sitting in a bus alone at night, frightened. Luckily, a girl got on the bus. (The thetic context designed by Kiss for her cross-linguistic study of topic-prominence, Kiss 1997)

1.3. Syntactic realization of thetic judgments in Hong Kong Sign Language
Elicited data from the four native signers in the current study show that thetic sentences are realized as primary predication structures, at least as the surface word order reflects:

Example (9) (context 1):

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2 The sign SOME involves a 1-handshape with an outward palm orientation. It makes use of a tremor pivoting movement at the wrist roughly across a horizontal path at the signer’s eye level in the neutral space.
Examples of signed thetic sentences by HKSL signers show that the surface word order of thetic judgments does not differ from that of categorical judgments.

1.4. Alternative syntactic tests for thetic/categorical distinction?

Kiss (1997) argues that although in English both thetic and categorical sentences manifest the same SV order, the subjects of these two types of sentences actually occupy different structural positions. This subtle distinction is evident in the possible placements for sentence adverbials and negative
particles in thetic and categorical sentences (examples 33 and 34 in Kiss 1997):

(13a) John fortunately has been born on time. (categorical judgment)
(13b) *A baby fortunately has been born. (thetic judgment)

(14a) Not a baby was born.
(14b) *Not John was born on time.

As Kiss (1997) explains, as the usual position of sentence adverbials and the negative particles across languages is between the subject of predication and the Predicate Phrase, the above asymmetry in thetic and categorical sentences can provide evidence that non-specific subjects are internal to the Predicate Phrase (IP), whereas the specific subjects are external to it.

Since the subjects of both thetic and categorical sentences in HKSL appear preverbally, an attempt was made to look for possible syntactic tests in HKSL similar to the sentence adverbials and negative particles in English. From my observation, however, there seems to be a lack of sentence adverbs in HKSL corresponding to those in English. Most sentence adverbs in English are speaker-oriented, expressing the speaker’s comment on or evaluation of the propositional content of the sentence. In HKSL, however, these functions are usually realized as non-manual features (e.g. facial expression accompanying a sentence), a wh-cleft structure (e.g. LUCKY WHAT? IX-1p FATHER DIE NOT-HAVE ‘Luckily, my father survived’), or an independent adjective following the sentence to be commented on (e.g. IX-3p GREEDY, OBVIOUS ‘He is greedy. That’s obvious’). Therefore, there seems to be no suitable sentence adverbials that can help determine whether non-specific subjects in thetic sentences are internal or external to the Predicate Phrase. Negative particles in HKSL provide no reliable clue, either, as they are restricted to the sentence-final position in the majority of cases.

To the best of my knowledge, the only syntactic unit whose placement may be sensitive to
thetic/categorical distinction is temporal adverbials such as PAST and RECENTLY. According to the intuition of native signers, PAST or RECENTLY can appear after a definite subject if the sentence is categorical, but can be sentence-initial if the context requires a thetic reading:

**Example 15:**
Signer B: RECENTLY JENNY TAKE-AWAY. “Jenny took it away recently” (thetic sentence)

**Example 16:**
Sign A: JENNY RECENTLY BORROW SIGN-LANGUAGE BOOKS MANY, WHY?
“Jenny recently borrowed a lot of sign language books. Do you know why?” (categorical sentence)

However, this still cannot serve as a conclusive test for thetic/categorical distinction because a non-specific subject may sometimes appear before a temporal adverbial, as in the following sentence:

(17) SOME STUDENT RECENTLY PUNCH SCHOOL-PRINCIPAL. KNOW YOU
“A student punched the school principal recently. Do you know it?”

It is well-known that non-specific indefinite NP cannot serve as a notional subject. Hence, temporal adverbials such as RECENTLY may not serve as a reliable clue for thetic/categorical distinction. Further research is warranted in order to find out whether subjects of thetic and categorical sentences occupy different syntactic positions in Hong Kong Sign Language.
1.5. **Summary of findings on topic prominence in HKSL**

In brief, the surface syntactic word of HKSL is not reflective of their logical-semantic predication as in other topic-prominent languages. The evidence presented here so far indicates that HKSL is probably not topic-prominent in accordance with the discourse-configurational theory proposed by Kiss.

**2. Focus Prominence**

2.1. **Information focus vs identificational focus**

According to Kiss, focus is used in at least two different senses in the literature: information focus and identificational focus. Information focus refers to the part of the sentence that carries new information. It is used in contrast to the presupposed part of the sentence (i.e. background). There is no restriction on the constituent size of the information focus. It can be an N, NP, ADJ, VP, or even an entire sentence in the case of ‘wide focus’. Identificational focus is sometimes called focus operator in the literature. It introduces a set and identifies a subset of it as such of which the predicate exclusively holds. It is a major constituent of the sentence, which undergoes operator movement either in syntax or in LF to a position from which it c-commands its scope (Focus Movement). In the following Hungarian example of identificational focus provided by Kiss (1995:15), the context invokes a set of members, for instance, students of a class, and the focusing of János means that among this set of members only John got A+.

(18) JÁNOS kapott jeste
    John got A+
    “It was John who got A+”

Presumably, every language is capable of expressing the discourse-semantic notion of identificational focus, but the means by which it is expressed may differ across languages. The two most commonly seen methods are phonological and structural. Some languages express identificational focus by stress and
intonation. Other languages express identificational focus through an invariant structural position, with or without a morphological focus marker. Kiss argues that languages which express identificational focus in an invariant structural position are focus-prominent. In her observation, focus-prominent languages are often also topic prominent, but not necessarily so. There are topic-prominent languages with no structural focus, such as Japanese, and there are also non-topic-prominent languages with structural focus. The second research question of this paper concerns the extent to which HKSL can be considered focus prominent according to Kiss’s definition.

2.2. Research Methodology on Focus Prominence

To find out how identificational focus is expressed in Hong Kong Sign Language, seven contexts were designed to elicit identificational focus on different types of syntactic constituents, including subject NP, object NP and the verb:

i. Jafi said it was Ng that gave the book to Jenny. (subject of the subordinate clause)

ii. It was Brenda and Kenny who went to Brazil. (subject)

iii. It was books that father bought. (object)

iv. It was Jenny whom Jafi saw in the office. (object)

v. Lisa and Fok only observed the teaching in the classroom; they did not teach or play or participate in any caring work. (verb)

vi. Mother only scolded Chun Chun. She did not beat him up. (verb)

The contexts were explained to the four native signers in signs by the author of this study. The signers worked in pairs, and they were given time to discuss how these sentences could be expressed naturally before the recording started.

2.3. Expression of Identification Focus in Hong Kong Sign Language

Interestingly, identificational focus in HKSL can be expressed in a variety of ways, including a fixed structural position and focus-in-situ. In what follows, I will basically use identificational focus
involving subjects as examples, due to the fact that subjects, which are canonically preverbal in HKSL, can best illustrate Focus Movement which results in the structural encoding of identificational focus in a postverbal position.³

First of all, the meaning of exclusivity can be expressed by context without invoking any morphological, phonological or syntactic markings.⁴

(19) JAFI SAY NG BOOK GIVE JENNY ONE, ANYONE GIVE NOT-HAVE

Focus-in-situ is allowable in the presence of ONLY-ONE.⁵

(20) JAFI SAY NG ONLY-ONE BOOK GIVE JENNY

It is possible to mark the constituent bearing the identificational focus with brow raise and pressed protruded lips without any change in word order.

brow raise & pressed protruded lips

(21) KENNY BRENDA TWO-BOTH CL-two-go-to BRAZIL

³ As I observe, identificational focus can be expressed by similar strategies regardless of whether the subject is embedded or not.
⁴ In fact, this method is considered by all four signers to be the clearest way to express exclusivity. They only came up with other strategies when I urged them to try to use one sentence to express identificational focus.
⁵ Note that the lexical item ONLY-ONE takes a variety of form: (a) an index finger releasing from a fist with a leftward path movement (for right-handers) in front of the signer’s forehead (or with initial contact with the forehead); (b) an upward 1-handshape with an inward palm orientation plus a bending movement of the wrist towards the signer in the neutral space; (c) a 1-handshape with a downward facing palm plus a pronating movement of the wrist. The preliminary observation shows that form (a) and (b) can be used when NP is being focused. Form (c) is used exclusively for focused verbs in this study’s data set. Signers can also use numerals such as ONE, followed by FINISH-exclusive. It seems that the lexical item ONE is in the process of being grammaticalized into some kind of morphological marker for exclusiveness. Due to time constraint I cannot go any further into this intriguing phenomenon and would like to leave it for future research.
Signers may also assign a locus for the focused NP referent and use the lexical item ONLY-ONE which agrees with it at the end of the sentence:

(22) JAFI TELL-ME IX-ng_i NG BOOK GIVE JENNY ONLY-ONE_i

The above methods to express identificational focus do not involve a change in word order. Yet signers can employ structural means to represent exclusivity. One way of doing this is to use a wh-cleft construction with the focused constituent followed by the lexical item ONLY-ONE.

(22) JAFI SAY BOOK GIVE JENNY WHO? NG ONLY-ONE

The second syntactic means is to associate the focused constituents structurally to a postverbal position⁶ plus the sign FINISH-exclusive⁷:

(23) FLY-TO BRAZIL, IX-1P BREND A WE-BOTH FINISH-exclusive

2.4. Summary of Findings

In brief, signers may adopt a variety of ways to mark identificational focus in HKSL, and associating focus with a structural position is just one of them. HKSL is therefore focus-prominent according to the definition provided by Kiss. However, HKSL may be considered less focus-prominent when compared with other languages in which structural position is the only means to encode identificational focus.

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⁶ I would like to leave the direction of movement (whether the focused elements move rightward or the non-focused elements move leftward) open here for future research. Although the focused constituent in the example appears sentence-finally, other constituents such as negator and modal may appear after it. Hence the focused position is probably post-verbal rather than sentence-final in HKSL.

⁷ This FINISH-exclusive is accompanied with pressed, protruded lips. It involves a spread 5-handshape, an inward palm orientation and a (or repeated) pronating movement at the wrist in the neutral space. It is therefore non-manually different from the aspectual marker FINISH, which is not accompanied with a specific set of non-manual features.
3. Conclusion

This paper has made an attempt to test whether Hong Kong Sign Language can be considered discourse-configurational on the basis of Kiss’s notions of topic and focus prominence. Preliminary observations suggest that HKSL is probably not topic prominent because the thetic/categorical distinction is not reflected directly in the syntactic predication structures as in other topic-prominent languages. Identificational focus can be encoded structurally in HKSL, as the focused constituent can be postposed to a postverbal position with or without the lexical item ONLY-ONE. HKSL can therefore be considered focus-prominent.

It should be noted, however, that this paper actually raises more questions than it can answer, as a number of important issues are left unaddressed. Although both thetic and categorical subjects show up in the preverbal position in HKSL, it is still possible for these two types of subjects to occupy different syntactic positions as in English. Further syntactic tests are needed to see whether HKSL is similar to English in this regard. If HKSL is indeed not topic-prominent, as the preliminary evidence suggests, then how are thetic and categorical judgment distinguished in the grammar? Does HKSL employ phonological means, such as a specific set non-manual features or a particular kind of rhythm? When the native signers were given the contexts inducing identificational focus, they came up with a variety of methods: change in word order, use of non-manual features, and use of lexical item ONLY-ONE. Do these constructions differ from each other in any subtle ways? Under what circumstances would a signer opt for a structural means to code identification focus? What syntactic position does structural focus occupy in relation to other sentence-final focused elements such as wh-word in HKSL? All these questions are worth-investigating and can be possible directions for future research.
References:


Acquiring verb agreement in HKSL: Optional or obligatory?

Gladys TANG,
Scholastica LAM, Felix SZE, Prudence LAU, Jafi LEE
Centre for Sign Linguistics and Deaf Studies
Chinese University of Hong Kong

0. Introduction
Acquisition of verb agreement has been widely studied in spoken languages but few studies have focused on a similar phenomenon in signed languages. For those that have been reported in the literature, omission of agreement marking has been the subject of recent debate. While most studies report on omission of agreement markings (Meier 2002, Morgan et.al. 2006), some recent studies observe few errors of omission with children acquiring ASL and LSB (Quadros and Lillo-Martin 2006). The present study attempts to examine child acquisition of verb agreement in HKSL with data drawn from a longitudinal corpus of a deaf child (2;6.17 – 5;7.20) and experimental studies conducted when he was at age 6. Within the general framework of examining agreement marking in the child’s data, we focus on the effect of optionality of verb agreement in the adult grammar on the acquisition of this grammatical area. Following Lam (2003), agreeing verbs may appear in three forms, depending on the interaction between syntactic position and person value: (a) uninflected form, (b) direct to the actual or imaged location of the referent, and (c) inflected for syntactic verb agreement. In what follows, we will first present the literature regarding verb agreement and its acquisition in both spoken and signed languages; then we will present the findings of two studies on the acquisition of verb agreement in HKSL by a deaf child. Our findings reveal that the deaf child’s acquisition process shows properties pertaining to late learners of verb agreement, displaying consistently violations of the constraints observed in the grammar of verb agreement in HKSL.

1. Verb agreement in Spoken and Signed Language

1.1. A Typological Account
Corbett (1998) identifies person, number and gender as the three common agreement features in natural languages with typological variation. Russian shows very rich agreement morphology for all the three features; English shows agreement in person and number but not gender and Chinese does not show overt agreement morphology. This paper focuses on person agreement. In the spoken
language typology, in addition to subject-verb agreement, there are languages such as Aruchi (Kibrik 1993) or Chukchee (Muravyova 1998) that require person agreement marking between the verb and the object. iii Adopting a typological perspective, Croft (1998) observes that subject-verb agreement for person is more common than verb-object agreement, and the latter implies the former. Also, marking of verb agreement is predictable, if required. Even with English where verb agreement is not rich, subject-verb agreement is marked consistently in contexts where the subject is third person and singular.

Assuming that agreement is governed by similar universal principles, a venture into research on verb agreement in signed language lends itself to interesting research issues. Verb agreement is common among the signed languages under study so far. It is commonly accepted that, to mark grammatical relations, a verb sign is directed to either a present referent or to a locus in space, and different verb agreement patterns are represented by changes in path movement, accompanied by facing of the hands to agree with the direct or indirect object (Sandler and Lillo-Martin 2006). iv In fact, relying on space for nominal establishment in signed language for purpose of satisfying grammatical relations such as verb agreement is said to be modality dependent (Fischer and Gough 1978, Lillo-Martin 1991). In signed language, agreeing verbs and pronouns share some phonetic, morphological and semantic properties. Both are deictic, expressed by directing a sign to a location in space (i.e. referential locus) in order to refer to a definite and specific referent in a signing discourse, and both use directionality of movement to mark person value. v Hence, pronominal pointing or directing a verb towards a locus in space allows the encoding of grammatical relations between the subject and object, as well as their person values.

Signed language also differs from spoken language in that signed language allows optionality of agreement marking. In ASL, object agreement is obligatory while subject agreement is optional (Meier 1982, Padden 1988). This observation offers counter-evidence to Croft’s generalization. Optional subject agreement is also reported in other signed languages like BSL (Morgan et al. 2006) and ISL (Meir 2002). vi What causes optionality of agreement marking is still subject to debate, namely one between adopting a syntactic or a thematic account (Meir 2002). The phonology of signed language may be another factor as body-anchored signs seldom occur in agreeing verbs. Cormier (2002) also observes that plurality of number may also render verb agreement not to be marked even though in other linguistic contexts it is obligatory.

The seemingly lack of a consistent or ‘constrained’ realization of verb agreement, in particular, the diverse spatial loci and directions of pointing has led to queries about its linguistic status (Liddell 2000). However, Lillo-Martin (2002) cautions against this outright rejection arguing that there are indeed fixed phonological forms for first person and plural, and person agreement
does interact with the licensing conditions for null arguments in ASL. Meir (2002) suggests that directionality of movement reveals crucial thematic properties of Source and Goal and facing of the hands can be a dative case assigner. Rathman and Mathur (2002) place formal verb agreement and gesture on a continuum and suggest that there are two pathways to the development of verb agreement in signed language. Process of grammaticalization may encourage ‘pointing’ to combine with other elements like handshape, location that are more linguistic in nature, hence the formation of agreeing verbs. On the other end of the continuum, plain verbs may acquire a gestural component of ‘pointing’ and become agreeing verbs. In disputing Bahan’s (1996) claim that verb-object agreement across all verb types in ASL is licensed by eye gaze, Thompson et. al. (2006) through an eye-tracking experiment observe that eye gaze marks syntactic agreement with object only for agreeing verbs, but locative arguments for spatial verbs. They agree with Lillo-Martin (2002) that even though ‘pointing’ is gestural, that fixed phonological forms such as facing and non-manuals such as eye gaze interact with the linguistic realization of syntactic arguments.

1.2. Verb agreement in HKSL

Although no systematic analysis has yet been done, Lam (2004) preliminarily observes that HKSL allows null arguments for both the subject and the object, as such, verb agreement through directing a sign to a locus in space or a discourse topic can license null arguments in HKSL, as shown in (1) and (2):

(1) pro 2-SEE-3 SCHOOL-B
‘You see School B.’

(2) IXdet SECONDARY-FIVE UNDERSTAND e CAN.
“These secondary five (students) can understand (these computer softwares).

Lam (2004) assumes that the empty category in (1) is licensed by agreement morphology of the verb SEE. In (2), it is governed by the verb UNDERSTAND and is licensed by a discourse topic through a binding relation. Following Tang and Sze (2002), an agreeing verb in HSKL is realized by directing the sign through a path movement to a referential locus in space. Hence, the locus has the indices of being specific and definite; otherwise a different phonological form is adopted to mark other referential or semantic properties. An agreeing verb such as GIVE in HKSL may be overtly marked for subject and object (3):

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HKSL also allows optional subject agreement, like ASL or BSL. In addition to (3), we also observe agreeing verbs in uninflected form, or uninflected for subject but inflected for object like (4a), but not vice versa (4b), suggesting that person inflection for subject implies the same for object, contrary to Croft’s generalization that object agreement implies subject agreement in spoken languages (Croft 1998).

(4a) KENNY CANDY 0-GIVE-3 BRENDA
“Kenny gives a candy to Brenda.”

Unlike ASL, object agreement is not entirely obligatory in HKSL (Lam 2003). The data show that uninflected forms (i.e. 0-GIVE-0) are acceptable but agreement marking is required when the subject is second person (5a) or when the object is first person (5b). Hence, the lack of person agreement marking under these conditions will result in ungrammatical sentences like (5c) and (5d).

(5a) CANDY 2-GIVE-3 KENNY.
“You give the candy to Kenny.”

(5b) KENNY CANDY 3-GIVE-1.
“Kenny gives me a candy.”

(5c) *CANDY 0-GIVE-3 KENNY.
“You give the candy to Kenny”
Lam (2003) argues further that the spatial modality has an effect on verb agreement in the sense that verbs directed to present referents may obscure syntactic verb agreement. However, evidence may be obtained under specific conditions. One such condition is when the signer introduces a nominal referent into the discourse for the first time. With the referent being potentially third person, the phonological form requires that the sign is directed to a location on either side of the signing space. Another condition is when the signer role shifts to assume the identity of another signer and introduces a referential locus in space that may be either second or third person. Whichever horizontal plane of articulation that the signer shifts to, this way of consistently ascribing person value to a newly established abstract referent in space offers data for us to investigate the verb agreement phenomenon in HKSL. While first person object and second person subject need to be obligatorily marked due to discourse reasons that they typically involve the signer and the addressee, we assume that theoretically they have person features, albeit underspecified.

To sum up, there are three forms of GIVE: (a) uninflected GIVE, (b) fully inflected GIVE, and (c) GIVE uninflected for subject but inflected for object. Their formation is subject to the person values of the subject and object as well as their syntactic position in the sentence.

2. Acquisition of verb agreement

2.1. Acquiring verb agreement in spoken language

Acquisition of verb agreement has attracted a lot of studies in both spoken and signed language literature. It has been well-documented that children acquiring spoken languages such as English, Danish, Dutch, French or German that are non-null subject languages omit these inflectional elements initially and produce infinitival as well as tensed forms at a subsequent stage of development. This stage of development is referred to as Optional Infinitives Stage (Hyams and Wexler 1993, Wexler 1994). Yet, optional infinitives do not show up in children acquiring languages that show rich agreement morphology and allow null subjects and objects like Italian or Spanish; instead they acquire verb agreement early and accurately (Guasti 2002). These studies show that constraints of agreement in the target language have an effect on acquisition. However, all these languages show subject-verb agreement, but not verb-object agreement. A further example is from Swahili.\textsuperscript{viii} Recently, Deen (2006) reports on an asymmetry in the acquisition of subject and
object agreement in Swahili. He observes that his four longitudinal subjects show omission of subject agreement at a consistently higher rate across four stages but a relatively lower rate as well as a gradual reduction over the stages with object agreement. According to him, ambiguous input results in this asymmetry. In adult Swahili, subject may be omitted in certain discourse contexts; however, object agreement is obligatory when the object is specific. Where the object is non-specific, object agreement is not permitted. He proposes that child acquisition of Swahili is subject to specificity condition.

2.2. Acquiring verb agreement in signed language

Acquisition of verb agreement has so far covered a number of signed languages such as ASL (Fischer 1973, Meier 1982; Lillo-Martin et.al. 2004), BSL (Morgan, et. al. 2006), LiBrasS (Quadros 1997), SLN (Bogaerde & Baker 1996) and LIS (Pizzuto 2002). Most studies found that the average age of acquisition of verb agreement with a present referent can be as early as age 3, and as late as age 5 if the referent is non-present because deaf children have to learn to direct the verb to a referential locus in space. In Meier’s (1982) study, his subjects show errors of omission when the referent (subject or object) is second or third person. Morgan et. al. (2006) report that errors of omission are distributed over many agreement patterns in BSL like first to third, second to first, and there are more errors with third person subject and object than other person values. Conflicting results have been reported: Lillo-Martin et. al. (2004) and Quadros et. al. (2006) argue that since ASL and LSB are mixed null subject languages, their longitudinal subjects being exposed to ASL or LSB at an early age do not show substantial omission of agreement or overgeneralization, in support of Guasti’s generalization that children learning null subject languages do not go through an optional infinitive stage. However, some of their learners who are exposed to signed language as late as age 6 or above commit these errors substantially, lending support to the critical period hypothesis (Lillo-Martin et al. 2004). This finding is similar to that in reported in Morford’s (2003) in which his two adolescent subjects (age 12;1 and 13;7) show a prolonged stage of uninflected verb agreement.

Another research finding is the asymmetry in the learners’ development of of subject and object agreement. Using elicited imitation to examine double-agreeing verbs (i.e. inflecting for both subject and object), Meier’s (1982) ten deaf children (ages 3;1 to 7;0) show more omission with subject than object agreement. That signed language learners prefer to mark object agreement more regularly than subject agreement in ASL is also observed in the two late learners of ASL (Morford 2003).
Some studies examined how deaf children develop verb agreement with non-present referents using story narration as methodology. They report that invoking spatial loci to identify non-present referents for agreement inflection takes longer to acquire, and children by age 5 still show problem of inflecting for subject or object using spatial loci (Morgan 2000; Loew 1983). According to Morgan (2000), even though his subjects are able to mark agreement in space, they fail to identify the arguments in the discourse.

What is seldom discussed in the literature of verb agreement acquisition is the properties of intermediate grammars before the deaf child achieve full competence. In theories of language acquisition, intermediate grammars reveal the underlying grammatical processes the child learner undergoes. Optional infinitives for children acquiring non-null subject languages is one such property. Although not explicitly discussed in the literature, a detailed analysis reveals that there seems to be a link between the co-occurrence of uninflected agreeing verbs but inflected index signs. The deaf child of BSL in Morgan’s study produces an inflected index sign to mark first person subject and third person object after the uninflected verb, as shown in (6). (7) is reported in Quardros and Lillo-Martin (2006), it is produced by the child learner Aby at age 1;10.

(6) Mark: BITE 1IX3 (2;2)  
‘Bite me on it.’ (Morgan et. al. 2006)

(7) MOTHER, <1> GIVE <mother> IX <mother>, <1> GIVE <mother>  
“Mother, (I) give (mother), IX<mother>, (I) give (mother).” (Quardros and Lillo-Martin 2006)

In (7), the sign GIVE is uninflected but an index sign (IX) follows which is directed at the location of the indirect object, <mother>. Meier’s (2002) subject also flanks the verb GIVE with index signs, as shown in (8):

(8) POINTcameraman GIVE POINT2, GIVE.  
“You give (it) to him (cameraman).”

These data show that the relationship between the index signs and the directionality of movement encoded by agreeing verbs is more complex than it has been discussed in the literature. It might be that instead of making person agreement on verbs, index signs that are typically derived from pointing gestures are first adopted to encode grammatical relations between the subject and the object. Also, if assuming that a prerequisite for verb agreement acquisition is knowledge of verb
subcategories in signed language -- plain, agreeing and spatial, it is possible that these learners perceive agreeing verbs as lexical, plain verbs with simplex morphology initially. As such, encoding grammatical relations between the subject and the object will have to rely on other grammatical operations like word order or pronominals realized by index signs. Tang et. al. (2006) also report that deaf children initially mis-analyze classifier constructions as plain verbs and treat them almost like a lexical unit rather than a morpho-syntactic unit. xii In sum, despite some conflicting results, the observation reported here are illuminative of the interaction between components of the intermediate grammar of the child learners.

3. Research Questions

Assuming that language acquisition is based on positive evidence, a deaf child exposed to HKSL will come to know that it allows optional subject and object agreement. He will also eventually acquire the constraints associated with verb agreement. This leads to the occurrence of three forms of agreeing verbs: (i) verbs in uninflected form, (ii) verbs that are spatially marked for locative agreement, and (iii) verbs that are syntactically marked for verb agreement. Deen’s (2006) study suggests that optionality of subject agreement in adult Swahili due to register or discourse factors may provide an explanation for a higher rate of subject agreement errors. It seems that a similar acquisition phenomenon can be found with learners acquiring HKSL.

In addition, a deaf child needs to acquire the knowledge that spatial loci bear referential indices and some phonological forms to spatial loci are linguistic. In a signing discourse, verbs with either first or second person values are not good candidates for investigating this linguistic property because the signer and the addressee are inherently present in the discourse, blurring syntactic agreement in favor of locative agreement. However, we argue that while directing a verb to a present referent satisfies locative agreement, directing a verb to a non-present referent with a fixed phonological form may be indicative of the intrinsic person value of the referent, satisfying the requirements for syntactic agreement. Does a deaf child of HKSL have this knowledge as part of grammar of verb agreement? How does a deaf child acquire knowledge of this part of grammar in HKSL?

To summarize, we pose the following research questions:

a. Does a deaf child of HKSL go through an uninflected stage in the acquisition of verb agreement morphology in HKSL? If it does, what causes such a development?

b. Does a deaf child show evidence of optionality for both subject and object agreement, meaning that both inflected and uninflected verbs may co-exist in the course of acquisition?
c. Does he know the constraints associated with verb agreement, namely that certain contexts obligatorily require subject and object agreement in HKSL?

In the following sections, we will report on two studies on a deaf child who develops verb agreement morphology in HKSL over a period of about three years. In addition to longitudinal data, we also set up three experiments to examine his state of knowledge of verb agreement. Experiments are useful as previous studies are primarily concerned with longitudinal data on verb agreement involving present referents. In this study, we set up three experiments to examine the acquisition process of verb agreement when the referents are not present in the signing discourse.

4. Study 1: Longitudinal Data on a Deaf Child of HKSL

4.1. The Subject

The subject was a deaf boy “Chun-chun” who was born to a deaf couple but was not exposed to the linguistic input of HKSL until age 1;9.6 when the observation began. During this period, he attended a special childcare centre that emphasized oralism but he was exposed to HKSL when his parents interacted with him after work and when the research team comprised of two native deaf signers visited Chun-chun’s family once or twice a week. His parents were not born of deaf parents and only his father was a fluent signer because he had attended a deaf school at age 6. Chun-chun’s mother was not a native signer and she had attended a hearing school for her education. Therefore, Chun-chun was acquiring HKSL in an acquisition poor environment, both in terms of quantity and quality of input.

4.2. Data Collection & Transcription

Chun-chun’s naturalistic interactions with either his mother (only for the first few months) or a native deaf signer were filmed for about one hour per week. However, the data for this study were drawn from the monthly transcriptions of the video recordings between age 2;6.17 and age 5;7.20, with a total of around 38 hours of data. The videos were transcribed by trained deaf researchers who were native signers and checked by a team of hearing researchers for accuracy of transcriptions.

In the analysis, we first extracted Chun-chun’s production of GIVE throughout this period and categorized the tokens first according to whether the verb was uninflected, spatially directed to present referents, or inflected for person agreement. For the inflected ones, we identified the agreement patterns to check for optional and obligatory agreement. Last, we checked whether Chun-chun was directing the verb sign to a present or a non-present referent in the signing discourse.
4.3. Results

GIVE is chosen for the analysis because it is a typical double-agreeing verb, enabling the researchers to analyze Chun-chun’s development of subject and object agreement and the related asymmetry issue. It is triadic and requires three arguments expressed grammatically in terms of subject, object and indirect object. The 150 tokens of GIVE produced by Chun-chun during this period are categorized into: (i) uninflected GIVE, (ii) GIVE directed to the location of a present referent, and (iii) inflected GIVE for person agreement (i.e. directing the verb via abstract directionality to a spatial locus).

![Figure 1. Production of GIVE between age 2;6.17 to 5;7.20](image)

The data show that Chun-chun produces all three forms of GIVE during the period of observation. The first emergence of GIVE uninflected for person agreement or directed to present referent is at age 2;6:17, but it is only until the age of 3;5.23 when Chun-chun produces GIVE systematically. (9) shows that GIVE is inflected for third person object but not for subject.

(9) 0-GIVE-3 ELDER-BROTHER EAT CANDY (3;5.23)
“[Mother] gives elder-brother a candy to eat.’

(Insert Clip 5 about here)

There is a period during which GIVE does not surface in the data. Then, GIVE reemerges in both uninflected and inflected forms. In our analysis, verbs directed to present referents are not unique evidence of syntactic verb agreement because directionality under these circumstances is a function of locative agreement because the referents are present in the discourse. However, for
those cases that locative agreement is called for, there is no evidence showing that Chun-chun
directs the signs to an inappropriate argument in the data.

Next, we examine Chun-Chun’s production of GIVE by categorizing the verb according to
agreement patterns. The results are presented in Table 1.

<table>
<thead>
<tr>
<th>Optional Contexts</th>
<th>Obligatory Contexts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-GIVE-2</td>
</tr>
<tr>
<td>Uninflected</td>
<td>5.00%</td>
</tr>
<tr>
<td></td>
<td>(1/20)</td>
</tr>
<tr>
<td>Directed to</td>
<td>65.00%</td>
</tr>
<tr>
<td>present</td>
<td>(13/20)</td>
</tr>
<tr>
<td>referents</td>
<td></td>
</tr>
<tr>
<td>Inflected</td>
<td>30.00%</td>
</tr>
<tr>
<td>for verb</td>
<td>(6/20)</td>
</tr>
<tr>
<td>agreement</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 summarizes Chun-chun’s production of the different forms of GIVE during the period
of observation. As for the contexts of optional agreement in HKSL, the tokens cluster
overwhelmingly around the agreement between third person subject and third person object (i.e. 3-
GIVE-3). However, about 68.89% of the tokens in this category are uninflected. There are just 18
tokens for first person subject and third person object (i.e. 1-GIVE-3) and they are evenly
distributed over the inflected and uninflected forms. Where the object is second person (i.e. 1-
GIVE-2), Chun-chun tends to direct the sign to a present referent (65%) who is the deaf researcher.
Yet, Chun-chun role shifts to assume first person of another signer (i.e. 1-GIVE-2), hence
producing instances of inflected verb agreement for first person subject and second person object,
amounting to about 30% of the data.

On the other hand, most tokens for the obligatory contexts involve second or third person
subject and first person object (i.e. 2-GIVE-1, 3-GIVE-1). 75% of the tokens in the 2-GIVE-1
contexts involve directing the verb sign to present referents and Chun-chun also produces 25% of
instances of 2-GIVE-1 under role shift conditions, implying that he has some knowledge of
assigning second person value to an abstract spatial loci. As for the 3-GIVE-1 contexts, 70.83% of
the tokens are inflected. If we assume that first and second person may encourage directing the sign
to present referents, these findings show that they may serve as an anchor for the child to acquire
subject marking for third person. This is quite different from his production in the optional 3-GIVE-3 contexts where only 28.89% of the tokens are inflected. Yet, Chun-chun still commits a significant percentage of errors of omission, as high as 29.1% of his tokens under the 3-GIVE-1 contexts are uninflected (i.e. 0-GIVE-0). There are very few 2-GIVE-3 or 3-GIVE-2 contexts, the tokens show that Chun-chun either directs the verbs to present referents or leaves them uninflected. Figures 2 and 3 show Chun-chun’s production of GIVE in the optional and obligatory contexts over time. Figure 2 shows that there are more tokens of uninflected than inflected GIVE in the optional contexts but less so in the obligatory contexts, as shown in Figure 3. Although Chun-chun is sensitive to the obligatory contexts for person agreement, both figures show that he prefers uninflected to inflected GIVE in the optional contexts and continues to produce uninflected GIVE in the obligatory contexts even at age 5;7; this only suggests that he has not yet fully acquired this grammar and is not sensitive to the constraints involved.

**Figure 2. Production of GIVE in optional contexts**
To sum up, Chun-chun has undergone a stage of uninflected verb agreement (ref. Research Q1). There is evidence of optionality in person agreement in the optional contexts, (ref. Research Q2), but Chun-chun seems to overgenerate optionality to the obligatory contexts, leading to a significant percentage of erroneous production. Despite this, the percentage of inflecting for first person object agreement remains high (ref. Research Q3). There are many instances of directing a sign to a present referent in contexts involving first and second person, but Chun-chun seldom errs even in identifying the referent appropriately in other contexts.

That Chun-chun omits object agreement even in the obligatory contexts over time is a characteristic of the late learners reported in Morford (2003) and Lillo-Martin et. al. (2005). From an acquisition point of view, Chun-chun’s age of onset of sign language acquisition and the impoverished input stimuli in his acquisition environment are crucial factors affecting his acquisition of HKSL. Firstly, due to his background, the quantity of input may not suffice to facilitate language acquisition. Also, optionality of verb agreement in the adult grammar may result in ambiguity in the input data. Seen in this light, to claim he has achieved knowledge of optionality akin to that of the native deaf adults’ is premature because the data shows that he prefers not to inflect in the optional contexts and overgenerates this knowledge of optionality in the obligatory contexts.

In acquisition terms, such optionality may be extended to how Chun-chun perceives and distinguishes verb types in HKSL. In fact, in the course of acquiring verb agreement, Chun-chun also needs to identify which type of verbs takes the property of verb agreement morphology. The data here do not address the issue of errors of commission, that is, imposing person agreement on plain verbs. However,
we observe that Chun-chun’s lack of person agreement is usually compensated not only by pronominal index signs, but also name signs or common nouns in his production. As discussed in the earlier section, proper names or common nouns are inherently third person. To address this issue, we systematically selected 7 sessions with an interval of 6 months in the longitudinal data out of which we identified 27 tokens of GIVE for a closer analysis. The data show that Chun-chun uses a lot of name signs and his index signs are mostly spatially directed to the present referents (first person subject or object), and, on some occasions, towards a spatial locus, as shown in (10a – 10b):

(10a) 1X-1p 0-GIVE-0 YOUNGER_SISTER BOOK.
“I give a book to my younger sister.”
Insert clip (6) here.

(10b) (BRENDA) CL: biscuit_sticks 0-GIVE-0 IX-3p.
“Brenda gives biscuit-sticks to him (Kenny).”
Insert clip (7) here.

Hence, the uninflected forms are usually followed by a common noun or a name, or an IX sign directed to a present referent. This suggests that Chun-chun may initially assume that all verbs are just plain and person is encoded by other grammatical means such as index or name signs until he encounters positive evidence showing that some verbs require person agreement morphology. If our argument is on the right track, knowledge of marking agreement morphology is triggered by specific positive evidence within the obligatory conditions and that makes the child realize that there are verb subcategories in signed language. Errors of commission as reported in previous studies are exemplars of this acquisition process. In order to investigate this issue further, we design a series of experimental procedures to tap Chun-chun’s knowledge of verb agreement.

5. Study II : Experimental Procedures
Study II involved three elicitation tasks based on the verb GIVE: (a) Present Referents Task (PR), (b) Story Retelling task (SR), and (c) Truth-value Judgment Task (TJ). For the PR task, we aimed to confirm whether Chun-chun was sensitive to locative agreement with a present referent in the signing discourse. In this task, our deaf researcher performed the task of giving some food to an object located in the room. Chun-chun was asked to describe what the deaf researcher had done, and was enticed to produce utterances like “Connie gives the fish to the cat”. The beneficiaries of GIVE
(i.e. the indirect objects) were placed in various locations in the room and some of which did not conform to the conventional spatial location for person agreement in HKSL, such as placing the indirect object at the back of the child signer. There were four tokens to test Chun-chun’s knowledge of directing the sign to present referents in the discourse.

The SR task had the advantages of examining whether Chun-chun’s knowledge of using referential loci in space to set up person agreement with the verb. Crucially, story retelling also allowed us to examine how Chun-chun encoded verb agreement in contexts of first-mentioned referents with a third person value, which to us was a litmus test for tapping Chun-chun’s knowledge of abstract agreement morphology. Again, we focused on the verb GIVE. In this task, Chun-chun had to watch a story signed by a native deaf researcher A and relate it to native deaf researcher B. The signing was recorded, transcribed by a native deaf researcher, checked for accuracy and scored for verb agreement. The TJ task involved three videotaped events based on GIVE with either optional or obligatory person agreement in HKSL. The events portrayed a simple event of “A gives a candy to B”. After watching the video clips, a native deaf researcher signed a series of sentences based on the proposition of the event. Some sentences were grammatical and some were not. For instance, if the event portrayed that “Connie gives a candy to Brenda”, a native deaf researcher (Kenny) who assumed an outsiders’ point of view would sign sentences like (11a) and (11b) below. While controlling for consistency of propositional content, various agreement patterns were set up to test for grammaticality.

(11) Episode: Connie gives a candy to Brenda.

Stimuli: (11a) Kenny: “CONNIE CANDY 3GIVE 3 BRENDA √
(11b) Kenny: “CONNIE CANDY 2GIVE 1 BRENDA x

Chun-chun first viewed the episode shown on the computer, he then judged the sentences for their grammaticality. For each, he indicated his judgment by pressing either a “correct” button or a “wrong” button. For the distracters, we incorporated clips of classifier constructions using verbs of motion showing movement of a person classifier from one location to another in different manner. A native deaf signer was invited to complete the task whose data were used for baseline comparison.

The tasks were administered in the sequence of SR > PR > TJ about five months later. To score the tasks, 1 score was given for the correct production of GIVE with directionality of locative agreement in the PR task. For TJ task, correct responses were given a score of ‘1’ and ‘0’ for an inaccurate one. For the SR task, tokens of verb agreement were collected from Chun-chun and coded for person agreement inflection, use of referential loci, and role-shift as well as markers.
With tokens displaying inflection, they are further categorized into different agreement patterns for further analysis.

6. Results

6.1. Story Retelling Task

In the SR task, there are nine contexts for person agreement in the story. Chun-chun produces 8 tokens of person agreement only under 7 contexts, missing 2. Table 2 presents a qualitative analysis of Chun-chun’s production of the person agreement patterns.

Table 2: Analysis of GIVE in Chun-chun’s SR Task

<table>
<thead>
<tr>
<th>Context #</th>
<th>Person agreement</th>
<th>Context #</th>
<th>Person agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 WANT 1-GIVE-3i KENNY BRENDA</td>
<td>1-3 (locus i)</td>
<td>#1 WANT BUY 0-GIVE-0 KENNY EAT</td>
<td>0-0</td>
</tr>
<tr>
<td>#2 CANDY gesture: give_me 3j-GIVE-1 TWO gesture: give_me</td>
<td>2 (locus i) -1, +role shift +markers</td>
<td>#2 KENNY 0-SEE-1j SAY 2j-GIVE-1 EAT</td>
<td>2 (locus i) -1, +role shift +markers</td>
</tr>
<tr>
<td>#3 CANDY 1-GIVE-2j 1-GIVE-i</td>
<td>1-2 (locus i)-1, +role shift +markers</td>
<td>#3 CONNIE SAY CAN, 1-GIVE-2j, IXp IXp TWO, 1-GIVE-3p, TWO,</td>
<td>1-2 (locus i) -1, +role shift +markers 1-3 (locus k)</td>
</tr>
<tr>
<td>#4 WANT 1-GIVE-3j BRENDA</td>
<td>1-3 (locus i) +role shift +markers</td>
<td>#4 KENNY WANT 0-GIVE-0 BRENDA</td>
<td>0-0</td>
</tr>
<tr>
<td>#5 SEE KENNY CANDY 3i-GIVE-3j BRENDA</td>
<td>3 (locus i) -1, +role shift +markers</td>
<td>#5 CL:hold-candy 0-GIVE-0 BRENDA</td>
<td>0-0</td>
</tr>
<tr>
<td>#6 KENNY GOOD 1-HELP-3j gesture &quot;give_me&quot; 3j-GIVE-1</td>
<td>2 (locus i) -1, +role shift +markers</td>
<td>#6 -----</td>
<td>-----</td>
</tr>
<tr>
<td>#7 CL:tear_open_wrapper 1-GIVE-3j BRENDA</td>
<td>1-3 (locus i) +role shift +markers</td>
<td>#7 KENNY CL:open_wrapper 0-GIVE-0</td>
<td>0-0</td>
</tr>
<tr>
<td>#8 2j-GIVE-3i KENNY</td>
<td>2 (locus i) -3, +role shift</td>
<td>#8 IXp DON’T EAT, 0-GIVE-0 KENNY</td>
<td>0-0</td>
</tr>
<tr>
<td>#9 3j-GIVE-1</td>
<td>3 (locus i) -1, +role shift</td>
<td>#9 -----</td>
<td>-----</td>
</tr>
</tbody>
</table>

*markers include body turn, head turn or eye gaze

Table 2 shows that Chun-chun’s GIVE generally inflects more for object than for subject agreement, giving some evidence to support the subject/object asymmetry in verb agreement
acquisition. Also, it seldom inflects for either subject or object when the contexts permit optional verb agreement such as first person subject and third person object (e.g. Context #4), or third person subject and third person object (e.g. Context #5). Yet, on two counts, Chun-chun attempts to “repair” the verbal inflection. One example is Context #7 with data repeated in (12):

(12) KENNY CL:open_wrapper 0-GIVE-0, CL:open_wrapper 0-GIVE-3 BRENDA.

“Kenny unwraps the candy and give (it) to (Brenda), unwraps the candy and gives (it) to Brenda.
(Insert clip 8 here)

In (12), Chun-chun first signs an uninflected GIVE and then switches to 0-GIVE-3 to assign a locus for the indirect object BRENDA. This suggests that Chun-chun has some knowledge, albeit limited, of directing the sign through a conventional phonological form to encode a third person value, hence evidence of syntactic object agreement. Out of the three contexts that require obligatory object agreement (i.e. Contexts #2, #6, #9) presented by the native deaf signer, Chun-chun only creates one (i.e. Context #2) with correct person agreement inflection. However, he errs when the context requires obligatory subject agreement (e.g. Context #8). As for the use of spatial loci for verb agreement, Chun-chun either directs the verb to different loci in space or he consistently adopts one locus for almost all referents. However inadequate, Chun-chun attempts to role shift but he seldom refers to a third person indirect object as the native signer does in most situations in the task. Data show that he either avoids it (Context #7) or role shift to direct a verb sign to a spatial locus for second person subject (i.e. Context #2 & #3). This suggests that Chun-chun has knowledge, albeit limited, of syntactic agreement for second person through establishing an abstract second person locus in space.

The earlier observation from the longitudinal data that Chun-chun resorts to name signs or index signs to obviate the need for person agreement finds further evidence in this task. Table 2 shows that except for one (i.e. Context #7), a name sign follows the uninflected verb in four out of five tokens (i.e. Contexts #1, #4, #5, #8). Proper names are inherently third person in semantic terms. There is one token which shows that a name sign also follows GIVE which is inflected for third person but uninflected for second person (Context #7b), almost identical to that of the native deaf signer.

6.2. Present Referents Task

Since the stimuli involve grammatical third person subject and third person object, meaning that either the uninflected form or spatially directed from is acceptable. However, Chun-chun prefers to adopt the uninflected form for subject but optionally chooses to direct the verb to the location of the indirect objects
present in the discourse. There are four stimuli in this task and Chun-chun produces a total of seven tokens of GIVE distributed over four indirect objects in the pattern of 3-1-1-2. None of them show evidence of syntactic verb agreement, they are either in uninflected form or spatially directed to the indirect objects. Out of the seven tokens, four are uninflected forms, as in (13)\textsuperscript{xiii}:

(13) CONNIE MILK 0-GIVE-0 BABY DRINK\_MILK.
“Connie gives the baby milk to drink.”
(Insert clip 9 here)

While no tokens show subject agreement, three tokens are spatially directed to the location of the indirect objects, two to the “monkey” located directly in front of Chun-chun and one to the “baby” on the side in front.

Taken as a whole, the task offers some evidence that Chun-chun has knowledge of locative agreement. Unlike the native signer, he does not necessarily adopt locative agreement even though the referents are present. For those that he does, the verb is spatially directed more to the object than to the subject.

6.3. Truth-Value Judgment Task
There are three experimental conditions – 3-GIVE-3, 3-GIVE-1 and 1-GIVE-3 – for the TJ task. As mentioned, the sentence stimuli use the verb GIVE to encode the grammatical relation of the subject and indirect object and Chun-chun needs to judge if the agreement pattern is compatible for such a relation. While the proposition remains the same, some of the stimuli sentences use an incompatible agreement pattern that causes the sentences to become ungrammatical. Methodologically, we assume that if Chun-chun has knowledge of optionality of person agreement in HKSL as well as the related constraints, he will accept the uninflected and inflected GIVE under the 3-GIVE-3 and 1-GIVE-3 conditions while he will reject the uninflected form and accept the appropriately inflected GIVE under the 3-GIVE-1 condition. Moreover, Chun-chun will systematically reject those incompatible agreement patterns because they violate the interpretation of the experimental conditions.

The pre-test using the verb SCOLD shows that Chun-chun has no problem comprehending the episodes and the task requirement. Chun-chun’s judgments of the grammatical forms in various conditions are not consistent enough to indicate full acquisition. In the 3-GIVE-3 condition, Chun-chun accepts the uninflected form and the 0-GIVE-3 form but he rejects the appropriately inflected
3-GIVE-3 form. The native deaf signer on the other hand judges these three stimuli sentences to be grammatical. Also, while the uninflected form and the appropriately inflected 1-GIVE-3 form are grammatical according to the native judgments, Chun-chun rejects the uninflected form but accepts the inflected 1-GIVE-3 form. Lastly, Chun-chun accepts the uninflected form for the 3-GIVE-1 context, which is not acceptable according to native judgments. He also rejects the appropriately inflected 3-GIVE-1 form. The results show that Chun-chun’s knowledge of person agreement is variable, meaning that he has not yet fully acquired optionality of subject and object agreement in HKSL as well as the related constraints.

### Table 3: Chun-chun’ Performance on TJ Task

#### A. 3-GIVE-3 Context

<table>
<thead>
<tr>
<th></th>
<th>Chun-chun</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninflected</td>
<td>grammatical</td>
<td>1</td>
</tr>
<tr>
<td>3_3</td>
<td>grammatical</td>
<td>0</td>
</tr>
<tr>
<td>0_3</td>
<td>grammatical</td>
<td>1</td>
</tr>
<tr>
<td>2_1</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
<tr>
<td>3_1</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
</tbody>
</table>

#### B. 1-GIVE-3 Context

<table>
<thead>
<tr>
<th></th>
<th>Chun-chun</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninflected</td>
<td>grammatical</td>
<td>0</td>
</tr>
<tr>
<td>1_3</td>
<td>grammatical</td>
<td>1</td>
</tr>
<tr>
<td>3_1</td>
<td>ungrammatical</td>
<td>1</td>
</tr>
<tr>
<td>3_3</td>
<td>ungrammatical</td>
<td>1</td>
</tr>
<tr>
<td>2_1</td>
<td>ungrammatical</td>
<td>1</td>
</tr>
<tr>
<td>2_3</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
</tbody>
</table>

#### C. 3-GIVE-1 Context

<table>
<thead>
<tr>
<th></th>
<th>Chun-chun</th>
<th>Native</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninflected</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
<tr>
<td>3_1</td>
<td>grammatical</td>
<td>0</td>
</tr>
<tr>
<td>3_3</td>
<td>ungrammatical</td>
<td>1</td>
</tr>
<tr>
<td>2_3</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
<tr>
<td>1_3</td>
<td>ungrammatical</td>
<td>0</td>
</tr>
</tbody>
</table>

Chun-chun’s judgments of the ungrammatical stimuli are most accurate only with the 1-GIVE-3 condition as three out of four items are correctly judged to be ungrammatical. He fails all the ungrammatical items in the 3-GIVE-3 condition and three out of four ungrammatical stimuli in the 3-GIVE-1 condition. Note that when Chun-chun rejects the appropriately inflected form under the 3-GIVE-3 and 3-GIVE-1 conditions, his judgments of the ungrammatical forms for these specific contexts are correspondingly inaccurate.
7. Discussion

The results from the longitudinal and experimental data reveal that Chun-chun’s knowledge of person agreement shows great variability. As a whole, the longitudinal data show that Chun-chun produces both uninflected and inflected GIVE for person agreement, and such a pattern is also observed in contexts where the inflected verb is disallowed. The experimental data also show that Chun-chun prefers to use the uninflected form in the PR and SR Task. The TJ Task reveals that Chun-chun’s knowledge of person agreement shows variability in both forms of verbs in different conditions. Hence, we argue that although in some contexts where optionality may be the norm in the adults’ grammar, Chun-chun’s performance seems to reveal that his knowledge of optionality in person agreement may have intrinsic properties that are different from the adults’. As mentioned in 6.3, optionality of verb agreement in signed language is being constrained by either syntactic position, as in ASL or BSL, in the sense that only subject agreement is optional and object agreement has to be obligatory, or an interaction of syntactic position and person value, as in HKSL where second person subject or first person object need to be marked, otherwise, agreement of subject and object is optional. This raises a learnability issue: what makes the child know that optionality of verb agreement in HKSL comes with constraints? We argue that to characterize the adults’ grammar with respect to verb agreement, optionality has to be measured against obligatoriness because judgments of native signers show that they have knowledge of which form is optional or obligatory under what conditions. In Lust’s (2006) terminology, such knowledge represents some ‘tacit’ understanding of what is and is not possible in the grammar, the ‘end-state’ of language acquisition. Although Chun-chun’s data consistently show the co-existence of uninflected and inflected forms among the agreement patterns, it is premature to equate such a state of knowledge as having similar epistemology as the native signer’s. Note that in the longitudinal data, there are more uninflected than inflected forms of GIVE in at least two agreement contexts, and approximately around 30% of uninflected forms in the obligatory contexts (Table 1). This suggests that Chun-chun’s knowledge of optionality in verb agreement in HKSL is not as constrained as that displayed by the native signer’s. This result is corroborated by the experimental findings which show that Chun-chun tends to use uninflected GIVE in the SR and PR tasks. This “intermediate knowledge” of optionality surfaces through the TJ task as the results show that Chun-chun has problems judging the uninflected forms in at least two agreement conditions. If language acquisition is based on positive evidence, clearly the input to the deaf child is ambiguous as both uninflected and inflected forms surface in the adults’ input, leading to a learnability problem.
because he needs to looks for specific positive evidence that constrains his grammar in accordance to syntactic position and person value.

What triggers the deaf child to constrain his overgenerated grammar? We predict that it is not data that shows specificity condition, as suggested in Deen’s study on the child acquisition of Swahili. In signed language acquisition, as we mentioned in Section 1.2, specific positive evidence may stem from two sources of adult input (a) third person locus for a non-present referent in the 3-GIVE-1 condition because it consistently requires obligatory object agreement, and (b) second person locus under the role shift condition in which the signer needs to shift the plane of articulation and directs the sign to a new spatial locus, denoting a second person. Although verbs directing to the signer and the addressee as present referents have underspecified person value and obscured by locative agreement, a signer directs a verb sign to spatial loci under the first-mentioned condition may give us a clue about syntactic verb agreement. The tokens of role shift in the SR task shows that he has acquired some knowledge of syntactic verb agreement, but he also show violation of constraints of verb agreement.

8. Conclusion
In this study, we investigate the acquisition of verb agreement in HKSL by a deaf child, using naturalistic production as well as experimental data to tap the state of knowledge of the deaf child in the acquisition process. The findings reveal that he consistently violates the constraints of verb agreement and over-generates uninflected agreeing verbs during the period of observation. As such, he resembles the late learners of signed language in this aspect of grammatical development, similar to the findings reported in previous studies. Given Chun-chun’s background, this study fails to address issues related to early child acquisition, in particular, the lack of error of omission in obligatory contexts of person agreement as evidence to support the hypothesis that learners of null subject languages do not show an Optional Infinitive Stage, as argued by Guasti (2002) on hearing learners of Italian and Lillo-Martin et. al. (2005) on deaf child learners of ASL and LSB. Nonetheless, the study offers the perspective of “intermediate optionality” in the acquisition of verb agreement in signed language, which could be the result of the learners’ initial misanalysis that verbs in signed language are morphologically simplex during the early stage of language acquisition, marring the distinction between plain verbs and agreeing verbs, and probably classifier predicates. While naturalistic production data are helpful, experimental data are necessary in order to verify this hypothesis more systematically. The current attempt to tap a deaf child’s state of knowledge of verb agreement in HKSL through experimental procedures based on just one verb is rather
exploratory. As research on verb agreement acquisition develops, more agreeing verbs need to be examined with more fine-grained experimental methodology.

**Notational Conventions**

1. Signs are glossed in capital letter with the closest English translations. Signs which require more than one English word in the translation are linked up with a hyphen (e.g. DRINK_MILK).
2. Agreement marking is glossed as 1 (first person), 2 (second person) and 3 (third person). If an agreeing verb is marked for both subject-verb agreement and verb-object agreement, the verb is glossed as 1-GIVE-3, 1-GIVE-2 or 3-GIVE-1. If an agreeing verb is marked for verb-object agreement only, the sign is glossed as 0-GIVE-3. Locations that agreeing verbs directed to are represented with i, j and m. Chun’s production of non-adult directionality is represented as k and p.

3. Classifier predicates are glossed as CL: description of the classifier predicates.
4. Null arguments licensed by verb agreement are glossed as *pro* and null arguments licensed by discourse topic are glossed as *e*.

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Agreement morphology is realized by affixes, with suffixes on the verb being the most common for either subject agreement (e.g. English) or both subject and object agreement (e.g. Russian). Chukchee uses prefixes for subject agreement and suffixes for object agreement.

Both Meir (2002) and Sandler and Lillo-Martin (2006) use “facing of the hands” for marking object, a closer examination suggests that it is the palm of the hand that provides this phonetic description.

Here we diverge from Meir (2002) who claims that directionality is primarily for the thematic function of marking Source and Goal. We assume that while this is a crucial thematic property, some fixed phonological form embedded in directionality is evident of morphological marking of person value. Directing a sign to a referential locus using a form that is conventionally interpreted as ‘third person’ during first mention of the referent is evident of using directionality for marking person value.

Morgan et. al. (2006) also claim that verb agreement morphology in BSL is constrained by aspectuality. Agreement morphology occurs when the verb is transitive eventive (e.g. GIVE, PUSH, BITE), not when the verb is transitive stative (e.g. KNOW, BELIEVE) or intransitive, eventive or stative. This phenomenon is not observed in HKSL where transitive statives can mark person agreement, e.g. IX-1p MARY 0-ADMIREF-3. What causes a verb to fall into this category is a subject for future research.

Tang and Sze (2002) observe that non-specific referents adopt a wavy path movement without a hold in space, which is different from a path movement to a specific location in space, denoting a definite referent.

Swahili is a SVO language and has prefixes for subject and object agreement in the verbal complex having the sequence: SubA-Tense – ObjA – Verb Root – Mood.

Deen identifies three contexts where the objects are inherently specific: (a) personal names, (b) topicalized objects, and (c) first and second person, and he observes that Swahili children reliably produce object agreement in these contexts, as evidence of knowledge of condition of specificity at an early stage.

Quite a number of acquisition phenomena have been reported (Meier 2002). In this paper, we will focus on three issues.

This result makes Meier (2002) claim that deaf children prefer single agreement marking (i.e. marking object agreement) to double-agreement marking (i.e. marking both subject and object agreement) when they begin to mark agreement on verbs.

Quadros and Lillo-Martin’s (2006) subjects are reported to master knowledge of verb sub-categories fairly early.

Among them, 2 tokens of GIVE involve an indirect object (i.e. “the dog” or the “cat”) located at the back of Chun-chun. However, deaf signers usually spatially direct the verb to the present referents but use the uninflected form followed by a name sign when the referent is not present.
0. Introduction

The recognition of ASL as a fully grammatical language—due in great part to Stokoe, Casterline, and Cronebeg's (1965) seminal work on the structure of ASL and subsequent studies (e.g., Stokoe, 1978; Klima & Bellugi, 1979; Liddell, 1980, 2000; Emmorey & Lane 2000)—has had as a consequence a growing interest in ASL and Deaf culture and a proliferation of ASL teaching programs all over the United States and Canada. In fact, ASL has become one of the most commonly taught languages in North America and is now accepted in many universities to satisfy the foreign/second language requirement for graduation. Yet, in spite of the large number of individuals (both hearing and deaf) who are now learning ASL as a second language (L2), studies on ASL acquisition as an L2 are rather scarce. While research on the L2 acquisition of spoken languages has attracted significant attention, sign language L2 acquisition remains largely an unexplored field. One might expect that sign language L2 learners face many of the same challenges as any other L2 learners and that past research on the L2 acquisition of spoken languages should be able to inform new studies on sign language L2 acquisition. However, due to the modality differences between spoken and sign languages, there are aspects of sign language learning—specifically those that relate to sign language spatial-visual grammar—that deserve special attention. With the purpose of helping to address this research gap, we conducted a longitudinal study focusing on the L2 acquisition of three components of ASL, namely, classifier structures (which we will refer to as third person discourse structures), role-shift or constructed action structures (which we will refer to as first person discourse structures), and the use of location in the signing space. Particularly, we tracked the early development of certain spatial skills that are

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central in the production of the above-mentioned components and addressed the following questions:

1) Do any preexisting spatio-visual skills transfer into the acquisition of the spatial aspects of ASL?

2) How do spatial skills develop in relationship to one another? That is, is there an ordering relationship for ASL skill development? Do some skills group together?

1. Rationale for our study

Linguistic transfer is an important topic in the study of L2 acquisition (See Gass 1996 for a review.) Transfer refers to the role that previous linguistic knowledge plays in the acquisition of an L2. Recent studies on the gestures produced by speakers have found that while gesture might not have a grammatical function, it is an important part of language and interacts with the grammatical elements of spoken languages in ways that are more systematic than previously thought (Kendon, 1986; McNeill, 1992). Since gesture makes use of the spatio-visual domain, it is possible that previous gestural abilities might transfer into the L2 acquisition of the spatial features of sign languages.

Many similarities have been noted between certain aspects of sign languages and the gestures produced by speakers. Liddell (2000) has created a precise explanation for this phenomenon based on conceptual blending. According to Liddell, both signers and speaking gesturers create a blend (Fauconnier & Turner, 1996) between an imagined mental space and real space (i.e., the conceptual model of the space in which they stand). In the blend, imagined entities are conceived of as located in the space around the person. Iconic and deictic gestures may be aimed toward those entities, or may track their progress through space. For sign languages, these gestures are tightly constrained to unify with lexical and grammatical elements, and they are consistently used and understood by the signing community. For spoken languages, gestures are loosely integrated with the speech signal and they may or may not communicate information to the listener. Additionally, in contrast to the consistency found across signers regarding the shape and usage of spatially-mapped information, the gestures of speakers show considerable variation as to their shape, size, and clarity and as to how much information they convey.

With the goal of quantifying the linguistic contribution of gesture in spoken language narratives, Taub, Piñar, and Galvan (2001) conducted a study in which native users of ASL, Spanish, and English were asked to retell cartoon episodes in their respective languages. Interestingly, subjects showed remarkable consistency within each language regarding what type of
conceptual information (i.e. path, manner, etc.) is likely to be expressed spatially (with or without accompanying lexical elements). However, a great deal of variation was also observed from subject to subject among English and Spanish-speaking subjects regarding the expressive quality of their gestures and the extent to which the whole body as well as facial expression was involved. Thus, while all hearing subjects expressed some conceptual information through iconic and deictic gesture, some subjects made better use of the space in front of them than others, making their iconic gestures more easily identifiable and establishing clearer connections between gestural elements. Additionally, only some subjects made use of their whole body or of specific hand shapes to create blends that were very similar in nature to the use of role-shift and classifiers in sign languages.

One of our questions, then, is whether the presence of sign language-like gestural elements in naive hearing subjects will transfer to the linguistically meaningful use of spatially mapped information when they learn ASL. That is, can the way in which speakers gesture predict their ability to acquire some of the linguistic spatial aspects of ASL that are typically considered key for acquiring adequate levels of signing skills?

2. Some previous studies in ASL L2 acquisition

Although there are no clear guidelines as to which aspects of ASL are harder to learn, a descriptive study by Locker, McKee & McKee (1992) reports both student and teacher intuitions regarding the degree of learning difficulty of several features of ASL. While the teachers' perception in general was that the students had more difficulty in most areas than the students themselves thought, teachers and students agreed in identifying what the more difficult learning tasks were. One such task was adapting to the visual-gestural modality, that is, becoming comfortable with using the body. Both students and teachers also mentioned dexterity and coordination in producing and connecting signs, facial expression and other non-manual signals, spatial indexing through deixis, eye-gaze, and body-shift and classifiers. Fingerspelling was also rated as highly problematic.

Wilcox & Wilcox (1991) also address the issue of identifying difficult aspects of ASL. In their view, linguistic features aside, the most obvious difference between English and ASL is modality, which creates both production and reception difficulties for the adult hearing learner. Additionally, some of the characteristics that they identify as hard to learn are non-manual grammar features, the fact that ASL is a polysynthetic language that depends heavily on morphological inflection, and the use of classifiers. Thus, some of the features that have been identified in the literature as posing learning difficulties are part of the spatially-mapped component of ASL and may be found in a non-grammaticalized way in the co-speech gestures of hearing learners. If so, it
might be possible to devise strategies to tap into this pre-existing visual-spatial knowledge in order to facilitate the acquisition of the use of space in ASL.

Although, to our knowledge, there are no previous studies that look systematically at manual co-speech gesture as a predictor for ASL aptitude, McIntire & Snitzer Reilly (1988) examined whether the communicative facial expressions that are naturally used by people who use a spoken language are transferred into ASL facial grammar. Their study concludes that while preexisting affective facial expression does serve as a transition in acquiring non-manual grammar in ASL, the learner must first go through a reanalysis stage in which previous knowledge is processed as being linguistically meaningful. This reanalysis process seems to be necessary both for adults L2 learners and for infant L1 learners.

3. The present study

In our study, we investigate whether other gestural information, besides facial expression, may transfer into the acquisition of some of the linguistic spatial features of ASL and whether previous individual differences in gesturing across subjects will predict any differences in their ability to reach ASL competence. We focus on three specific target structures: 1) first person discourse structures, 2) third person discourse structures, and 3) spatial location.

The first type of structure is the equivalent in ASL of what Tannen (1989) termed as constructed dialogue for spoken languages, in substitution for the older term "direct speech." Constructed dialogue refers to one of the devices that speakers use to engage their audience. It consists of reconstructing a dialogue from memory and reporting it using grammatical first-person. In ASL, the notion of constructed dialogue has been recast as constructed action (Metzger, 1995). A dialogue or action is reconstructed from memory and reported by assuming the character's role, using features of first person discourse. ASL first person discourse incorporates one or more of the following elements: 1) partial or whole use of the body to convey actions; 2) neutral eye gaze (i.e. eye gaze that is not addressed at any member of the audience, but is rather addressed within the surrogate space in which the action is taking place; and 3) facial expression matching the reported action (cf.: Liddell, 1980; Padden 1986, 1990; Meier, 1990, Mather & Thibeault 2002). An example is given in figures 1 and 2. Figure 1 shows the target action, in which a cartoon cat smashes against a wall. Figure 2 shows the narrator using first person discourse to convey the targeted action by using part of his own body to represent the cat.
Actions can also be reported using third person discourse in ASL. In such cases, narrators do not assume the identity of the characters, rather they display their own perspective about the actions of a character or the movements of an object by standing back and gazing at classifier handshapes describing the event, as if watching a scene unfold before their eyes. This is illustrated in figure 3. The target action is the same as the one in figure 1. But here the narrator used third person discourse to display his own perspective of what the cat did by using a right-hand classifier handshape “1” to represent the cat and the classifier handshape “flat 5” to represent the wall. The relative position of his two hands represent the end result of the event.

Setting up the space is also an important aspect of ASL. Characters and objects are assigned specific locations within the signing space. Established locations are consistently indexed and referred to across the discourse.

We will track the development of these three aspects of ASL grammar at the early stage of ASL L2 acquisition and we will look at any possible transfer from previous gestural knowledge. Our hypothesis is that the quality of co-speech gesture in non-signers might predict successful
acquisition of certain spatial aspects of ASL. In particular, we hypothesize that: 1) use of role-shift in gesture might transfer into efficient learning of the elements of first person discourse in ASL; 2) use of classifier-like handshapes in gesture might transfer into efficient learning of the elements of third person discourse in ASL; and 3) ability to clearly and consistently set up the space in gesture might transfer into efficient learning of spatial locations in ASL. Additionally, we hypothesize that some of these skills might develop in relationship to one another.

3. Methods

Subjects
This is a longitudinal study of adult L2 learners of ASL. All subjects were hearing, native speakers of English within an age range of 17-47. They had no previous knowledge of ASL when they began their participation in the study. We tracked their ASL development after eight months since they started learning ASL. A total of eighteen subjects completed the study.

Procedures
The data collection involved two separate sessions. One took place before the subjects started learning ASL and the other one took place eight months after the subjects began learning ASL. In the first session, subjects were asked to watch seven cartoon vignettes and ten short clips from the vignettes. After watching each vignette or clip, they were filmed retelling the action to a partner in English. All subjects were also requested to fill out a background questionnaire that included, among other things, requests for information about their previous linguistic knowledge and expectations and attitudes about ASL learning. In the second session, eight months after the subjects started learning ASL, they were asked to watch the same cartoon vignettes and clips, and they were filmed retelling the stories in ASL. All subjects filled out the background questionnaire again to determine whether their expectations and attitudes about ASL had changed.

Coding
The research team devised a coding sheet to account for 1) use of first person discourse in co-speech gesture (pre-ASL) and in ASL; 2) use of third person discourse in co-speech gesture (pre-ASL) and in ASL; and 3) establishment of locations in co-speech gesture (pre-ASL) and in ASL. The coding sheet included the following measures for each of the above narrative components:
1) First person discourse measures: a) neutral eye gaze: gaze matches entity's eye gaze; b) facial expression matches character's emotion; c) body part(s) movement shows the character's performance.

2) Third person discourse: a) handshape and palm orientation are plausible (that is, iconically clear) to represent the entity's shape when using gesture, b) handshape and palm orientation are correct (matches the appropriate ASL lexicalized handshape/palm orientation) when using ASL; c) ability to use two different handshapes for different entities at the same time.

3) Location: a) locations are established correctly (matching the target cartoon); b) locations are referred to in a consistent manner; c) ability to set up two locations at the same time.

The research team, which includes hearing and Deaf researchers, coded the retelling of one cartoon clip both in English (pre-ASL) and in ASL for each subject. The one clip analyzed involved Sylvester the cat standing on the window ledge looking down at Tweety bird in its cage, also on the window ledge. Sylvester moves his index finger back and forth following Tweety's swinging on its swing. This clip turned out to be ideal because it elicited the use of role shift, classifier use, and the establishment of more than one location in both gesture and ASL. The coding ratings for the selected first person, third person, and location measures in gesture and ASL were transformed into numerical scores that were subsequently used to calculate statistical correlations.

**Analyses**

Specifically, our analyses looked at 1) which measures correlated with each other within gesture, to see whether any pre-existing gestural skills tend to group together; 2) which measures correlated with each other within ASL, to see whether any of the targeted skills develop together; and 3) we also looked at correlations between any of our measures in gesture and in ASL, to see if an individual’s skill in gesture could predict skill development in ASL after two semesters of ASL classes.

**3. 2. Results**

**First person discourse:**

Our first person discourse measures did not correlate with each other within gesture. First person role shift attempts (identifiable instances of role-shift use), eye gaze, and facial expressions did not correlate with each other. That is, although subjects used first person discourse strategies in gesture, they did not incorporate all the linguistic elements of first person discourse that are found in ASL,
such as matching expression and neutral eye gaze. This is to be expected since the use of co-speech gesture is not grammatical.

Within ASL, we see a different story. First person discourse attempts correlated with first person facial expressions (r = .670, p = .002). Additionally, first person facial expressions correlated with first person correct gaze (r = .600, p = .008). However, first person attempts did not correlate with first person correct eye gaze. That is, first person discourse in ASL was produced with correct facial expression more often than with correct neutral eye gaze. This suggests that linguistic use of eye gaze in first person discourse is harder to acquire than matching facial expression. Nevertheless, a comparison of the correlations among first person measures in gesture and in ASL suggests emerging linguistic nuance in the use of first person discourse (i.e., correct facial expression) at early stages of ASL acquisition.

None of our first person role-shift measures in gesture correlated with any of the first person discourse measures in ASL. The subjects who used role-shift in gesture were not necessarily the same ones who used first person discourse in ASL. At the first stages of ASL, use of first person discourse elements do not seem to be due to transfer from first person discourse abilities in gesture. We could see many of our subjects working to focus on ASL vocabulary items. This may have inhibited their natural use of first person discourse in their narratives.

**Third Person discourse:**
Within gestures, third person classifier attempts (identifiable instances of classifier-like structures in the subjects' gestures) correlated with third person classifier complexity (r = .748, p = .000). The more a person uses classifier-like handshapes in gesture, the more complex they tend to be (e.g., the use of two different handshapes simultaneously). Third person classifier attempts also correlated with third person classifier plausible handshapes (r = .601, p = .000). We interpret this finding to show that while third person classifiers do not show linguistic features in gesture—as one would expect—they do show iconic accuracy.

Correlations for third person discourse measures within ASL show a similar pattern. Third person discourse attempts are correlated with third person discourse complexity (r = .773, p = .001). In addition, third person discourse attempts are correlated with correct handshape for ASL (r = .470, p = .049). The more a learner attempts to use third person discourse, the more complex their third person structures tend to be. Learners unskilled at third person discourse tend to avoid using the structure. We conclude that third person discourse is used at an early stage with some degree of
linguistic nuance (subjects are able to use some, but not all of the grammatical features required of third person discourse structures.)

Correlations for third person discourse measures in gesture and ASL reveal a positive correlation between third person attempts in gesture and third person attempts in ASL (r = 0.579, p = .012). That is, there is transfer of this feature from gesture to ASL, with an evolution from nonlinguistic iconic gestures to linguistically nuanced forms (e.g. correct handshape in ASL). This suggests that the pre-existing use of classifier-like structures in co-speech gestures might predict early learning of third person discourse structures in ASL.

**Space and location variables;**

Within gestures, the measures of correct location and location consistency were positively correlated (r = 0.567, p = .014). In addition correct location and simultaneous placement of two locations were also correlated (r = 0.528, p = .024). This indicates that location variables pattern together within gesture. Subjects who naturally locate elements of the discourse correctly in space also tend to refer to these locations consistently. Additionally, subjects who are precise and consistent setting up their locations can also use more complex location structures and locate different elements of the narrative in relation to one another.

Correct location and location consistency are also positively correlated in ASL (r = 0.620, p = .006). No other location variables were correlated with each other in ASL. That is, location variables also pattern together in ASL but less so than in gesture. This might be due to the fact that using location within the linguistic constrains of ASL is harder than using location in spontaneous gesture.

Several correlations were found between location variables in gesture and ASL. The ability to place two simultaneous placement locations in gesture was correlated with the same ability in ASL (r = 0.726, p = .001). Location consistency in gesture was also correlated with the simultaneous placement of two locations in ASL (r = 0.529, p = .045). It seems, then, that some pre-existing skills in using location in gesture might predict the correct use of some location variables in ASL.

**Correlations between location and third person classifiers;**

Interestingly, a number of correlations between location variables and third person discourse variables were found, prompting us to analyze these findings as well. Within gesture, location consistency and third person classifier attempts were correlated (r = 0.724, p = .001). The simultaneous use of two locations in gesture was correlated with third person classifier complexity
in gesture \((r = .504, p = .033)\). The number of correct locations in gesture was correlated with third person classifier attempts \((r = .680, p = .002)\) and third person classifier complexity \((r = .726, p = .001)\). It seems that the natural ability to set up space and the use of classifier-like handshapes within that space are related skills in gesture.

There were no such correlations between location and third person classifiers in ASL. Location skills and third person discourse skills seem to develop separately at this early stage of ASL acquisition.

There were some correlations, however, between location and third person discourse structures between gesture and ASL. Location consistency in gesture is correlated with third person discourse attempts in ASL \((r = .730, p = .001)\). Third person classifier attempts in gesture are correlated with the simultaneous placement of two locations in ASL \((r = .565, p = .015)\). There seems to be a relationship among some abilities to set up space and the use of classifier constructions across gesture and ASL. This again suggests that these may be related skills.

### 3.3 Summary of skill development and skill transfer

First person shift is produced with some linguistic nuance early in ASL (i.e., correct body part movement and matching facial expression.) It appears, however, that correct eye gaze for first person discourse develops more slowly in ASL than correct facial expression. We find no evidence of skill transfer from gesture at this early stage of ASL acquisition.

Ability to use third person discourse also develops early in ASL, with some evidence of skill transfer from gesture to ASL. For example, pre-existing ability to use classifier-like shapes in gesture has some predictability for use of third person discourse in ASL, with evolved linguistic nuance in ASL (e.g. correct ASL handshapes.)

Regarding location measures, some location skills already pattern together at an early stage of ASL acquisition (location correct/location consistency). There is some predictability between ability to set up the space in gesture and ability to set up the space in ASL. Additionally, as we saw, there is a relation among several location variables and third person discourse variables both within pre-ASL gesture and across gesture and ASL. We might conclude that pre-existing ability to set up the space in gesture has some predictability for use of third person discourse in ASL. Correspondingly, the ability to use classifier-like shapes in gesture has some predictability for the development of some location variables in ASL.
4. Conclusions and further questions;

The reported correlations reveal some interesting patterns regarding the development of certain spatial ASL skills that are central in narrative discourse. While our study included a relatively small sample and one must be cautious in generalizing our results to all learners, we hope these results will generate further questions and stimulate further research about ASL L2 acquisition. For example, while we tracked the acquisition of a few selected skills eight months after the subjects began learning ASL, one might ask if our results will change at a later stage of ASL acquisition. Will the emerging linguistic features found in the subjects' use of location, third person discourse, and first person discourse continue to develop at a later stage, or is there a U learning curve, such as the one found by McIntire & Snitzer Reilly (1988) in their study on facial expression in ASL? Will skills that seem to pattern together (e.g., some location variables) at an early stage continue to pattern together at a later stage, or do they develop separately? For skills that pattern together, will enhancing one during ASL training help in the acquisition of the other (e.g., some location variables and use of third person discourse elements)? Our next step will be to track the same skill variables at a later L2 acquisition stage in order to get a clearer idea about the pace and order of skill development and about the relationships among different skills. Finally, we hope this research can bring insight into the issue of linguistic transfer in L2 acquisition when the L1 and the L2 have different modalities. Thus, while the linguistic spatial skills that we considered in this study have no parallel in the spoken modality, the gestures that accompany speech may reveal pre-existing spatio-visual skills that might facilitate or predict the development of some spatial skills in ASL. Looking at gesture as a possible component of linguistic transfer might prove fruitful not only in predicting aptitude in sign language acquisition, but also in devising teaching strategies and methodologies that may tap into the learners' preexisting visuo-spatial skills.

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An electronic dictionary of Danish Sign Language

Thomas Troelsgård and Jette Hedegaard Kristoffersen

Abstract

Compiling sign language dictionaries has in the last 15 years changed from most often being simply collecting and presenting signs for a given gloss in the surrounding vocal language to being a complicated lexicographic task including all parts of linguistic analysis, i.e. phonology, phonetics, morphology, syntax and semantics.

In this presentation we will give a short overview of the Danish Sign Language dictionary project. We will further focus on lemma selection and some of the problems connected with lemmatisation.

1. The project

The Danish Sign Language dictionary project runs from 2003 to 2007. The dictionary aims at serving the needs of different user groups. For signers who have Danish Sign Language as their first language, the dictionary will provide information about Danish Sign Language such as synonyms and variants. Furthermore, it will serve as a tool in their production of written Danish by providing Danish translations and by serving as a bridge to more detailed monolingual Danish dictionaries through the equivalents. For Danish Sign Language learners the dictionary will provide means to identify unfamiliar signs, as well as to produce signs.

There are two ways of looking up signs in the dictionary: either through a search based on the manual expression of the sign, or through a search based on a Danish word. In the dictionary each sign is represented by a video clip. For each meaning of a sign one or more Danish equivalents will be provided, as well as one or more sample sentences including the sign. Entries also include several types of cross-references to synonyms, "false friends" etc.

2. Lemma selection

Contemporary dictionary projects dealing with spoken/written language very often use text corpora when selecting which words to describe. If you have a large balanced text corpus, you can easily decide which words are the most frequent. Working with sign language, you could do the same, if
you had access to a large balanced sign language corpus. However, to build such a corpus is a task that by far exceeds the resources of the Danish Sign Language project. One would have not only to collect a considerable amount of video recordings representing different types of language use, but also, and this is the resource consuming part, to transcribe the videos consistently, in order to ensure that all instances of a specific sign are transcribed using the same gloss.

In the Danish Sign Language dictionary project we soon realised that the use of this approach would not be possible due to time and resource limitations. Hence, we had to consider a different approach. We chose a two-step approach that consists of an uncritical sign gathering followed by the actual lemma selection.

3. Collecting signs

We uncritically collect all Danish Sign Language signs known to us into a gross database in order to establish a pool of signs from which we can choose the actual lemmas. The database also gives us an idea of the approximate size of the largest possible lexicon.

As sources for the database, we initially used all existing Danish Sign Language dictionaries and sign lists, starting from the oldest existing Danish Sign Language dictionary from 1871 (ref.1, see figure 1). To ensure that also newer signs and multi-channel signs were included, we then started to make video recordings of a group of consultants, mainly native Danish Sign Language signers aged 20-60, from different parts of Denmark. We arrange meetings where the consultants discuss different Danish Sign Language-related topics, and are also asked to perform monologues on different topics. All discussions and monologues are recorded on video. From these recordings we gather signs not previously included in our database. Furthermore, we collect sentences for use as usage examples in the dictionary. In order to collect as many signs as possible, the consultant sessions are planned to continue almost throughout the editing period, although we now get considerably less new signs per session in comparison to the earliest sessions.

The gross database presently holds about 6,787 signs. 5,777 of these were found in existing dictionaries, the remaining 1,010 are “new” signs found in the video material from our consultant meetings.
The signs in the database are identified by their handshape and one or more Danish words equivalent to the meaning(s) of the sign. Furthermore, we enter the source(s) where the sign was found, and a usage marker that indicates whether the sign is still in use, or is considered to be outdated or otherwise restricted in use.

4. Selecting signs

For the first edition of the Danish Sign Language dictionary our aim is to select about 1,600 signs that cover the central Danish Sign Language lexicon according to the following criteria:

• long history of use
• high semantic significance
• high frequency

Thus, we have made a series of selections, each focusing on one (or two) of the criteria mentioned above. Our first selection aimed to include signs with a long history of use in Danish Sign Language, and we included all signs from the two oldest Danish Sign Language dictionaries, considered to be still in use.

The following rounds of selections focused on semantic significance and frequency. As we do not have a Danish Sign Language corpus, neither the resources to perform large scale surveys, we had to rely on the sense of language of our staff. We therefore individually rated the signs in our gross database. The rating was performed from different points of view as the deaf staff members focused on the actual signs, judging their frequency, and the hearing mainly on the semantic significance of the signs, i.e. their place in an imaginary hierarchy of concepts. Surprisingly there was a very high degree of concordance between our ratings, and the resulting list of signs, ordered according to the ratings, turned out to be one of our main guidelines for lemma selection.

In addition to the criteria mentioned above, we would like to ensure that semantic fields were covered in a balanced way, that is to ensure that if e.g. the signs for ‘red’, ‘blue’, ‘yellow’ and ‘black’ are selected, then the signs for ‘green’ and ‘white’ are included as well. To achieve this, all signs from the first rounds of selection were provided with semantic field marker(s), in order to make it possible to group the signs according to topic. These groups are then examined, and obviously lacking signs are included.

As a result of the rounds of selection, we have by now selected about 1,300 lemmas for the dictionary, saving the last 300 spaces for completion of semantic fields, as mentioned above. Figure 2 shows the distribution of the selected signs, according to their source. As most signs are found in several sources, the total number of selected signs exceeds 1,300.
<table>
<thead>
<tr>
<th>Source</th>
<th>Signs</th>
<th>In use</th>
<th>Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danish Sign Language Dictionary of 1871 (ref. 1)</td>
<td>118</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td>Danish Sign Language Dictionary of 1907 (ref. 2)</td>
<td>275</td>
<td>232</td>
<td>232</td>
</tr>
<tr>
<td>Danish Sign Language Dictionary of 1926 (ref. 3)</td>
<td>1189</td>
<td>944</td>
<td>482</td>
</tr>
<tr>
<td>Danish Sign Language Dictionary of 1967 (ref. 4)</td>
<td>2300</td>
<td>1789</td>
<td>679</td>
</tr>
<tr>
<td>Danish Sign Language Dictionary of 1979 (ref. 5)</td>
<td>2538</td>
<td>2240</td>
<td>934</td>
</tr>
<tr>
<td>KC Tegnbank¹ 1991- (ref. 6)</td>
<td>1350</td>
<td>1245</td>
<td>718</td>
</tr>
<tr>
<td>Nettegn² 2002- (ref. 7)</td>
<td>1600</td>
<td>1059</td>
<td>388</td>
</tr>
<tr>
<td>Other dictionaries</td>
<td>2661</td>
<td>1940</td>
<td>514</td>
</tr>
<tr>
<td>Danish Sign Language dictionary consultants</td>
<td>1010</td>
<td>998</td>
<td>441</td>
</tr>
</tbody>
</table>

Figure 2. Sources for the Danish Sign Language dictionary gross sign database

5. Lemmatisation

Lemmatisation in the Danish Sign Language dictionary is based partly on phonology, partly on semantics. In the following, we will focus on these two topics, as well as on the closely related problem regarding distinction between synonyms and variants.

6. Phonological description

In order to be able to search and sort signs based on their manual expression, a phonological description of every sign is required. A major problem in this respect is to decide the level of details in this description.

In the Danish Sign Language dictionary project, the minimum requirements for user searches are descriptions of handshape and location, but in order to be able to sort the signs without getting too large groups of formal homophones, additional information about at least orientation and movement is needed as well. An even more detailed phonological description would also give the possibility of making more detailed searches, along with other features that might be added in the future.

We therefore decided to establish a level of details that would allow us to generate Sign Language notation comparable to the Swedish notation system, as the Swedish Sign Language dictionary to some extent has served as a guideline for the Danish Sign Language dictionary project.

To achieve this level of phonology description, we developed a model where a sign is described as one or more sequences, each holding the following fields (the numbers in brackets indicate the number of values in the inventory):

- Handshape [59]
- Finger orientation [18]

¹ Not including signs that are considered outdated or otherwise restricted in use.
² Number of signs selected by November 2006.
³ Approximate numbers as new signs are continuously added to these dictionaries.
• Palm orientation [14]
• Location [32]
• Finger or space between fingers [9]
• Straight and circular movement [23] (used both for main and superimposed movements)
• Curved and zigzag movement [9]
• Local (hand level) movement [4]
• Type of contact [5]
• Type of contact extension [6]
• Initial spatial relation between the hands [5]
• Sign type (number of hands, type of symmetry) [6]
• Marker for bound active hand
• Marker for point-symmetrical initial position
• Marker for consecutive interchange between active and passive hand
• Marker for distinct stop
• Marker for repetition

A sequence can hold three instances of handshape and orientation – two configurations of the active hand (initial and final), and one of the passive hand. Location can be entered both for the active and the passive hand.

With this level of details we ensure that only signs that are actually alike are described as homophones. Furthermore, we gained the possibility of generating prose descriptions of the articulation of signs as well as descriptions in different notation systems, which could enable us to automatically compare the Danish Sign Language lexicon to other Sign Languages.

7. Semantic analysis of signs

In the Danish Sign Language dictionary project, we allow only meanings that are semantically closely related from a synchronous point of view (as well as their transparent figurative uses) to occur together in one entry. Thus, strongly polysemous signs are often formally described as two or more homophone signs. For example, Danish Sign Language expresses the meanings 'red' and 'social' through one sign (manually), but the sign has two separate entries in the dictionary because the semantic relation, although it might easily be explained diachronically, is considered synchronically opaque. This approach requires a thorough semantic analysis of every sign. The
semantic analysis is also needed in order to decide the structure of a sign entry, i.e. to decide if a sign entry should have one or several (related) meanings.

To ensure a consistent treatment of the signs, we discussed all possibly polysemous signs that were encountered during the editing in the early stages of the project. As a result of these analyses we were able to establish a series of typical semantic patterns that were then described in our editing rules, accompanied by sign examples. These rules are now being applied on signs with similar semantic content during the editing, and we now only have to treat relatively few semantically problematic signs at staff meetings.

Performing the semantic analysis of a polysemous sign, we first list all known meanings of the sign, and decide which of these constitutes the core meaning. If some of the meanings are considered not to form a transparent semantic relationship with the core meaning, they are treated in separate entries. We then try to group the remaining (related) meanings, in order to reduce the number of meanings in the final entry.

In the following, we will give an example of a sign, which meanings according to our rules can be grouped into one, as well as an example showing the opposite. The semantic structure of the described meanings is pictured in diagrams which central node denotes the core meaning, which equals a separate meaning in the dictionary entry. It can be equivalent to a lexicalised concept in Danish, or it can be an “artificial” concept on a higher level in an imaginary semantic hierarchy,
covering several related concepts. The “star nodes” denotes the actual concepts/equivalents covered by the core meaning.

The sign GRUPPE ‘group’ denotes many different kinds of groups of people, e.g. ‘(political) party’, ‘band’ and society. If we were to distinguish between these concepts, like a large monolingual dictionary would do, this sign would probably have 10-20 meanings. A level of details like that would imply investigation of each meaning, including a search of usage examples in our video recordings – a task that is far beyond the resources of the Danish Sign Language dictionary project. In cases like GRUPPE, we therefore try to establish a shared concept for all these meanings. In other words, we try to take one step up in an imaginary hierarchy of concepts. Thus, the analysis of GRUPPE resulted in the establishing of a core meaning something like ‘persons sharing an activity or otherwise forming a group’, and allowed us to group all the ‘group’ meanings of the sign together as one single meaning, see figure 3.

FRUGT ‘fruit’ denotes ‘fruit’ as well as the specific fruit ‘apple’. Theoretically, these two meanings could be described as one, if all remaining specific fruits were either lexicalised as FRUGT, or not lexicalised at all. This is not the case, as lots of fruits have their own signs, and a grouping of meanings like the one shown in figure 4 is therefore not possible. Consequently, FRUGT is described as having two meanings: ‘fruit’ and ‘apple’.

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Figure 4. Impossible grouping of meanings for FRUGT

FRUGT ‘fruit’ denotes ‘fruit’ as well as the specific fruit ‘apple’. Theoretically, these two meanings could be described as one, if all remaining specific fruits were either lexicalised as FRUGT, or not lexicalised at all. This is not the case, as lots of fruits have their own signs, and a grouping of meanings like the one shown in figure 4 is therefore not possible. Consequently, FRUGT is described as having two meanings: ‘fruit’ and ‘apple’.
8. Distinction between synonyms and variants

In the Danish Sign Language dictionary our main criteria for lemmatising are semantics and phonology. In other words, two signs that differ in meaning become separate entries, and so do two signs that differ in articulation. The main problem, of course, is to decide “how much” two sign forms should be allowed to differ in order to be treated as separate entries. The semantic differentiation is treated in the section “Semantic analysis of signs” above. The phonological differentiation presents a particular problem, as phonological variation is quite common in Danish Sign Language. In order to be able to describe two slightly different sign forms with the same meaning in one entry, we therefore have to allow for a certain amount of variation.

In the Danish Sign Language dictionary we consider two sign forms that differ in no more than one of the categories handshape, location, movement and orientation as variants.

Examples of variants:

- handshape: HÅR ‘hair’ (see figure 5 and 6)
- location: HVORFOR ‘why’ (see figure 7 and 8)
- movement: ÅR ‘year’ (see figure 9 and 10)
- orientation: MATEMATIK ‘mathematics’ (see figure 11 and 12)
Figure 7. HVORFOR-a 'why'

Figure 8. HVORFOR-b 'why'

Figure 9. ÅR-a ‘year’

Figure 10. ÅR-b ‘year’

Figure 11. MATEMATIK-a ‘math’

Figure 12. MATEMATIK-b ‘math’
Hence, instances of a sign with variation in two categories are formally regarded as synonyms, having separate entries. In some cases, a concept can be expressed through several different signs, e.g. the six signs meaning ‘September’ (see figure 13). Consequently the Danish Sign Language dictionary will have six different entries for ‘September’, as all these signs are commonly used. As the ‘September’ signs by the native signers are considered separate signs, this approach seems reasonable. In other cases, however, the variant rules lead to a splitting of signs into several entries that might seem contra-intuitive to the native signers. An example of this is the sign for ‘shrimp’, which has four variants, but is formally described as two signs, each having two variants (see figure 14-17).

![Figure 13. SEPTEMBER1-6 'September'](image)

![Figure 14. REJE-1a 'shrimp'](image)

![Figure 15. REJE-1b 'shrimp'](image)
As our variant rules are rather strict, we have had to add a few exceptions, in order to limit the number of formal variants. Thus we allow for repetition, articulation with two hands, opposite movement direction and change in the handshape of the passive hand, assuming that the meanings of the two variant forms are identical.

References

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The Danish Sign Language Dictionary project
Centre for Sign Language and Sign Supported Communication – KC
Kastelsvej 60
DK-2100 København Ø
Denmark

Thomas Troelsgård  e-mail: tt@kc.dk
Jette Kristoffersen  e-mail: jk@kc.dk
Do hands sign? Do mouths speak?

Bencie Woll¹, Cheryl Capek¹, Dafydd Waters¹,², Ruth Campbell¹, Mairead MacSweeney¹,², Mick Brammer³, Phil McGuire³, Tony David³

1. Deafness, Cognition and Language Research Centre, University College London
2. Institute of Child Health, University College London
3. Institute of Psychiatry, Kings College London

1. The articulators of sign language

- They are not just manual – there is a rich and complex role for other articulators: body, face, and, in particular, the mouth.
- The research reported here focuses on one subgroup of these mouth actions: 'echo phonology'
  (Woll 1996, 2001)
  - a repertoire of mouth actions not derived from spoken language
  - an obligatory accompaniment to some manual signs in a range of sign languages
  - characterised by 'echoing' on the mouth the articulatory actions of the hands.

2. Neurobiological perspectives

- Studies of neurons in the monkey brain by Rizzolatti and colleagues since 1996 have identified ‘mirror neurons’, which fire when the animal observes another individual making specific movements (primarily for reaching and grasping)
- The mirror system, in temporal, parietal and frontal regions, is part of a system specialised for perceiving and understanding biological motion
3. **Hand and mouth - Gentilucci**

- When humans are asked to open their mouths while grasping objects, the size of the mouth opening increases with the size of the grasped object.
- Grasping larger objects and bringing them to the mouth induces increases in the size of mouth opening and voice spectra of syllables pronounced simultaneously.
- Observing another individual grasping or bringing different sizes of objects to the mouth also affects the articulation of syllables.

4. **The hand and the mouth – shared actions**

- The anatomical closeness of hand and mouth related neurons in the premotor cortex may relate evolutionarily to the involvement of both in common goals.
- The relationship between mouth actions related to eating, and those found in spoken language, have been discussed in detail by MacNeilage.

5. **Non-manual actions**

![Non-manual actions diagram](image-url)
6. **The mouth in sign language**

There is extensive use of the mouth for a variety of functions

- **Mouthings**: borrowed from spoken words – used to disambiguate manually homonymous forms
- **Adverbials**: used to signal manner and degree
- **Enaction (“mouth-for-mouth”)**: the mouth represents an action directly (e.g. CHEW, BITE
- **Echo phonology**

7. **Echo phonology**

- obligatory in the citation forms of lexical signs
- not derived from spoken language
- specifiers of meaning, not adverbials added to citation forms
- not enactions
- the mouth action includes movement: either the exhalation or inhalation of breath, or a change in mouth configuration during the articulation of the sign.
- features are based on the articulatory features of the manual movement

In 3 different BSL signs all meaning ‘succeed’ or ‘win’, 3 different oral patterns occur, and one cannot be substituted for the other. The action of the mouth, while echoing that of the hands, is not in itself iconic.

8. **Examples of ep syllable types**

<table>
<thead>
<tr>
<th>mouth</th>
<th>gloss</th>
<th>hands</th>
</tr>
</thead>
<tbody>
<tr>
<td>pa</td>
<td>SUCCEED</td>
<td>associated with one or two active hands, movement consists of hand separation and twisting, with single sharp action</td>
</tr>
<tr>
<td>jff</td>
<td>EXIST</td>
<td>wriggling or fingers, repeated shaking or twisting of wrists(s), no path movement</td>
</tr>
<tr>
<td>hww or hyy</td>
<td>WIN</td>
<td>repeated shaking of wrist, no path movement</td>
</tr>
<tr>
<td>Ᾱp</td>
<td>THANK-GOD</td>
<td>closing and twisting of hand(s), sharp movement</td>
</tr>
<tr>
<td>am or Ᾱm</td>
<td>TRUE</td>
<td>hand closes and contacts passive hand, sharp movement</td>
</tr>
<tr>
<td>Ᾱp</td>
<td>DISAPPEAR</td>
<td>hand(s) close, sharp movement with abrupt stop</td>
</tr>
</tbody>
</table>
9. **fMRI Study**

An fMRI study was undertaken to explore the following conditions:

- silent speech (SS)
- BSL signs that require mouthing for disambiguation (DM)
- BSL signs that exhibit echo phonology (EP)
- BSL signs that require no specific mouth action (hands only - HO)

<table>
<thead>
<tr>
<th>Stimulus characteristics</th>
<th>mouth opening and closing</th>
<th>hand- arm movements (BSL)</th>
<th>English-derived mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands only</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Echo phonology</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Disambiguating mouth</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Silent speech</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

10. **Research questions**

- To what extent does the pattern of activation during speech perception and sign language perception differ?
- Does the perception of mouthing (DM) differ from signs without mouth (HO)?
- Does echo phonology (EP) generate distinctive activation compared with mouthing (DM)?
- How do hearing non-signers differ from deaf signers?

11. **Study participants**

- Thirteen (6 female; mean age 27.4; age range: 18-49) right handed participants
- congenitally, severely or profoundly deaf native signers, acquired BSL from their deaf parents
12. **Examples of experimental stimuli**

<table>
<thead>
<tr>
<th>EP</th>
<th>DM</th>
<th>Man</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXIST [ə]</td>
<td>FINLAND/ METAL</td>
<td>TABLE</td>
</tr>
<tr>
<td>WIN [ɨ]</td>
<td>BATTERY/AUNT</td>
<td>CHERRY</td>
</tr>
<tr>
<td>NONE [pʊ]</td>
<td>WOOD/ PROBLEM</td>
<td>BUTTER</td>
</tr>
<tr>
<td>SUCCESS [pə]</td>
<td>RUSSIA/ BOY</td>
<td>KNOW</td>
</tr>
<tr>
<td>END [pom]</td>
<td>ITALY/ WIN</td>
<td>FAX</td>
</tr>
</tbody>
</table>

13. **To what extent do the patterns of activation for speech perception and sign language perception differ?**

13.1. **Specific contrasts**

Three specific contrasts were designed to answer the following questions:

- Do any systematic differences occur as a function of language type (speech vs sign)?
- Within BSL, is the pattern of activation sensitive to the articulators used?
- Within BSL, can mouthings and mouth gestures be cortically distinguished?
• silent speech can activate regions in deaf people’s brains that have been identified as auditory speech processing regions in hearing people.
• common activations across the four linguistic conditions in frontal regions
• posterior regions, including regions known to be sensitive to the perception of biological actions are also activated

Comparing speech and sign

Regions for ANOVA contrasts: Silent speech (yellow) vs. Signs (EP, DM & HO) (blue)

14. How is the brain circuitry used by sign language affected by actions of the mouth?

Signs with Mouth Actions vs HO Signs
• greater activation for signs with mouth actions in superior temporal sulci of both hemispheres
• Additional activation in the left inferior frontal gyrus
• HO signs activated more right posterior temporo-occipital regions. These may be particularly important for the perception of hand actions
15. Does the perception of DM signs differ from HO signs?

- If language type (speech vs. sign) is the crucial reason for more posterior activation in BSL perception, then DM signs and HO signs without mouth should be processed identically.
- On the other hand, if the articulators determine the areas of activation, then DM and HO signs should differ, with more posterior activation for the HO signs.
- The data support the second alternative: anterior activation characterised DM signs and posterior activation HO signs.
- These findings are very similar to activations when viewing hand and mouth gestures that are unrelated to sign language.

Within BSL, can mouthings and mouth gestures be cortically distinguished?

Does EP generate distinctive activation compared with DM?

- DM generated relatively greater activation in a small region of the left middle and posterior areas of the upper temporal gyrus, while EP produced relatively greater activation further back.
- DM is more ‘speech-like’ than EP.
• Thus EP appears to occupy an intermediate position between HO signs and signs with mouth actions derived from spoken language.

**Different types of mouth action within bsl**

Contrast between DM and EP

• Differential activation in temporal regions
• DM is more like speechreading
• EP signs more closely resemble HO signs than DM signs.

This provides a reasonable cortical correlate of the proposal that, for EP, “the hands are the head of the mouth” (Boyes Braem and Sutton-Spence, 2001), as proposed by Woll (Woll, 2001). However, more research is needed on the role of the mouth in sign language and the hands in spoken language.

fMRI suggests that echo phonology occupies an interestingly intermediate position between signs and words. Sign language data are essential, since no studies of spoken language can offer analogues to these findings since spoken language utilises a single articulatory system, while sign languages use manual and nonmanual actions systematically and synthetically. While it is clear that various uses of the mouth are common across different sign languages, more research is needed on non-European sign languages.

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Imaging the Deaf Brain: Wellcome Trust, 068607/Z/02/Z
Early acquisition in deaf and hearing native signers: insights from the BSL MacArthur-Bates CDI

Tyron Woolfe
Deafness, Cognition and Language Research Centre, University College London

Introduction

The MacArthur-Bates Communicative Development Inventory (CDI) (Fenson et al., 1993) is a parent-rated vocabulary checklist to indicate the number of words understood and produced by their infants. There is an American Sign Language version (Anderson & Reilly, 2002). The British Sign Language (BSL) version is under development.

Question: Does the pattern of slower development in the early acquisition of spoken languages in same-mother bilingual children at 24 months in comparison to monolingual children extend to cross-modal bilingual children (native signers; hearing children) of deaf parents who are learning English and British Sign Language?

A substantial literature suggests that bilingual children:
- need to move from a single linguistic system to a more mature system where the two languages are separated. (Yotter & Tiersch, 1978).
- display divergence in the rate of development compared to that of Catalan/Spanish monolingual children on the CDI (Swaff et al., 2005).

Do such differences in early acquisition in bilingual families extend to cross-modal bilingual families too?

It has been claimed that sign language is acquired earlier than spoken language (Acredulo & Goodwyn, 1990). If this is the case, the overlap that occurs with two spoken languages may not occur in bimodal bilingualism.

Because signs and words can be produced at the same time, it is possible that the separation of languages may not occur in the same way.

Cross-modal and intra-modal bilingualism may resemble each other, therefore BSL/English cross-modal bilinguals may exhibit patterns similar to those of monolinguals.

Method

Data was collected longitudinally at tri-monthly points. A total of 256 data sets from 64 deaf and hearing native signers was used for subsequent analyses.

Results

Vocabulary growth by age (N=256)

Discussion

A transitory pattern was observed in the vocabulary curves, where hearing children had a significantly greater rate of development for comprehension, F(1,254)=23.35, p<.01 and production. F(1,254)=9.59, p<.01. However comparisons at each age interval via independent t-tests revealed significance only for comprehension between 17.3-1months.

Possible explanations for the difference in development of comprehension point to evidence that Deaf parents simultaneously produce English lexical items and BSL signs with their hearing children (bimodal input). This could be interpreted as suggesting that receiving two (simultaneous) channels enhances sign language in hearing children. However, this effect is notably transient.

Hearing children of deaf parents were predicted to have slower language development at 24 months where exposure to English would accelerate (divergence). Instead, we found them to surpass rates of BSL development in deaf children. Baker & Van den Boogaard (in press); Spencer & Harris (2005) also found hearing children to be more advanced in sign language than their deaf counterparts.

Conclusion

The results challenge bilingual theory, suggesting a difference in language development for bilingual bimodal children; hearing children of deaf parents. Theories of bilingual acquisition take no account of cross-modal bilingual children. What about deaf children learning two signed languages? Would their development be comparable to that of intra modal bilinguals?

Following on from this, deaf and hearing native signers appear to develop differently and this needs further investigation.

The key issue for the current standardisation of the BSL MacArthur-Bates CDI specifically is whether hearing children ought to be kept in the data analysis.

References


Roots, leaves and branches – The typology of sign languages

Ulrike Zeshan
International Centre for Sign Languages and Deaf Studies
University of Central Lancashire, Preston, UK

1. Introduction

This contribution is intended to summarise and exemplify important findings that have emerged from the systematic comparative study of sign languages over the last years. The increasing availability of data from diverse sign language around the world has made it possible, for the first time in the history of sign language research, to broaden our cross-linguistic data base sufficiently for meaningful typological studies across sign languages to be carried out. This new field of study is known as sign language typology.

The sections below look at the new sub-discipline of sign language typology from a variety of different angles. Rather than being a systematic, exhaustive account of the whole field of study, the aim of this article is to provide illustrative glimpses from different angles. Among others, we will look at the sources whose confluence creates the field of sign language typology (the “roots” in terms of the metaphor in the title), at the different ways of doing sign language typology and the associated methodologies (the “branches”) and at some of the fascinating data and their typological and theoretical significance (the “leaves”).

The remainder of this article is organised in four parts. In section 2, sign language typology is introduced, focusing on the aims and the methodologies of the field. Sections 3 and 4 illustrate the kinds of findings that emerge from the cross-linguistic study of sign languages. We look at examples of results from large comparative studies as well as data from sign languages used in village communities with hereditary deafness. The latter topic leads to a theoretically profound question about the nature of human language in the visual-gestural modality, showing how a broadening of the data base in sign language typology can lead to theoretically challenging issues. The article concludes by looking at the impact beyond linguistics that research in sign language typology has on communities of deaf people around the world.

1 Zeshan (in prep.) is an attempt at summarising comprehensively the current state of knowledge in sign language typology.
2. Introducing sign language typology

2.1. The sources of sign language typology

Sign language typology draws upon two source disciplines within linguistics that previously had little contact one another. As the name already suggests, these two disciplines are sign language research and linguistic typology. The interaction between them is schematically illustrated in Figure 1, which shows the double orientation inherent in sign language typology: On the one hand, sign language typology uses theoretical and methodological resources from linguistic typology, but broadens the range of the available languages to include sign languages. Conversely, sign language typology uses results from sign language research, but focuses on linguistic diversity within the group of sign languages from a typological perspective.

![Figure 1: The source disciplines of sign language typology](image)

As far as the entire range of linguistic sub-disciplines in spoken language research is concerned, no field is more naturally predestined to having an avid interest in sign languages than the field of linguistic typology. By and large, since coming into existence in the second half of the 20th century, linguistic typology has been concerned with evaluating how languages are different from or similar to one another. The seminal paper by Greenberg (1963) is often cited as a crucial point in the development of linguistic typology, and the field has developed rapidly since then. Although typologists use a very wide range of language data to study patterns of language variation, including many “exotic” languages in all parts of the world, sign language data have previously been almost entirely absent from research in linguistic typology. Many spoken language typologists
probably share the feeling expressed in Haspelmath (1997:17), where the author explains that sign
languages do not figure in his major study on indefinites because “[t]he cross-linguistic study of
sign languages is still in its infancy, and my own competence does not allow me to say anything
even about an individual sign language.”

The second topic that lies at the heart of linguistic typology and is closely related to the first
one, somewhat like the flipside of the same coin, is the search for language universals (e.g. Comrie
1989, Whaley 1997, Song 2001). What is it really that all languages have in common and that,
therefore, can be said to define the true nature of human language? More than for any other research
question, it is immediately obvious here that typologists must be most interested in what sign
language research has to say about a totally different type of visual-gestural language that has not
been considered before.

Just as typologists have previously ignored sign languages for the most part, sign language
researchers have also not taken into account a typologically informed perspective on their data. However, there is much to gain from such a perspective, as will become clear in section 3 below.
Indeed, the true extent of linguistic diversity across sign languages only becomes apparent when a
typological angle is applied to both known and newly discovered data, and these results continue to
surprise even experienced sign linguists.

Despite the clear connection between sign language typology and its two source domains, we
are not dealing merely with a merger of the two other fields. Rather, sign language typology brings
with it an entire new set of research questions and methodologies. These are detailed in sections 2.2
and 2.3 respectively.

2.2. The aims and methodologies of sign language typology

Sign language typology has two related immediate aims, both of which are associated with different
methodologies. The detailed documentation of individual sign languages around the world broadly
overlaps with corresponding descriptive research in sign linguistics, but has a somewhat different
focus. On the other hand, the systematic cross-linguistic study of broad samples of genetically and
geographically unrelated sign languages is a new undertaking that has no previously existing
parallels in sign linguistics, but is in many ways similar to corresponding work in spoken language
typology. These two types of investigation are intended to lead to a theory of variation across sign
languages, which is the most important secondary aim of sign language typology. Accounting for
the patterns of differences and similarities across sign languages then also allows us to re-assess the
question of language universals that hold both for sign languages and for spoken languages, as well
as the question of modality differences between sign languages on the one hand and spoken languages on the other hand. Figure 2 shows a flow chart of inter-relatedness of the main academic aims in sign language typology. The non-academic aims of sign language typology research are detailed in section 5 of this paper.

![Figure 2: The aims of sign language typology](image)

### 2.2.1. Documentation of individual sign languages

Since only a minority of the world’s sign languages have been documented to date, individual studies of as many different sign languages as possible are essential for sign language typology. Without a data base from a large number of geographically and genetically unrelated sign languages, meaningful typological work would be impossible, and the value of any generalisations drawn from a limited range of, for instance, mainly Western European and North American sign languages would be severely compromised. Therefore, one of the aims of sign language typology must be to collect reliable and adequately structured information on a broad range of sign languages. At the moment, we are still only scratching the surface of the real range of variation that can be found across sign languages.

So far, our state of knowledge about sign languages has developed like a mosaic that at first is rather sketchy and has many empty areas, but is increasingly giving us a clearer picture of the range of diversity in sign languages (see Figure 3). In the first decades since its inception, sign language research has been dominated by “western” sign languages in Europe and North America, first and foremost American Sign Language, and this is still the case to some extent. More recent work has
documented urban sign languages in other parts of the world, such as, for instance, in the Levantine Arab area (Hendriks 2004, Hendriks & Zeshan, forthcoming). For a number of regions, research results are not easily accessible to an international audience because of the language of publications. For instance, most publications on Nihon Shuwa, the sign language used in Japan, are in Japanese, and many publications on South and Central American sign languages are written in Spanish or Portuguese.

The most recent important addition to the sign language data mosaic consists of sign languages in village communities (see the purple trapeze in Figure 3). Village sign languages will figure prominently in section 3.2 and section 4 below. Finally, the final picture in Figure 3 contains a blue triangle marked with a question mark. This stands for any further types of sign languages that will certainly be discovered in due course. Most importantly, various kinds of minority sign languages that may be found to be in use by smaller groups of signers co-existing with “national” sign languages, are in need of further research.

For the purpose of sign language typology, not all kinds of linguistic documentation are equally valuable. The most important type of documentation is a reference grammar. Reference grammars are concise, yet in-depth accounts of all grammatical structures found in a language, and they are an important source of information for spoken language typologists, who can rely on several hundred reference grammars, though not all of equal quality. However, to date sign language research has not produced a single reference grammar on any sign language, so the sign language typologists has to rely on other, less than ideal, sources.

The framework of sign language typology is particularly suitable for boosting descriptive work on previously undocumented sign languages because it incorporates a broad perspective based on what is already known about typological diversity across spoken languages. For example, sign language researchers will not only wonder how a sign language expresses plurals, but also whether the language might have a category that is unmarked for number, whether nominal and verbal number is expressed differently or similarly, and how the category of number interacts with other...
We will not only ask how a sign language expresses possession, but also whether there is a relationship between possessives and existentials and whether there is a difference between alienable and inalienable possession. Typologically informed questions of this nature need to be answered for a large number of diverse sign languages before more extensive work can be done in sign language typology. At the same time, this kind of descriptive information is very useful input for the applied dimensions of sign language linguistics, such as the development of sign language teaching materials. The relationship between typological and applied sign linguistics will be discussed in detail in section 5.

2.2.2. Cross-linguistic studies of sign languages

Whereas the typologically informed documentation of individual sign languages aims at describing a wide range of structures within each one sign language, cross-linguistic studies investigate a particular grammatical domain across a suitably wide sample of different sign languages. Both strands of research are complementary, but cross-linguistic studies pose particular theoretical and methodological challenges that are discussed briefly in this section.

In order to arrive at a theory of variation across sign languages, it is necessary to make generalisations over comparable data from a wide range of sign languages. It is essential that these generalisations should be empirically substantiated, that is, based on real evidence from a range of primary data, rather than based on deductive reasoning and/or assumptions based on very few or even a single sign language. Cross-linguistic studies on sign languages address research questions about the parameters of variation that we can find across sign languages, about the range of variation that is displayed, and about patterns of variation. These are interrelated, yet separate undertakings. For instance, within the domains of questions, parameters of variation to investigate include facial expressions marking questions, the use of question particles, the set of question words in each language, pragmatic uses of questions, and the like. Within each parameter, sign languages in a sample will display a range of variation, and these can be compared to each other. For instance, the range of variation with respect to facial expressions is quite small across sign languages because there is a lot of overlap in the expressions used in many sign languages. On the other hand, question word paradigms (that is, the particular sets of questions words for which there are separate lexical items) show a huge range of variation across different sign languages. Moreover, some questions words and combinations of question words are found more frequently than others, and there is evidence for the inter-relatedness of question words and indefinites (Zeshan 2004b, 2006). Such patterns of differences in variability, frequency of occurrence, inter-relatedness of grammatical domains, etc., need to be accounted for in a theoretical framework of sign language typology. As
research in sign language typology progresses, we will be able to map out the structural diversity across sign languages in increasing detail.

For sign language typology, it is important to look for functional explanations of both similarities and differences across sign languages. Often the previous findings of spoken language typology can be of use here. For instance, the close relationship between interrogatives and indefinites, or between possession and existence, has been found in both spoken and sign languages, and explanations for these patterns have been suggested in the spoken language typology literature. Inventories of patterns, such as a limited number of construction types used to express possession (as in Heine 1997) can often be applied to sign languages as well. However, in other areas it is just as interesting to see that sign languages behave very differently from spoken languages, for instance with respect to some aspects of the domain of negation (see section 3.1.1).

Large cross-linguistic studies across sign languages present particular theoretical and methodological problems, some of which are the same as for spoken language typology. One serious issue, for instance, is the reliability of data. Clearly, since no single researcher can have personal knowledge of dozens of sign languages, how do we know if the information we are gathering is correct? There is no simple answer to this, and the problem of data reliability is inherent in typological work in any of the two language modalities. However, projects in sign language typology are in a somewhat different situation because it is necessary to actually generate a large part of the data within the course of a sign language typology project itself. This is due to the fact that so little published information is readily available, and means that the sign language typologist has greater possibilities of taking direct measures to enhance data reliability. On the other hand, collecting cross-linguistic data also presents its own challenges. An example of how this can be done is discussed in section 3.1.2.

Finally, cross-linguistic studies have to deal with the issue of sampling, that is, choosing which languages will be represented in a cross-linguistic study. Researchers in spoken language typology work with samples of languages for which information about the target domain is available. These samples should be both areally balanced (that is, not include too many languages from the same geographic region) and genetically balanced (that is, not include too many languages from the same language family). For sign languages, however, this is very difficult to do at this stage, since too few data are available to choose from. Moreover, we know too little about how sign languages are historically related, that is, to which language families the known sign languages belong, to even address the issue of a genetically balanced sample. There is currently no

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2 The kinds of measures that can be taken cannot be discussed in detail here, but see Zeshan (in prep.) for a further elaboration on this topic.
theoretically satisfying solution to this problem, so we need to work on the basis of practical considerations and just try to include as much information from as many sign languages as possible in our data in order to get at least a reasonable breadth of coverage. For instance, Zeshan (2004a, 2004b, 2005) used information from 37 diverse sign languages. Nothing can be done at this stage against areal and/or genetic bias in such a sample, except that we should be aware of the issue at all times and frame our generalisations in a careful way accordingly.

In the next section, I present some examples of recent cross-linguistic studies to illustrate the kinds of findings and methodologies that we typically encounter in such projects.

3. Case studies in sign language typology

Results from the first-ever large comparative study in sign language typology have been published in Zeshan (2004a, 2004b, 2005 and 2006). This study focused on interrogative and negative constructions (project duration 2000-2004) and has since been followed by a second large study on possessive and existential constructions (2005 to date; see Perniss & Zeshan, forthcoming). In addition to large-scale projects, smaller-scale cross-linguistic research on sets of sign language of various sizes have been undertaken in recent years, including work by McBurney (2002) on personal pronouns, Eccarius & Brentari (2007) on classifier constructions, and Schwager & Zeshan (forthcoming) on word class systems.

In this section, I illustrate the methodologies and findings that projects in sign language typology produce. A more comprehensive overview can be found in Zeshan (in prep.). Rather than attempting a summary of all the various topics that were investigated, I concentrate on a few points of interest here and show how these are relevant to the theoretical ideas outlined in the above sections. Section 3.1 thus deals with non-manual negation across sign languages, while section 3.2 focuses on patterns of predicative possession.

3.1. Non-manual negation

The cross-linguistic project on interrogatives and negatives mentioned above incorporates data from 37 diverse sign languages, though some are represented rather marginally by minimal data. The data are based on a variety of sources, with the most important part derived from answers to a typological questionnaire that was distributed to co-researchers around the world (Zeshan 2006). In addition to these, primary fieldwork data gathered by myself and published sources also contributed to the data, which were compiled in an MS Access database for analysis.
This study yielded many fascinating insights, of which we can only scratch the surface here. One of the most interesting patterns emerged from studying the non-manual marking of negative clauses across sign languages. In a nutshell, a side-to-side headshake in negative clauses occurs in all sign languages for which data about this topic have been available. However, the grammatical status of this negative headshake and the constraints of use are quite different in different sign languages.

The main typologically relevant difference relates to the relative prominence of manual and non-manual negation in the grammatical systems of sign languages. All sign languages in the data use both negative signs produced with the hands and non-manual marking of negative clauses, mainly in the form of head movements, such as a headshake. Logically then, either the manual or the non-manual negative could be more important to mark the negative clause, or both could be of equal prominence. There are a number of criteria that can be used to determine whether a system of negation has manual or non-manual prominence (see Zeshan 2004a for details). The examples (1), (2) and (3) below, from sign languages in Germany, Turkey and India, illustrate some of these criteria, focusing on the question of which part of the negation – manual or non-manual – is obligatory and which is optional.³

Germany (Deutsche Gebärdensprache, DGS):

(1a) \(\text{neg}\)
ICH VERSTEH
IX1 UNDERSTAND

(1b) \(\text{neg}\)
ICH VERSTEH NICHT
IX1 UNDERSTAND NOT

(1c) * ICH VERSTEH NICHT
IX1 UNDERSTAND NOT
‘I don’t understand.’

Turkey (Türk İşaret Dili, TID):

(2a) \(\text{neg-tilt}\)
BEN ANLAMAK DEGIL
IX1 UNDERSTAND NOT

(2b) * \(\text{neg-tilt}\)
BEN ANLAMAK
IX1 UNDERSTAND
‘I don’t understand.’

India (Indo-Pakistani Sign Language, IPSL):

³ For an explanation of the transcription conventions, see the appendix at the end of this article.
In each of the example sets, the first sentence (1a, 2a and 3a) is a common and grammatical way of saying ‘I don’t understand.’ In DGS, this involves non-manual negation only, and a manual negative sign is not necessary. Whereas manual and non-manual negation can also co-occur in DGS (example 1b), it is ungrammatical to omit the side-to-side headshake. Together with other evidence that we do not go into here, this allows to conclude that DGS has a non-manual dominant system of negation, where the headshake negation is obligatory. In the data used for the comparative study, this type of system was most common across sign languages including all Western sign languages, and it is the one best described in the literature.

A lesser-known type of system is exemplified by the TID data in (2). The usual way of expressing the same sentence involves both manual and non-manual negation (2a). Unlike in DGS, it is not possible in TID to negate this sentence by using a negative head movement only, which is why example (2b) is ungrammatical. A manual negative sign must be present in the sentence. Since the manual negation is obligatory in TID, this can be called a manual dominant system of negation. Relatively fewer sign languages in the data are of this type, and they are all outside Europe and North America, illustrating the importance of having a wide variety of data available for a typological study. In addition to TID, a manual dominant system of negation is found in the sign languages of Japan, China, and a village community in Bali.

Finally, the IPSL data contrast with both the DGS and the TID data in that none of the IPSL examples is ungrammatical (starred with an asterisk *). IPSL allows clauses to be negated both manually only and non-manually only, though the most common way is to use both, as in (3a). This together with other evidence suggests that neither manual nor non-manual negation is dominant in IPSL, and we can therefore speak of a balanced system of negation. One possibility that is worth exploring further would be that balanced systems of this kind are at a less advanced stage of grammaticalisation, where, in a way, the system has not “decided” yet which way it will go.

The categorisation of sign languages into manual dominant and non-manual dominant systems of negation as illustrated in the above examples is a good example of the kinds of generalisations

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4 The non-manual negation here is a backward tilt of the head accompanied by raised eyebrows, which is an areal feature of some Eastern Mediterranean sign languages. TID also uses a side-to-side headshake in addition to the negative head tilt, but this is not directly relevant to the discussion here.
that can be drawn in sign language typology on the basis of a careful investigation of empirical data. Sign languages can be assigned to one of the three types and the relative frequency of each type can be determined, yielding one pattern of many possible ones that, over time, will contribute to a theory of typological variation across sign language.

### 3.2. Predicative possession

Data presented in this section come from a study on possessive and existential constructions in sign languages. As will become clear below, both of these notions are closely related to one another, which is why they form a single domain of investigation. This study has again made use of co-researchers in various countries, but the methodology for this project is more sophisticated than in the first project. Figure 4 schematically represents the research cycle for this project.

A project in sign language typology typically starts with identifying the parameters of typological variation within a target domain, in this case within the domain of possession and existence (upper left hand corner of Figure 4). Data collection is based on these theoretical considerations, and in the case of this project, involves not only a typological questionnaire to be answered by co-researchers but also specialised elicitation techniques that are used in a standardised way by all project participants (lower left hand corner).

The elicitation materials consist of a number of game activities with visual content, e.g. pictures, where two or three signers have to interact and the resulting conversations are filmed. Games are targeted to elicit possessive and existential constructions, for instance, using a family tree picture in a game activity that targets kinship terms in possession. On the basis of the videotaped games, co-researchers extract relevant examples and answer questions from a typological questionnaire that covers the various sub-parameters of this domain. Compilation of all these data lead to inductive generalisations, of the kind discussed below, and these results can then secondarily be compared with spoken languages and can ultimately feed back into the theoretical considerations we started out with (right hand side of Figure 4).
TYPOLOGICAL PARAMETERS:
attributive vs. predicative possession
possessor and possessum
‘have’-construction vs. ‘belong’-construction
alienable vs. inalienable possession

DATA COLLECTION

*Figure 4: Research design for the cross-linguistic project on possession and existence

One of the sub-domains in this project is predicative possession, that is, ways of expressing utterances such as ‘I have a car.’, ‘How many children do you have?’, etc, with possession in a complete sentence rather than only in an NP (‘my credit card’, etc). In the typological literature on spoken languages, possession is a well-documented domain (e.g. Heine 2006, Baron, Herslund & Sorensen 2001, Payne 1999). A limited number of patterns for predicative possession have been identified in this literature, and this typology can be applied to sign languages as well, with a few modifications due to the nature of the sign language data. I exemplify the various types in the examples below.

A) From “taking, grabbing” to possession

In this type, a sign whose original meaning has something to do with “taking” or “grabbing” is used for possession. South Korean Sign Language has such a sign glossed HAVE-IN-HAND (in addition to another sign glossed HAVE/EXIST, for which see below). Examples (4a) and (4b) show that HAVE-IN-HAND can co-occur with both a positive and a negative existential sign. Interestingly, however, the pattern with HAVE-IN-HAND cannot be used for certain abstract notion such as ‘have time’ (example 4c). For such items, the existential pattern with the sign HAVE/EXIST must
be used, which has a wider, more general distribution than HAVE-IN-HAND. Figure 5 shows an example sentence using both possessive/existential signs.

**South Korea (South Korean Sign Language):**

(4a) WORK HAVE-IN-HAND HAVE/EXIST                      ‘have work’  
(4b) WORK HAVE-IN-HAND NOT-EXIST                       ‘not have work’  
(4c) *TIME HAVE-IN-HAND HAVE/EXIST                     ‘have time’

![Figure 5: South Korean Sign Language 'I have a car.'](image)

The “taking, grabbing” type of possessive construction is well attested in the data, so it is definitely a strategy that is available to sign languages. However, it is a minor type and not nearly as common as the next one, the existential pattern.

**b) From existence to possession**

Most sign languages in the data use a particle that expresses both existence and possession (existential particle). For example, such particles are used in the sign languages of India/Pakistan, Turkey, Russia, the US, the UK, Catalonia, Germany, Jordan, Iran, and China. Moreover, it is very common for positive and negative existential particles to be suppletive, that is, to have two entirely different, unrelated forms. Figure 6 shows the positive and the negative existential particles in Türk İşaret Dili (Turkey). The patterns under both (a) and (b) have been described for spoken languages in Heine (2006).
In some cases, the existential/possessive particle can be inflected in space, that is, the sign changes its form according to who is possessing something or according to what is the possessed item. Examples of this come, for instance, from sign languages in South Korea, China, Brazil and Germany (see Figure 7).

**Figure 7: DGS (Germany): HAVE/EXIST in neutral space (‘there is, someone has’; left hand picture) and with first person reference (‘I have’; right hand picture)**

**c) From predicative quantifier/modifier to possession**

Another very common pattern that can be found in many sign languages is the “predicative quantifier/modifier” construction (Hengeveld 1992). In this pattern, as soon as some further information is given about the possessed item, such as its quantity, or some adjectival information, there is no particle expressing the possessive relationship. Rather, one says something like ‘I, the children are three’, ‘My children are three.’ (example 5)

India (Indo-Pakistani Sign Language):

(5a) IX1 CHILD-pl EXIST ‘I have children.’
(5b) IX1 CHILD-pl THREE ‘I have three children.’ (lit. ‘My children are three.’)
(5c) \( y/n \) IX2 CHILD-pl EXIST? ‘Do you have children?’
Several other minor patterns have also been found in the comparative sign language data (cf. Perniss & Zeshan, forthcoming), with the structures in village sign languages being of particular interest, but these cannot be discussed in detail here.

\(d\) **The semantics of possession**

In the domain of possession, there are many other points of interest, in particular the various constraints on how different categories of possession are expressed. For example, kinship relations (‘my parents’, ‘my siblings’, etc) are often expressed differently from the possession of objects. Also, body parts (‘my head’), illnesses (‘have a headache’), and part-whole relationships (‘roof of the house’) often use different patterns.

A close investigation of the data also reveals subtle semantic distinctions in the domain of possession that are entirely comparable to the level of complexity found in the domain of possession in spoken languages. Figure 8 shows an example from Turkish Sign Language, where the last sign in the sentence is another possessive in addition to the existential particle in Figure 6.

![Figure 8: Turkish Sign Language 'The car belongs to me and my wife.'](image)

The sign glossed POSS in Figure 8 is much more restricted in use than the general possessive/existential HAVE/EXIST. POSS is only used when the possessed item is something large or important, such as a house, a car, and the like. It cannot be used in conjunction with items such as a pen, a coin, or a pet (except if, for instance, one has a pet breeding business where the pets constitute something of substantial importance). Moreover, the use of POSS is mostly restricted to
inanimates (and sometimes animals) and cannot be used with kinship terms (such as having children), with abstract items (such as having time), or with terms for illnesses and body parts.

In summary, the cross-linguistic investigation of possession and existence in sign languages shows that findings from spoken language typology can be fruitfully applied to sign languages, with some modality-specific modifications such as spatial inflections on possessives, and the project again demonstrates how sign language data can be grouped into typological patterns that have explanatory value. Moreover, the notion of a typologically informed perspective on sign language data as discussed in section 2.2.1 is clearly evidenced in the kinds of subtle distinctions and linguistically rich patterns such as the ones discussed here.

4. Sign languages in village communities

As mentioned in section 2.2.1, it is of utmost importance for sign language typology to collate data from sign languages that are as diverse as possible. In charting the territory of different sign languages, it is useful to consider the sociolinguistic parameters of various settings where sign language using communities exist. These include, among others:

- the age of the sign language
- the size of the user community
- the contact situation with other (spoken/written/signed) languages
- the degree of endangerment
- the relative numbers of first language (L1) vs. second language (L2) users

This section is about a type of sign language that differs radically from the better-known situation of largely urban deaf communities that are users of minority sign languages and members of a minority cultural group, such as is the case in all sign languages discussed in section 3. In contrast to these sign languages, there are also sign languages used in village communities with a high incidence of hereditary deafness, and the sociolinguistic situation in these villages is radically different.

The use of signing in village communities has been identified in many parts of the world, for instance, in a Yucatec Mayan village in Mexico, Adamorobe village in Ghana, Providence Island in the Caribbean, the Urubu-Kaapor tribe in the Brazilian Amazon, Ban Khor village in northern Thailand, a village in the area of St. Elizabeth in Jamaica, the al-Sayyid Bedouin tribe in Israel (cf. Marsaja (2008), for some further details on these communities).

Most known village sign languages have similar characteristics. Hereditary deafness occurs in such a the village over a number of generations, and therefore a local sign language develops in the
community, but there is typically no or very limited contact with deaf people from outside the
city, but there is typically no or very limited contact with deaf people from outside the
village. Deaf people are integrated into the hearing majority in daily life, and they do not face
communication barriers, since most hearing people in the village community are more or less fluent
in the local sign language. Thus the deaf villagers typically do not form a sub-culture, and do not
have a sense of “Deaf” identity as is the case in urban deaf communities. Due to the larger number
of hearing signers in a “deaf village”, most users of the sign language are L2 users, with only the
deaf individuals being monolingual L1 users of the village sign language. The village sign language
in such a setting typically has time depth and a stable user community, and so is a fully developed
language.

Linguistic research on these sign languages, which were previously known only from a socio-
cultural point of view, has only just begun in recent years. However, it has already become clear
that they include structures that differ radically from what is found in urban sign languages. One
such example is the particular use of the signing space and spatial aspects of sign language
grammar.

4.1. Use of the signing space in Kata Kolok, Bali

From 2004 onwards, our Sign Language Typology Research Group at the Max Planck Institute for
Psycholinguistics and subsequently at the University of Central Lancashire has had an expanding
research focus on the linguistic documentation of village sign languages. One of the target sign
languages in this sub-project is Kata Kolok (literally “deaf language”), used in a village community
in northern Bali. Kata Kolok is the first (and only) language of deaf people in the village. It is also
used as a second language to a greater or lesser extent by most hearing people. Kata Kolok is not
related to any other known sign language. Although it is in contact with spoken languages, there
seems to be no significant influence from spoken languages on the structure of Kata Kolok.
However, there is evidence for significant influence of local gestures on Kata Kolok, as would
indeed be expected. Sign language is believed to have existed in the village for several hundred
years, and the community has several myths about the origin of the sign language. Unlike some
other village sign languages, which are under threat from larger urban sign languages in their
respective countries, Kata Kolok is not currently endangered, although this situation could change
quickly.

Extensive data collection and transcription of Kata Kolok texts has revealed that the use of the
sign space in this language is radically different from what is known about other sign languages. In
fact, many of the structural features that were believed to be universal across all sign languages

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relate to the use of the sign space, such as spatial verb agreement, for instance. Therefore, it is particularly significant to find evidence for differences between sign languages in this domain. In this section, only a very brief summary of initial findings can be given, and further publications will have to explicate each of the phenomena and further justify the analysis in each case (cf. Zeshan, in prep.).

In Kata Kolok, the sign space is much larger than in sign languages used in urban deaf communities and frequently includes movements with the arms fully extended, movements of the entire body (e.g. turning around, bending down) and “acting out” of movements (e.g. “walking”). As in other sign languages, Kata Kolok signers can create complex spatial layouts, including two-handed constructions. The sign space is used extensively to talk about the movement and location of referents and the spatial relationships between referents. However, the choice of locations for setting up referents is peculiar in Kata Kolok in that the language uses absolute spatial reference. This is particularly evidence with respect to index finger pointing. Absolute spatial reference means that rather than selecting arbitrary locations in space to set up reference, e.g. on the right and left sides of the signer, the location of referents in the real world determines where the signer will point. In order for this to work, signers must be able to know the real-world locations of referents (e.g. the homes of people they are talking about) at all times. This ability is not uncommon among a number of tribal communities of hearing people, for instance some Australian Aboriginal communities, and the influence of an absolute spatial reference system can be seen in their use of gestures (Levinson 2003:244ff). Interestingly, spoken Balinese uses an absolute reference frame, so that the spatial logic of the spoken and the signed language overlaps in the case of Balinese and Kata Kolok.

To illustrate how absolute spatial reference works in Kata Kolok, the following is an example of a signed utterance:5

(6) MATING WH MATING IX:fwd.1 IX:back BAD
    'Where/with which one are you mating (your cow)? Are you mating it with this one? That one is bad.

Here the signer uses index finger pointing (IX) to set up two locations referring to two bulls, one of which is good for breeding while the other one is not as good. In an urban sign language, such as Indian, German, Japanese or American Sign Language, the two bulls would probably be localised by the signer on the right and left sides respectively, since setting them up on opposite sides metaphorically reflects the logical contrast being made between the two. However, the Kata Kolok signer points to a location slightly to his left with his arm raised and almost fully outstretched

5 WH in Kata Kolok is a question sign with general semantics, so it translates into a wide range of question words depending on the context of the utterance.
for the first bull, and points behind himself for the second bull. The reason for this is that in the real world, this is where the two bulls live in the village, and both signer and addressee know the absolute location of the bulls’ homes from where they are sitting during the conversation. This principle of localisation is radically different from what signers in urban communities would do in a similar text.

In addition to using absolute spatial reference, the use of sign space in Kata Kolok also differs in other respects from better-known urban sign languages. For instance, Kata Kolok signers do not use a metaphorical time line where the past is located behind the signer and the future in front, and a system a spatial agreement verbs is almost completely absent (Marsaja, 2008). For a more comprehensive account of these differences and their significance for the comparative study of sign languages, see Zeshan (in prep.).

Interestingly, another village sign language, Adamorobe Sign Language in Ghana, also has many peculiarities in its use of the sign space. However, the system is both different from urban sign languages and from Kata Kolok (see Nyst 2007), which is of interest because it precludes any premature conclusions about such differences being due to a unified new “village sign language type”. Certainly, this would be too simplistic, and more systematic research into other village sign languages is needed at present.

4.2. Signing in village communities – Is language gradual?

The sign languages used in both Adamorobe village in Ghana and in the deaf village in Bali have been in existence for generations and their linguistic status as full-fledged languages is not in question. The sign language using communities are also sufficiently strong in numbers to be a viable language community, in the case of Kata Kolok, for instance, comprising about 50 deaf people of all ages and the majority of the over 2,000 hearing villagers. However, the linguistic situation is so clear in other rural settings where deaf people live and communicate in the gestural medium. For instance, recent fieldwork has investigated a community in rural Surinam, where 11 deaf people have been identified so far and the known time span of signing in the community has so far not been traced back further than 50 years. The deaf people and some of the hearing people in this community use signed communication, but given the sociolinguistic situation, it is not clear “whether or not their signing is a sign language or a communal home sign system” (van den Bogaerde 2006). Similar situations with any given number of deaf people of course exist in many

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6 However, Adamorobe Sign Language is now endangered due to the influence from Ghanaian Sign Language, which the younger deaf villagers learn at the residential school for the deaf (Nyst 2007).
communities, particularly in developing countries, and the status of their communication poses a real theoretical challenge to linguistics.

In a nutshell, the research question is the following: What is needed for a language to be viable, in terms of both time and space? This question cannot be addressed in the realm of spoken languages because the extreme linguistic isolation that deaf people may face and that produces the known improvised and idiosyncratic home sign systems of somewhat limited functionality (see e.g. work by Goldin-Meadow 2003) does not occur among hearing people. If we think of settings where gestural communication is used by deaf people, this could range anywhere from extremely isolated home signers to large deaf sign language communities, with all intermediate points possible. It is the intermediate situations such as the one possibly obtaining in Surinam, the cases of “communal home sign systems”, that pose the greatest theoretical puzzle. In such a case, can something be no longer a limited home sign system but not yet quite a full-fledged sign language? Can language itself be thought of as a gradual phenomenon?

The schematic representation in Figure 9 illustrates this point. They represent two hypothetical types of communities of deaf people. In this situation, there would be just one or two deaf individuals in each of a number of villages (indicated by the dots within the squares), each of whom may well be a home signer to begin with. However, these individuals may have infrequent and unsystematic contact with one another (indicated by the arrows), for example meeting only once or twice a year for a major festival, especially if the villages are quite far away from one another and transport is difficult. When would such a situation be sufficient for a common language to emerge and be maintained between these people? In other words, can a linguistic system be maintained across space? How much distance can be tolerated before the system is disrupted?

![Figure 9: Hypothetical contact situation between deaf people in a rural area](image)

The same question could be asked with respect to time. What does the time scale of contact between deaf individuals have to be like for a true sign language to emerge? How much of a time
gap can be tolerated before the system is disrupted? Spoken languages face this issue mainly when languages are dying out, and it is known that attrition processes begin to affect the linguistic system at a certain point. However, the semi-speakers still using some of this language have adopted another spoken language as their main language, and can therefore not in any sense be called semi-lingual people. The situation with respect to signing in deaf people is different in this respect.

This whole complex of questions has not been addressed by sign language research, and minority signing communities of the type discussed here are only just entering the picture of sign language linguistics. While the answers seem quite far away at present, raising the issue certainly shows how the collection of new evidence from diverse sets of signing communities can be an enriching experience and can raise potentially very profound theoretical questions in linguistics.

5. Conclusion: Sign language typology beyond linguistics

This article has demonstrate the fascinating ways in which results from sign language typology can enrich our understanding of linguistic diversity across sign languages and across human language in general. However, this is not the whole story. Research in sign language typology also has effects on the user communities that go beyond theoretical research. Most of these are well-known in sign language linguistics, but are brought to bear particularly strongly on the field of sign language typology because of the particular range of its research, which goes beyond the more established research pathways in urban deaf communities in Western industrialised societies.

Research on sign languages and deaf communities needs to be particularly sensitive about ethical considerations in the way that research is conducted and results are applied. With spoken language research nowadays also moving into new areas such as the large-scale documentation of endangered languages, ethical concerns have become more prevalent and more openly discussed in linguistics. For instance, the ethics guidelines of the linguistics department at the Max Planck Institute for Psycholinguistics state:

“Members of the department must, wherever possible, ensure that they contribute to the communities in which they work. Exceptions to this policy can only be considered in truly unusual circumstances where implementation of the policy is impossible, and such exceptions require detailed justification and the approval of the department director.” (MPI-EVA 2002).

Signing communities are typically vulnerable and often face linguistic oppression, so most sign language linguists are well aware of their duties to “give back to the community”. With the rise of research on more diverse communities under the sign language typology research paradigm, new
questions present themselves that have to do, for instance, with working in a “deaf village”, or with situations of sign language endangerment (cf. Nonaka 2004). This is a very complex issue, so rather than going into details here, I briefly discuss potential benefits to sign language using communities that are often associated with research in sign language typology.

The greatest benefit from sign language typology research certainly applies to the many sign languages whose linguistic structures have not been documented to date. Since sign language typology systematically seeks out these languages and has a very strong focus on documentary field linguistics (cf. section 2.2.1), many sign language communities can benefit from additional resources being put into first-time research into their languages.

Over time, this research can generate important language resources, since it is only on the basis of sound descriptive work that projects in applied linguistics, such as sign language teaching, interpreter training, etc., can become truly successful and sustainable. An example of how theoretical and applied research can go hand in hand is documented for India in Zeshan, Vasishta and Sethna (2004).

Strengthening the linguistic, and subsequently the applied dimensions of sign language research is particularly important in many developing countries, and sign language typology is well placed to contribute to such developments. If experienced researchers conduct fieldwork in a region where sign linguistics and its applications has yet to establish itself, important knowledge transfer between the foreign researcher and the local deaf community can take place, and local signers will have the opportunity to receive linguistic training. Consequently, the level of metalinguistic awareness in deaf communities with on previous sign language experience will increase over time.

Finally, participating in a large cross-linguistic project provides an excellent training opportunity for beginning researchers. They will be part of a research group setting and can be guided by the project coordinators and other co-researchers in the project team to pursue a research project that is independent to some extent, yet takes place in a structured environment according to common standards and methodologies of sign language research.

Even though many issues in the domain of empowerment for deaf communities worldwide remain open to date, sign language typology research clearly has a contribution to make and could potentially make a real difference to the situation of deaf communities in many parts of the world.

Abbreviations and transcription conventions:
SIGN gloss for s manual sign
SIGN/SIGN sign with two meanings
SIGN-SIGN-… single sign transcribed with more than one gloss word
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