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The influence of typology and modality on the acquisition of verb agreement morphology in British Sign Language

Gary Morgan, *City University, London*

Isabelle Barrière, *Yeled V'Yalda Multilingual Development and Education Research Institute, New York*

Bencie Woll, *University College London*

ABSTRACT

The development of morphological verb agreement in children's language involves several different linguistic phenomena. Language-specific influences impact on developmental patterns and age of acquisition. This study addresses three potential factors involved in the development of verb agreement morphology in sign languages and more specifically in a case study of one deaf child of native signing parents acquiring British Sign Language. The data were collected longitudinally between the ages of 1;10 and 3;0 with analysis concentrating on the emergence and mastery of the inflectional system for encoding person agreement. The data are compared with other studies of verb agreement in both signed and spoken language acquisition. Analysis reveals a relatively late onset of verb use and protracted development of the agreement system with productive use of inflectional morphology reached at 3;0. The observed developmental patterns and age of acquisition are explained by the combined influence of a set of both typological and modality-specific factors.

KEYWORDS

Argument structure; deaf; morphology; non-concatenative; space

INTRODUCTION

Once linguists began to study sign languages seriously, they were faced with the inevitable conclusion that language was not synonymous with speech. Sign language research so far has demonstrated that in the organization of grammar, in the constraints on articulation and processing, in the breakdown through brain lesions or developmental impairments and lastly in children's first language acquisition, *broadly* similar patterns have appeared across the spoken and signed language modalities (Emmorey, 2002; Meier, Cormier & Quinto-Pozos, 2002; Morgan & Woll, 2002). In one particular area, language acquisition, researchers have recently begun to go further and ask questions concerning some of the observed differences between signed and spoken language (Lieven, 2002; Lillo-Martin, 1997). In what ways and for what reasons may typological and modality characteristics in sign languages influence typical first language acquisition? We focus on one particular grammatical device – verb agreement – as a window onto this question.

The paper is organized as follows: Section 1 describes how verb agreement is encoded in the grammar of British Sign Language (BSL). This is related to three factors: (a) particular types of morphophonological processes, (b) semantic subcategorization, and (c) the role of the visual modality in how morphological marking on verbs is articulated in sign space. Section 2 describes the previous literature on the development of verb agreement across different signed and spoken languages. This section concludes with a statement of the main aims of the study. This leads to Section 3 and the current study, which looks in detail at the emergence of BSL verb agreement morphology in one child between 1;10 and 3;0. In Section 4 we discuss the factors that may play a role in the development of morphological verb agreement in BSL and other languages, and outline directions for future research.

1. VERB AGREEMENT

Agreement is best defined as a morphosyntactic phenomenon by which 'the appearance of one item in a sentence in a particular form requires a second item which is grammatically linked with it to appear in a particular form' (Trask, 1993: 12). From a semantic perspective, subject- and object-verb agreement, in combination with word order and with other features (e.g., stress), indicate who is doing what to whom.

Verb agreement in British Sign Language (BSL)

In this overview of BSL, only those characteristics relevant to morphological verb agreement are discussed (for a wider description of BSL, see Sutton-Spence & Woll, 1999).

Three subclasses of verb have been distinguished in BSL and other sign languages (Sutton-Spence & Woll, 1999):

- (a) Spatial verbs, which make use of topographic space, and are marked for manner, aspect, location and movement. Within this class of verbs we include entity classifier constructions.¹



${}_k\text{ASK}_j$
'(she) asks (him)'

Figure 1 Movement of the agreement verb ASK between two locations in sign space to encode subject and object agreement

- (b) Agreement verbs, which are used in non-topographic space. They are marked for manner, aspect, person and number (for both subject and object) and constitute the focus of this study
- (c) Plain verbs, which are marked for manner and aspect. The present summary will only focus on examples of agreement and spatial verbs.

Languages differ in how they encode agreement between the verb and its arguments. Spanish for example has rich verb morphology with several inflections on verbs to encode person and number agreement for the subject. English, on the other hand, has only the 's' inflection on third person singular forms. BSL is more like Spanish, as it has morphological verb inflections for person and number and uses these inflections for both subject and object agreement. However, BSL and other sign languages differ from all spoken languages in how this rich set of inflections are realized. In the English example in (1), word order and the 3rd person singular marker indicate who is doing what to whom.

- (1) The girl asks the boy

The same meaning in BSL requires a completely different mapping. The class of verbs known as 'agreement verbs' uses modality-specific means to encode person-agreement, through the establishment of syntactic locations in sign space and the movement of the verb between these locations. There are two options in BSL for using agreement verbs. The first is shown in an English gloss in (2). The movement of the sign between locations on the right and left of sign space is shown in Fig. 1.²

- (2) $\text{BOY}_j \text{ IX}_j \text{ GIRL}_k \text{ IX}_k \text{ } {}_k\text{ASK}_j$
'The girl asks the boy'

In (2) the signer establishes indexes for the two NPs by pointing towards areas of sign space. Once the two locations are set up on the right and left of the signer, she inflects the verb ASK between these locations to encode the specific agreement relation.



${}_k\text{ASK}_j$
'(she) asks (him)'

Figure 2 Movement of the agreement verb ASK between the signer and a location in sign space to encode subject and object agreement

In the second option for encoding agreement, the agreement verb moves from the location of the signer who acts as the subject; this is shown in (3). The movement of the sign between the signer and the third person location is shown in Fig. 2.

- (3) $\text{BOY}_j \text{IX}_j \text{GIRL}_k {}_k\text{ASK}_j$
'The girl asks the boy'

In (3) the referent boy is first indexed to an arbitrary syntactic location in front of the signer in sign space (BOY IX). Then the signer mentions the girl and moves the verb from her own body towards the boy index. The signer takes on the location of the subject. The movement of the verb starts from the location of the signer (GIRL) and moves towards the location previously indexed for BOY . Therefore it is not always necessary to overtly mark subjects when using agreement verbs in BSL (see Morgan, Herman & Woll, 2002).

Thus in BSL and other sign languages, spatial locations act as referential indexes (either the spatial location of the present referent or an arbitrary location assigned to a non-present referent). The referential index of a noun phrase is normally unexpressed in spoken languages, while in sign languages the referential index is overtly established through an index point to a location in sign space (Lillo-Martin, 2002). In linguistic terms, BSL verb agreement is no different from other languages in that it requires that the verb takes a particular form in order to be linked grammatically to the subject or object index.

The final class of verbs in BSL to be discussed are known as 'plain' verbs with meanings such as LIKE , KNOW or WANT . While remaining uninflected in terms of agreement, this class of verb can either be coupled with overt noun phrases and use sign order to indicate who is doing what to whom, or use points towards indexed spatial locations to illustrate arguments. This is shown in (4).

- (4) IX_a LIKE IX_b
'(she) likes (him)

Some sign languages (for example, SLN: Sign Language of the Netherlands, and DGS: German Sign Language) have auxiliary verbs with a meaning of 'act on' (Bos, 1994; Rathmann & Mathur, 2002). In these sign languages a plain verb is coupled with the auxiliary verb, which indicates the subject and object by movement between syntactic locations.

In general, sign languages are best characterized as polysynthetic, as a single sign may be polymorphemic. Furthermore, sign languages have been typically compared to agglutinative languages. The hallmark of agglutinative languages such as Turkish, Inuktitut and Georgian is that they do not typically exhibit portmanteau morphs and have morphemes which are linearly ordered (Spencer, 1991). Sandler (1999) and more recently Brentari (2002) have argued that some morphophonological processes in sign languages are best characterized as non-concatenative, in that the phonological features involved are sequential but not adjacent. From this morphological perspective, sign languages are closer to Semitic languages than to Turkish.

Agreement verbs in BSL exhibit this non-concatenative morphophonology. For example, in (2) the morphemes which encode the verb's meaning and the morphological agreement are not structured adjacently. Furthermore, non-concatenative processes in sign languages may be more complex than in spoken languages. Thus, for example, while the relevant segments in Semitic languages are produced in a linear fashion (despite the non-adjacent nature of the morphemes), in BSL and other sign languages, a great deal of information is presented simultaneously rather than linearly. While a range of sign languages (e.g., ASL (American Sign Language), BSL and SLN) and some spoken languages share the typological characteristic of non-concatenative morphophonology, the special nature of these processes applied to agreement marking in sign languages appears to be modality-specific.

In addition to this property of non-concatenative morphology, BSL and other sign languages have subcategorization features which characterize the class of verbs that can carry morphological verb agreement inflections. Unlike spoken languages with rich verb morphologies, BSL and other sign languages encode morphological agreement only on the class of agreement verbs. This pattern appears to be modality-specific to sign languages. Close examination of BSL reveals that the difference between agreement verbs and other verbs in BSL is linked to the interaction between meaning and syntax.

The presence of inflectional morphology on BSL agreement verbs is constrained by the interaction of the semantic distinction between eventive and stative meanings and the transitive/intransitive verb frame pattern. Transitive eventive verbs (e.g., ASK, GIVE, PUSH, BITE, HIT) can be inflected for subject, direct object and indirect object, while transitive stative verbs (KNOW, LIKE, WANT, BELIEVE) cannot. Intransitive frames can be filled with both eventive and stative verbs, but these cannot be inflected.

The encoding of morphological person verb agreement is the same across different sign languages (through movement between syntactic indexes), but the semantic coherence between lexical items within the particular subclass of verbs that can and cannot take agreement may differ.

The difference between agreement and plain verbs appears to be more semantically coherent in BSL than in other sign languages. For example, the transitive stative verb HATE in ASL can be inflected for morphological verb agreement while in BSL it cannot; conversely the transitive eventive verb SUPERVISE can be inflected in BSL but not in ASL. These differences have led some ASL researchers to conclude that in ASL 'there is a basic dichotomy between verbs that agree and those that do not. This dichotomy is not related to the semantics or transitivity of the verbs in any obvious way.' (Janis, 1995: 198). In BSL what licences person agreement through morphological inflection is the semantic coherence of the subclass of verbs. Transitive eventive verbs inflect while transitive stative verbs do not.

In spoken languages such as Spanish, Italian and Hebrew, different verbs belong to different inflectional paradigms, and in this sense require paradigmatic knowledge to select the right inflection on the verb. The distinction between different classes of verb paradigms determines the form the agreement marker exhibits. In contrast with this, in BSL the paradigm determines whether or not it is marked for the feature of agreement at all. In this respect, the distinction between verb classes in these particular spoken languages is less drastic than in BSL, in which two systems co-exist: one that involves morphological agreement marking and one that does not.

One spoken language that is similar to BSL in this respect is Georgian. In Georgian the verb conjugation paradigms and the nature of agreement marking are constrained by semantic (aspectual) and syntactic (transitivity) features. However, the aspectual distinctions relevant to agreement marking in Georgian (activities versus statives versus inchoatives versus achievement) are more subtle than in BSL (eventive – including activity, achievement, and accomplishment – versus statives). This means that, although sign languages differ from spoken languages in how agreement is realized and also in the distinction between verbs that carry verb agreement and those that do not, when BSL is compared typologically with specific spoken languages, clearly similar patterns appear in how features determine subcategorization.

The last aspect of verb agreement in BSL relevant to the present study is that Pro-drop is allowed. Regardless of whether it is morphologically or syntactically expressed through word/sign order, the nature, number and distribution of participants play a role in the licensing of null arguments (Lillo-Martin, 1986). The signer's own body, as shown in example (2), is normally associated with the agentive role in the event being described (Kegl, 1990). As a consequence, subjects are less overtly marked than objects in BSL sentences. When there is one agreement slot available it is with the object, not the subject. If there are two slots available then the object marker is obligatory and the subject marker is optional (Rathmann & Mathur, 2002).

Agreement verbs normally appear in utterance final position with the coindexation between locations agreeing with subject and object indexes previously articulated. This is shown in sentence (5a). Plain verbs normally appear in SVO sign order as shown in (5b).

(5a) JOHN_j IX_j MARY_k IX_k jASK_k
'John and Mary (he) asks (her)'

(5b) JOHN KNOW MARY
'John knows Mary'

In summary, typological and modality-specific factors determine the appearance of agreement morphology in BSL. In addition, there also exist marked differences between signed and spoken languages in how the articulators of agreement morphology are perceived and produced.

The major effect of modality on the realization of agreement is that in sign languages morphosyntactic features are encoded through physical movement of a sign through sign space rather than the production of a spoken word with affixes. Interlocutors are required to visually process movement between locations in order to perceive signs and conversely are required to produce movement in order to encode morphological agreement. These modality-specific factors have consequences for how adults sign to young children. Adults often adjust the movement of a sign to make it more visible to a young child, e.g., making sure it is in the child's line of sight (Harris, 2001). It is not known how these modality-specific alterations to sign in child-directed signing (CDS) influence the development of particular aspects of sign language grammar.

Having completed this outline of BSL agreement morphology, it becomes apparent that BSL exhibits certain key characteristics, some of which are found both in BSL and some spoken languages (typological characteristics) while others are found in other sign languages but not in spoken language (modality characteristics)

Typological characteristics

As in many languages (e.g., Italian, Spanish, Georgian), the morphological paradigm used to mark agreement is rich.

Subject and object morphological agreement only apply to a subclass of verbs that are semantically (according to the type of events they refer to) and syntactically (transitivity) defined; this characteristic is shared with at least one spoken language: Georgian.

As in some spoken languages (e.g., Italian and Spanish), BSL is a Pro-drop language in which subjects are more frequently omitted than objects.

Modality-specific characteristics

Indication of who is doing what to whom is encoded in agreement verbs through movement of the sign between locations. Other classes of verbs make use of other devices such as sign order.

The morphological processes which agreement marking involves are best described as polysynthetic and exhibit a specific type of non-concatenative process.

Interlocutors visually process the movement of signs between locations in order to interpret the use of agreement inflections.

2. THE ACQUISITION OF VERB AGREEMENT

From the earliest studies of language acquisition, researchers noticed that the first word-combinations produced by young children acquiring English did not exhibit systematic marking of subject-verb agreement (Brown, 1973). The speed of development of verb agreement morphology differs across different languages. Most cross-linguistic research in this area has been carried out on spoken languages and is reviewed briefly before discussing acquisition in sign languages.

Factors involved in the acquisition of verb agreement in spoken languages

For English (Brown, 1973) there is a very high rate (more than 50%) of inappropriately inflected forms produced up to 2 years. Around age 2, this proportion dramatically went down for Eve (around 40%) while it remained high for Adam (above 60%) until at least 3 years. This slow development is different from that reported for Italian (Guasti, 1992): 7–25% of inappropriately inflected forms were used between 1;7 and 1;8; 5–15% until age 2;0; after this, the percentage dropped to 3% at 2;1 and 0% at 2;3.

The acquisition data across different languages suggest that specific linguistic factors affect rate of development of agreement. These include:

- (a) Whether the language allows null subjects (e.g., Spanish and Italian): around age 2;0, children acquiring these languages seem to produce mostly inflected verbs (Philips, 1995), although there are some debates in the literature regarding what constitutes evidence of productivity (e.g., Gathercole, Sebastián & Soto, 2000).
- (b) Whether the verbal paradigm exhibits a rich morphology: in English a morphologically impoverished language, the systematic use of inflections emerges much later than in Inuktitut (Crago & Allen, 2001).

There has been more limited research on the acquisition of object-verb agreement although the acquisition of subject- and object-verb agreement has been documented for Georgian. According to Imedadze & Tuite (1992), children start producing agreement markers in Georgian at 2 years and 'grasp the relationship between animacy and number agreement' (p. 94). However, for a long time, until at least 5, children's agreement marking is not quantitatively like that of adults, in that they frequently omit agreement markers including those in contexts in which the subject is plural and refers to an animate.

As described in Section 1, a typological feature of Georgian which is particularly relevant to the study of BSL acquisition is that Georgian verb classes depend on both syntactic (transitivity) and semantic (aspectual) features.

The development of verb agreement in sign languages

Although there have been several studies of the acquisition of verb agreement morphology in sign languages (for a review, see Meier, 2002), it still remains a relatively unresearched area. The majority of studies carried out so far have been on ASL although data have been reported on other sign languages, e.g., LiBrasS (Brazilian Sign Language; De Quadros, 1997), BSL (Morgan, Herman & Woll, 2002), SLN (Van den Bogaerde & Baker, 1996) and LIS (Italian Sign Language; Pizzuto, 2002). Many of these studies are on small numbers of children and they use different methodologies (e.g., spontaneous or elicited samples).

There are two important issues to consider when looking at the development of morphological verb agreement in sign languages. As described above, in the adult language, subject and object NPs and their referential indexes accompany the inflection of a verb. Agreement verbs can be used, however, without NPs if the subject

and object can be retrieved from the surrounding discourse (either as antecedents as in example 5a or when physically present). When the referent is present in the environment, the verb inflects towards the real world location.

Studies of development of verb agreement morphology have largely focused on agreement inflections with present referents, i.e., agreement morphology on verbs directed towards the location of subject and object referents in the surrounding environment. A small number of studies of the development of agreement to non-present referents have used analysis of narrative as a methodology (e.g., Loew, 1983; Morgan, 2000). However, mastery of narrative involves additional cognitive demands that may influence the age at which inflections are used. The use of agreement in narratives with non-present participant roles develops late, with children showing a prolonged period of acquisition that continues past age 5;0 (ASL: Loew, 1983; BSL: Morgan, 2000), marked by the use of appropriate movements in agreement verbs but without identification of their arguments.

It is not clear whether this late use of agreement morphology and abstract locations in sign space has to do with linking a word to a non-present referent (a general conceptual issue) or more to do with the particular linguistic devices used to refer to a non-present referent (indexing of abstract locations in sign space). In their review, Newport & Meier (1985: 905) concluded that 'we see no reason to implicate morphology of verb agreement per se as the source of these errors. Rather, the data seem to us to suggest that the errors arise from difficulties in establishing and maintaining spatial loci.'

There are few studies of spoken language acquisition to address the issue of inflections for non-present referents, as it does not appear to be a central problem for children. Although young children prefer to talk about the 'here and now', it is not evident that they use morphemes (inflections or pronouns) to refer to present referents before non-present referents. In a finding that may be related, Budwig (1990) demonstrates that in the early stages of acquisition, children refer only to themselves as agents. Because of the problems in deciding whether the difficulty in using abstract spatial loci is language- or non-language-related, most studies into the acquisition of person verb agreement morphology in sign languages have focused on the mastery of inflections for present referents, as is the case in the present study.

In early work on ASL it was found that children master morphological verb agreement in present referent contexts at around 3;0 (Fischer, 1973; Hoffmeister, 1978; Kantor, 1982). Before this age children use word order without inflections (e.g., POINT₂ ASK POINT₃ 'you ask him'), where the arguments are instantiated through pointing to the present referents in contrast to encoding the agreement in the inflection as in the grammatical adult ASL construction ₂YOU-ASK-HIM₃. In the typical child error the movement of the verb is grammatically uninflected although the syntactic context, as well as the meaning of the verb, makes the inflection obligatory.

In Meier (1981), errors of this type are reported for 3 children acquiring ASL. Between 2;8 and 3;8, one child (Shirley) omitted the inflection in 30 obligatory contexts, all involving an inflection between a second and third person present referent. Across studies of ASL in general, children begin to use ASL agreement morphology from 2;0 to 2;6, with many verbs remaining uninflected up till 3;6. In their study of the acquisition of SLN, Van den Bogaerde & Baker (1996) report that in a 10-minute interaction at 2;6, one child produced 15 utterances containing a verb (27% of the total utterances) but none of them was inflected.

One piece of evidence for the acquisition of a grammatical feature is overgeneralizations. There are some reports of children overgeneralizing agreement to verbs that do not require agreement, i.e., the class of plain verbs. Fischer (1973) and Casey (2000) have reported on overgeneralization of agreement morphology to plain verbs in ASL. Casey (2000) also reports errors of disagreement in ASL between the ages of 2;7 and 2;11, where verbs are moved towards the location of their subjects rather than towards the object location as was clear from the context.

This last set of errors provides compelling evidence for the young child's morphological rather than mimetic analysis of the movement of the verb (Meier, 2002), since children at this age are using inflections correctly on some agreement verbs and thus have some knowledge about morphology in ASL. At this point in development, however, the abstract nature of person agreement continues to cause problems related to the understanding of how different verbs map out subject and object inflections onto their movement.

In summary, children master agreement for present referents in several different sign languages around the age of 3 years. Non-first person referents continue to cause problems up to and beyond 4 years, but this may be because of non-linguistic factors, for example the establishment and maintenance of spatial loci (Newport & Meier, 1985).

The review of spoken language acquisition presented at the start of Section 2 concluded that in languages that allow Pro-drop and have rich verbal morphology there is a pattern of early and rapid development. Sign language verb agreement morphology, while sharing these morphological characteristics, appears to be acquired much later. However, as argued in Section 1, the importance of features of (1) complex non-concatenative morphophonological processes and (2) the restriction of agreement to subclasses of verbs found in sign languages may have been overlooked in the literature. A third factor may be the modality-specific features of child-directed signing. Consideration of these three factors may explain the developmental patterns exhibited by young signers.

The aim of the study reported below was to investigate the acquisition of morphological verb agreement in BSL and in particular the contribution of this set of typological and modality-specific factors outlined at the end of Section 1 to this development. Currently there are no standardized norms for ages of development of early BSL grammar (before 3 years), although there is an assessment battery available for later language development (Herman, 2003). There have been no studies of the extent of individual variation in BSL acquisition at this age.

3. METHOD

Participant

The participant was a deaf boy referred to by the pseudonym 'Mark'. He had been exposed to BSL from his parents and older siblings (all native signers) since infancy and so constituted a valuable case-study of native first language acquisition of a sign language, given that the majority of deaf children do not experience early exposure to language because they are born to non-signing hearing parents.

Table 1 Data collection

<i>Recording session</i>	<i>Length (hours)</i>	<i>Age of child (years;months.days)</i>
1	2	1;10.5
2	3	1;10.19
3	2	1;11.8
4	2	2;1.18
5	3	2;2.24
6	3	2;3.2
7	3	2;3.16
8	2	2;4.13
9	3	2;5.13
10	2	2;6.3
11	2	2;6.23
12	3	2;8.13
13	2	2;9.19
14	2	2;10.9
15	2	2;11.0
16	3	3;0.1

Data collection and transcription

Deaf and hearing investigators filmed Mark, his siblings and parents in 2- to 3-hour sessions in naturalistic interaction in the home from 1;10 to 3;0. The data are described in Table 1. The videos were transcribed and coded by the investigators. The data reported here focus on Mark's signing, although some of the input to Mark coming from his mother has also been transcribed.

4. RESULTS

First verbs

To make the data more easily comparable to crosslinguistic reviews of the literature (e.g., Phillips, 1995), results for the sessions were collapsed as follows:

1;10–1;11	3 sessions
2;1–2;2	2 sessions
2;3, 2;3	2 sessions
2;4–2;5	2 sessions
2;6–2;8	3 sessions
2;9–2;10	2 sessions
2;11–3;0	2 sessions

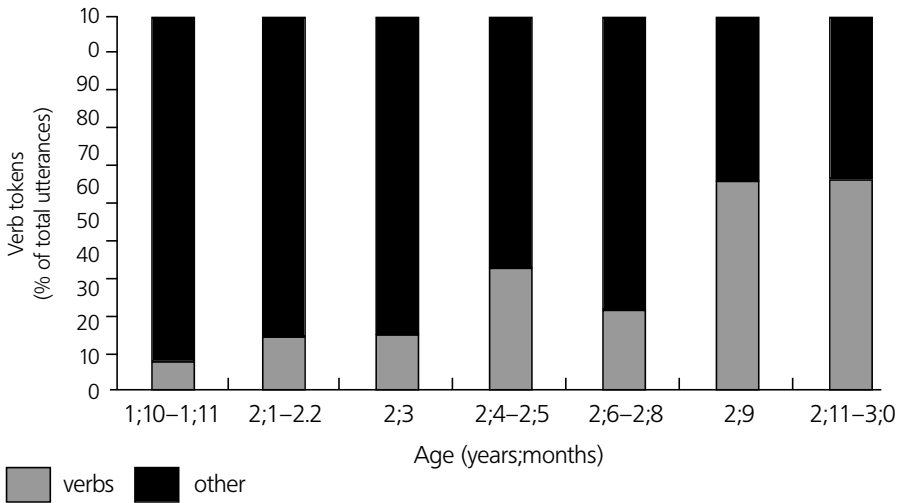


Figure 3 Verb tokens as a percentage of all utterances across sessions

All Mark's signed utterances that contained a verb were transcribed. Across the time period of the study, we recorded 300 verb tokens and 163 verb types. First we calculated the total number of verb tokens of all verb classes (i.e., agreement, spatial and plain) as a percentage of all lexical signs produced (nouns, questions, quantifiers, etc.) for each session. Derivationally related nouns and verbs are distinguished morphophonologically in BSL, i.e., lengthened movement for verbs versus reduced movement for nouns (Morgan, Barrière & Woll, 2003; Sutton-Spence & Woll, 1999); we applied these criteria as far as possible in categorizing Mark's signs. If it was not possible to see a distinction, the sign was not counted at that stage. Results of this count are presented in Fig. 3.

Next, a finer analysis of verb use was carried out. Verb tokens were classified by verb types for the different verb classes across the data; see Table 2.

Following this description of general verb use, further analysis concentrates on agreement verbs and the appearance of morphological inflections for person agreement.

Emergence of verb agreement

We counted the marking of morphological person agreement on the 77 agreement verbs with inflections across the data. Inflected agreement verbs were compared with the number of omissions of agreement on agreement verbs in obligatory contexts. In omitting the inflection Mark frequently pointed towards the present referent in order to indicate arguments instead of the semantically and syntactically licenced morphological inflection on the verb. A breakdown of this comparison is shown in Table 3. The gradual increase in morphological marking and reduction in omissions is shown in Fig. 4 for verb types and tokens.

Table 2 Breakdown of verb use according to class and number of types and tokens (in brackets)

<i>Age</i>	<i>All verb types and tokens</i>	<i>Agreement types and tokens</i>	<i>Spatial types and tokens</i>	<i>Plain types and tokens</i>
1;10–1;11	9 (17)	3 (4)	1 (2)	5 (11)
2;1–2;0	17 (31)	5 (15)	4 (4)	8 (12)
2;3	18 (18)	5 (5)	3 (3)	10 (10)
2;4–2;5	4 (6)	2 (2)	0 (0)	2 (4)
2;6–2;8	29 (69)	7 (13)	6 (24)	16 (32)
2;9	45 (88)	13 (22)	25 (36)	7 (30)
2;10–3;0	41 (71)	13 (16)	8 (19)	20 (36)

Table 3 Breakdown of type and token ratio for agreement verbs (marked and omissions)

<i>Age</i>	<i>Agreement marked types and tokens</i>	<i>Agreement omissions types and tokens</i>
1;10–1;11	0 (0)	3 (4)
2;1–2;2	2 (4)	3 (11)
2;3	0 (0)	5 (5)
2;4–2;5	1 (1)	1 (1)
2;6–2;8	3 (8)	4 (5)
2;9	6 (9)	7 (13)
2;10–3;0	10 (13)	3 (3)

We also looked at the frequency of specific person agreement relations on agreement verbs (e.g., moving the verb from first person to second person locations, 'I' to 'you', or second to third locations, 'you' to 'he/she') and the omissions. All the possible inflections appeared as omissions across the data (e.g., first to third, second to first, third to first, third to third, etc). There were slightly more cases of omissions with third person arguments, either as subject or object (e.g., YOU PUSH HER) than other cases, but there was no clear pattern of more omissions for any agreement relation.

The productivity of the inflections was also coded using three degrees, based on Crago & Allen (2001):

1. Emergence of an inflection: no evidence of the clear analysis of a morpheme.
2. Weak evidence of productivity: an agreement verb appears with and without an agreement inflection.

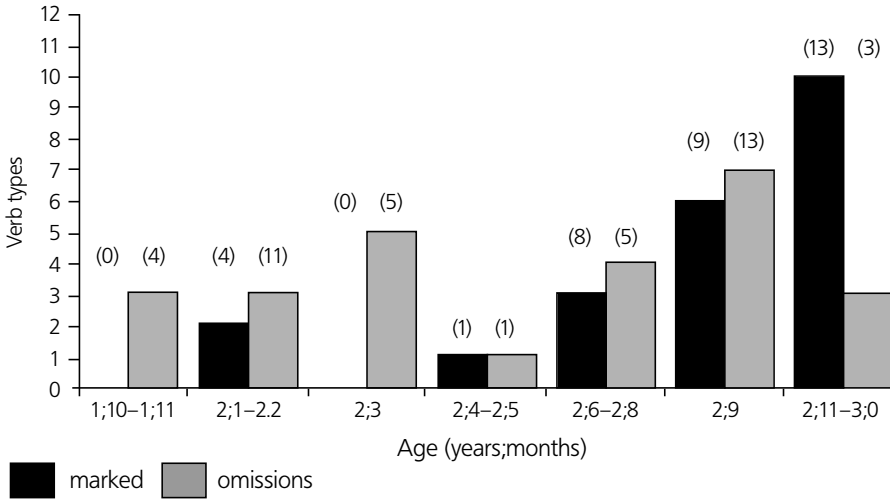


Figure 4 Comparison of agreement marking on verb types (marked) in relation to agreement verbs used without agreement (omissions); number of verb tokens shown in brackets

Table 4 The productivity of verb agreement morphology

Markers	<i>Emergence</i>	<i>Weak evidence of productivity</i>	<i>Strong evidence of productivity</i>
Subject agreement	2;2	2;6	2;11
Object agreement	2;2	2;5	2;11

3. Strong evidence of productivity: more than one verb appears with agreement; at least one verb indicates different agreement relations, e.g., first to second person agreement and third to third person agreement.

On the basis of this analysis, the pattern outlined in Table 4 emerges

Mastery of agreement in BSL

At the start of two-sign combinations, Mark treated nouns and verbs differently. Between the ages of 1;10 and 2;1, although two and three nouns were being combined, almost all verbs were produced in single sign utterances. From a total of 60 verb tokens recorded during this period, there was one combination of a verb with another sign: PUSH ME (1;10.19), where the verb stem was produced without inflections (the hands move away from the body). This was the only example in the

recorded sessions between 1;10 and 2;1 where a verb was produced with an accompanying sign indicating a subject or object argument

All the subsequent verbs first appeared in citation form, i.e., there was no use of space for grammatical purposes. These included those verbs classified as intransitive/eventive in the adult language (plain verbs) and so not able to inflect for verb agreement (SWIM, CRY and SLEEP); and also transitive/eventive verbs (agreement verbs) which were produced without morphological markers (for example, BITE, CLOSE, EAT and THROW). All these verbs were produced without an overt subject or object.

At 2;1 there was one attempt to provide information about how the subject and object were related in a transitive eventive context. When describing a picture of a boy biting a girl, the child signed BITE in the uninflected form, followed by a depiction of the bitten girl's reaction (a shudder of the body and a startled facial expression). Thus the utterance used the 'own body' option for the subject but a non-linguistic attempt to indicate the object.

At 2;2 an adult signed to Mark: $_1\text{BITE}_3$ '(I) bite (it)'. Immediately after this Mark signed: BITE $_1\text{IX}_3$ 'Bite me on it'. The verb BITE was uninflected but the index point moved between himself and the object location: $_1\text{IX}_3$ 'me on it'. This resembles the auxiliary verb in SLN and DGS 'act on' (Bos, 1994; Rathmann & Mathur, 2002) described in Section 1. Also at this age, subject and object verb agreement emerged with a small number of verbs, and Mark began to introduce uninflected verbs into multi-sign combinations. From 2;2 to 2;5 there were no inflections in the data. At 2;5 when Mark signed DOG MAN DOG $_3\text{WASH}_3$ 'The dog/man washed him', the verb was inflected towards the assumed subject location of the signer's own body. Because there was no index assignment for the arguments DOG or MAN, it was difficult to interpret the intended meaning. In the adult language this construction would be understood as 'the dog/man washes itself/himself'.

From 2;5 agreement inflections appeared with a variety of person agreement relations (1st person inflection to 3rd, 3rd person inflection to 3rd, etc.). For example at 2;6 Mark used a first to second person inflection: $_1\text{COMB-HAIR}_2$ 'I comb your hair'. From 2;9 onwards, morphological agreement appeared on more verbs, especially with those expressing visual perception, object transfer and causality. Some examples of these are shown below as glosses with the direction of the verb's movement in encoding the agreement relation shown through the arrow in the semi-circle sign space. The flat side of the sign space represents the front of the signer's own body:

(6) BOY GIVE-FOOD $_3$, BOY PUSH-OUT $_3$, (2;9)



'the boy feeds (it)',



'the boy pushes (it)',

$_3\text{SNAKE SEE}_3$,



'the snake sees (it)',

$_3\text{BITE}_3$



'(it) bites (it)',

(2;9)

The verb LOOK was used in more diverse constructions, including the sentence 'both

of them look at the kangaroo', which is a third person plural to third person single inflection:

(7) LOOK-AROUND, ₂LOOK-AT-ME₁ (2;9.21)



'(it) looks around', '(you) look at me'

₃BOTH-LOOK₃ IX KANGAROO₃ (2;10)



'both of them look at the kangaroo' (child uses both hands simultaneously)

Although verb agreement morphology was used at 2;9, the majority of new transitive/eventive verbs that entered the lexicon around this time continued to be produced as citation forms, e.g., MAN KICK, DUCK BITE, ICE-CREAM POUR, MUMMY BREAK, or in single-sign utterances. What Mark seemed to find difficult was not agreement marking per se but the identification of the subclass of verbs which may undergo agreement marking.

This conservativeness in using new signs in multi-sign utterances also appeared with other types of verbs. Some intransitive/eventive verbs already in Mark's lexicon appeared with subject NPs, e.g., DRIVE MUMMY, BOY CRY, BIRD FALL. However, new verbs entering his vocabulary were signed in one-sign utterances without inflections, e.g., DRAW, VOMIT, WEE-WEE, SLEEP, BUMP-OWN-HEAD, CYCLE, WAKE-UP.

Inflections in child-directed signing (CDS)

The analysis of the mother's CDS to Mark is still preliminary but it was interesting to observe that across the recording sessions a number of the mother's agreement verbs were signed to the child without inflections in obligatory contexts. These appeared as citation forms, with indexing towards the referent subject or object (similar in form to the child's omissions). Some of the same verbs were signed to Mark in conversation with and without their obligatory agreement morphology within the same sampled session. For instance, in the same period when the child was aged 2;8 the mother signed ASK with inflections (₁ASK₃ 'I ask him') and without obligatory inflections (YOU ASK HIM), although the inflection was obligatory in both contexts.

The mother's utterance with omitted inflections (YOU ASK HIM) is shown in Fig. 5a and the grammatically correct version (YOU-ASK-HIM) is shown in Fig. 5b. In Fig. 5a the mother broke the sign down into pronouns (YOU and HIM) and an uninflected verb (ASK). She produced the three parts of the sentence sequentially (YOU ASK HIM), and all signs were in the child's direct line of sight (i.e., straight in front of the child). Figure 5b illustrates the correct form in BSL. This form of the verb requires the child to process the meaning of the verb stem and the intended arguments simultaneously. In the mother's signing in adult-adult dialogue there were no omissions of obligatory verb agreement inflections.

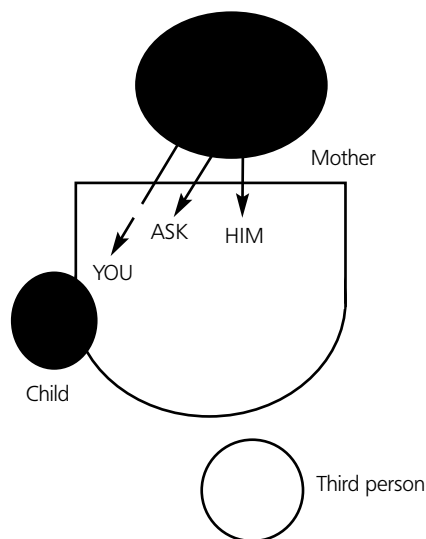


Figure 5a The agreement verb ASK produced without morphological verb agreement

Summary of the results

The percentage of verbs (plain, agreement and spatial) in the child's production (Fig. 3) was relatively low until age 2;4. Additionally, it was not until after 2;2 that Mark combined verbs with other signs. This scarcity of verbs and verb combinations in the early sessions partly contributes to the late appearance of verb agreement morphology in the data. To underline this point we observed no verbs at all in the child's language at 1;10.5.³

As Fig. 4 illustrates, morphological agreement is used as early as 2;1–2;2 (as described in the acquisition of ASL, e.g., Meier, 1981), but because of the many omissions at this stage (64%) and the lack of evidence for productivity of agreement inflections, these examples are probably best treated as unanalysed wholes. The agreement marker may be said to have emerged at this age without being productive.

As described previously, Mark's reluctance to use agreement morphology at this age (2;2) was also observed in his unusual substitution of a moving point coupled with the sign BITE rather than morphological agreement on the verb as modelled in the adult's utterance. This point only encodes the agreement and not the verb's meaning and so is morphologically simpler than the adult's sign.

Between the ages of 2;4 and 2;5 the number of inflections decreased in Mark's data, as did the number of all types of verbs in general. From 2;6 to 2;9, inflections re-emerged but with a parallel increase in omissions. At 2;9 the child produced the highest number of verb constructions made up of all verb types (plain, agreement and spatial) and agreement verbs with and without morphological markers (13 verb types and 22 verb tokens). This contrasts with the period 2;3–2;6 when very few verb constructions meant few opportunities to try out new linguistic devices. During this

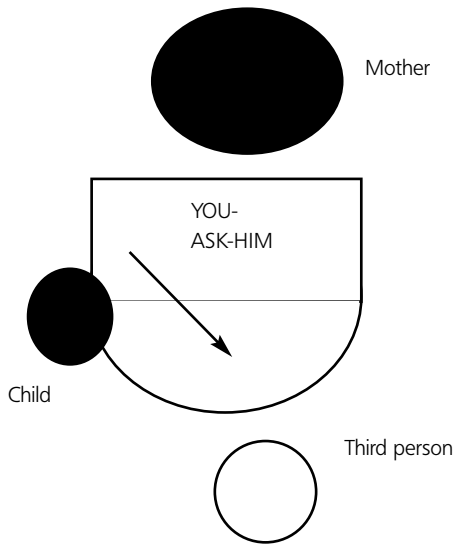


Figure 5b The agreement verb ASK produced with morphological verb agreement

period we also saw that the child's verb lexicon was growing in both types and tokens. At the same time a small number of verbs were appearing in many different types of constructions. The verb LOOK became a test model for attempting to express more complex morphosyntactic constructions (cf. Ninio, 1999). It was not until 2;11–3;0 that the child began to produce more than 75% of agreement verbs with inflections in obligatory contexts, although within this period Mark generalized verb agreement morphology to new lexical items slowly.

5. DISCUSSION

In this section the findings from the present study are related to the typological and modality-specific factors outlined in Section 1. The developmental patterns described in the results are explained in terms of the contribution of each of these factors.

Typological considerations: subcategorization features

Compared with some spoken languages with rich morphologies, the major finding that emerges from this study is the late onset and mastery of agreement verbs in BSL. In previous studies of morphologically rich languages (including those that exhibit non-concatenative morphology such as Hebrew) and Pro-drop languages, subject agreement is acquired at around 2 years (Crago & Allen, 2001; Phillips, 1995). This is considerably earlier than in the BSL data where the productive stage of agreement marking only begins between 2;11 and 3;0. This is more similar to non-Pro-drop languages such as German (Behrens, 1993) and languages such as English with poor

morphological verb paradigms (Phillips, 1995). The late age of acquisition of verb agreement morphology in BSL has also been reported for other sign languages (ASL: Fischer, 1973; Meier, 1981; SLN: Van den Bogaerde & Baker, 1996; LIS: Pizzuto, 2002).

A clue to what underlies this finding comes from the comparison of BSL and Georgian. Productive use of subject and object agreement marking in both Georgian and BSL emerges around the same age, 3;0. In these languages the expression of agreement marking depends on both syntactic and semantic factors. If the presence of a morpheme is dependent on the complex interaction between meaning and transitivity, it is possible it will take longer to build up the relevant knowledge needed to begin to generalize new candidate verbs to the right verb class. In contrast, in languages such as Spanish, paradigms of verb inflections appear across verbs with different meanings.

Some differences between the BSL data collected on Mark and the ASL studies emphasize further the role of subcategorization features in the acquisition of agreement verbs. In the present study there were no overgeneralizations of agreement markers to plain verbs. Fischer (1973) and Casey (2000) both report overgeneralization of agreement morphology to plain verbs in ASL between the ages of 2;7 and 2;11. Janis (1995) argued that in ASL agreement verbs make up an 'arbitrary class'. In contrast, the semantic coherence of the agreement verbs in BSL enables the child to make use of these syntactic and semantic cues in order to identify agreement verbs and restrict subject and object agreement only to this verb class. Given that none of these cues is relevant to agreement marking in ASL, children overgeneralize agreement marking. This suggests that, although age of acquisition is similar across sign languages, the more restricted class of agreement verbs makes overgeneralization less easy. Further work from experimental methods, for instance, testing children's willingness to inflect transitive and intransitive and eventive and stative nonce verbs, would enable us to test this hypothesis.

The similarity between the development of BSL and Georgian suggests that both semantic and syntactic constraints play a role in the timing of the productive use of agreement morphology in both language modalities. In comparing acquisition across languages it is important to take into account all the relevant typological factors involved.

Modality-specific factors: morphophonology

The late mastery of BSL verb agreement and the parallels between this study and results reported on other sign languages suggests that the distribution of morphemes through the morphophonology is important.

In Section 1 it was argued that the morphophonological processes in BSL may be different from those in other polysynthetic languages such as Inuktitut, and in languages with non-concatenative morphology such as Hebrew, where subject verb agreement is acquired from around two years. In sign languages the nature of verb agreement appears to involve even more overlap of simultaneous morphemes than in spoken languages with non-concatenative morphology (Brentari, 2002). This means that the linguistic segmentation of morphemes in sign languages by young children is made more difficult, and this would explain why agreement is acquired later in BSL than in Hebrew.

Children acquiring sign languages tend to produce uninflected forms of verbs with pronominal points produced sequentially (i.e., they substitute points for inflections). This finding has been reported several times in studies of children's development of different sign languages (e.g., De Quadros, 1997; Meier, 2002; Pizzuto, 2002; Van den Bogaerde & Baker, 1996). Simplification of the morphology was observed in the present study in Mark's innovative production of a moving pronominal point at 2;2, where, in copying the utterance, the child marked agreement morphologically on a pronoun rather than the verb (BITE \downarrow IX₃ 'I bit it').

While from a perceptual perspective, the movement of a verb across sign space from subject to object arguments is highly salient, the identification and segmentation of each morpheme (the linguistic processing) is certainly more complex. In BSL production children attempt to separate out these overlapped morphemes past 3;0 for complex verbs (Morgan, Herman & Woll, 2002). Thus performance factors such as morphological processing may partly explain late mastery.

As is described in more detail in the following section, it was also the case in the present study that some of the mother's utterances addressed to the child which contained agreement verbs were produced without inflections and with the arguments mapped out sequentially. This suggests that adults may be sensitive to young children's difficulty in segmenting sign morphology when produced in non-concatenative patterns. One difficulty in evaluating this explanation is that we know very little about how the sign-stream is segmented by young infants.

In comparison, the findings in the last 30 years on infant speech perception have shed light on early discriminative capacities that may enable them to bootstrap into crucial aspects of morphosyntax (Juszyk, 1997; Morgan & Demuth, 1996; Soderstrom, Seidl, Kemler-Nelson & Juszyk, 2003).

Comprehension tests of 2-year-old children's understanding of BSL agreement marking using, for example, the Visual Preferential Paradigm (Golinkoff, Hirsh-Pasek, Cauley & Gordon, 1987), would help assess whether they are able to map the relevant inflections or not.

Modality-specific factors: child-directed signing (CDS)

As described in Section 1, deaf adults when talking to young children sometimes make modifications to a sign's movement in order to make it more salient (e.g., articulating the sign in the child's line of sight) or in order to attract the child's attention (Harris, 2001). Although there have been very few studies looking in any linguistic detail at CDS and fewer still that have calculated the use of verb agreement morphology by adults in CDS (see Pizzuto, 2002), the limited data from the present study suggest that adults may adapt their language by omitting inflections in certain contexts.

Further work is required, but in the present study we observed the mother both using and omitting obligatory morphological inflections with the same verbs in the same session when interacting with Mark but not when signing with another adult. In related work, Van den Bogaerde & Baker (1996) reported that in a 10-minute sample of SLN child-directed signing containing a total of 47 verb tokens, only 4 carried inflections. They do not report on verb types or the relative frequency of omissions in obligatory contexts and the sample

size is small, but with less than 10% of the verbs being inflected it may be that morphological inflections for verb agreement were also sometimes omitted.

We have suggested that one motivation for the mother to split apart polymorphic signs into a sequence of elements is her concern to make the sign more visible to the child. We are left with the problem of deciding which is the more important factor: does the child omit inflections because of performance limitations in perception and production or because he observes omissions in the input?

Another reason for splitting up the polysynthetic sign into a sequence of signs is related to the complex non-concatenative morphology of sign languages. Adults may be reducing the linguistic processing demands (not just visual processing) by making the simultaneous morphology sequentially ordered. Further research is needed to evaluate the influence of agreement omissions in CDS and to evaluate the exact conditions under which adults use sequential ordering of signs.

For whatever reason adult omissions occur, inconsistency in the use of inflections in the sign input may introduce inconsistency in the patterns the child is attempting to analyse. While inconsistent use of agreement inflections in CDS makes communication more successful (as the child's attention is captured and linguistic segmentation is more transparent), CDS may have the effect of making important grammatical processes harder to identify.⁴

Other studies have found that general simplification features of CDS (which might include omissions of inflections) become less common in adult's signing to children after 2;0 (Erting, Prezioso & O'Grady Hynes, 1990). This age is fairly late considering that this is just the time that children exposed to Spanish or Italian are starting to use inflectional morphology productively.

6. CONCLUSIONS

Appropriate evidence needed by children to acquire a grammar comes from different sources (Weissenborn & Höhle, 2000), with a combination of cues leading the child in the right direction for rule-based analysis. This study has reported a late onset of BSL verb agreement morphology followed by productive use and mastery at an age comparable to that documented for the acquisition of other sign languages and for one spoken language, Georgian.

One motivation for our research on sign language acquisition is to discover in what ways and for what reasons do typological and modality characteristics influence typical first language acquisition. We have proposed three main factors that play a role in the acquisition of verb agreement inflections in BSL. First, the study of BSL acquisition enables us to ask questions about how the morphophonology and semantic coherence of one class of verbs influences the speed at which children identify the relevant constraints on verb agreement. Second, crosslinguistic comparisons make salient the particular processes children go through in language acquisition. Finally, paying attention to the radical differences between how signed and spoken languages are produced and perceived can also provide an insight into the general ways children use linguistic patterns in the input they are exposed to.

For many years theories of language development were based only on data from

children acquiring spoken English. Thankfully this is no longer the case, but research must now compare acquisition based on both typological and modality factors. This means studying similarities and differences not only between signed and spoken languages but also between different sign languages. There are many sign languages in the world that could provide important acquisition data if they were studied within a framework of crosslinguistic research. With this in mind, it is more important than ever to document sign language acquisition. This is crucial if we are to take advantage of the striking difference in modality and use it to address the question of whether development follows a universal course.

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NOTES

1. In all sign languages described to date, handshapes in verbs of motion and location represent object class, e.g., round-object, long thin object, animate non-human, etc. For more details on spatial verbs, see Emmorey (2003).
2. Signed sentences that appear in the text follow standard notation conventions. Signs are represented by upper-case English glosses. When the sign structure requires more than one English word to encode all meaning elements this is shown through hyphenation, e.g., the single sign I-ASK-YOU 'I ask you'. The gloss IX (index) is a point to an area of sign space, which acts as a syntactic index for referring to an argument in the sentence. In some examples the direction of the verb's movement is indicated by an arrow within a semi-circle representing the sign space. Subscripted lower-case letters indicate coindexation.
3. Of course this is only in the two hours of recorded data.
4. There have been similar claims made about competition between grammar and non-linguistic communication, with the use of the 'furrowed brows' facial expression for marking questions and negations in ASL and the motivation to show a 'baby friendly' face to young children (Reilly & Bellugi, 1996).

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ADDRESS FOR CORRESPONDENCE

Dr Gary Morgan
Department of Language and Communication Science,
City University London, Northampton Square, London, EC1V 0HB, UK
E-mail: g.morgan@city.ac.uk
