

A constraint-based analysis of sign language agreement

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1 Background: Agreement in sign languages

Sign language agreement differs in several respects from agreement in spoken languages (Lillo-Martin/Meier 2011). First of all, it is well known that not all verbs in sign languages are able to realize agreement overtly. In addition to so-called agreement verbs, sign languages also have plain verbs that cannot show agreement and spatial verbs, whose beginning and endpoints are not determined by arguments of the verb but by spatial referents. This is illustrated by the example in (1) from German Sign Language (DGS).

- (1) a. Agreement verbs in DGS: GIVE, HELP, TEACH, ASK, VISIT, SHOW, ...
 b. Plain verbs in DGS: LIKE, KNOW, WAIT, THINK, BUY, ...
 c. Spatial verbs in DGS: MOVE, PUT, STAND, LIE, BE-AT, ...

Secondly, verbs in sign languages express subject and object agreement by path movement and/or orientation of the hands (palm orientation or orientation of the fingertips, cf. Meir 1998). With the DGS verb GIVE in (2a), path movements begins at x , the location associated with the discourse referent of the subject, and ends at y , the location associated with the discourse referent of the object. By contrast, the DGS verb INFLUENCE does not express agreement by path movement but by orientation of the hands. In (2b) the fingertips are oriented towards the location associated with the object, i.e. y . Some verbs like HELP (2c) use both means of agreement marking.

- (2) a. x GIVE y 'to give something to someone'
 b. x INFLUENCE y 'to influence someone'
 c. x HELP y 'to help someone'

Note that in sign languages, discourse referents are linked to referential loci in the signing space (cf. figure 1a). These loci are either actual locations of present referents or locations that are assigned for non-present referents on the horizontal plane of the signing space (Steinbach/Onea 2016). Non-present discourse referents can be localized in various ways. One major strategy is the use of the determiner like signs such I(NDE)X and POSS, cf. the first sentence in (3).

- (3) POSS₁ MOTHER I_{3a} BOOK++ LIKE.
 'My mother likes books.'
 YESTERDAY I_{3a} BOOK_{3a}GIVE₁
 'Yesterday she gave me a book.'

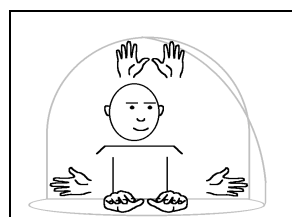


Figure 1a:
Signing space

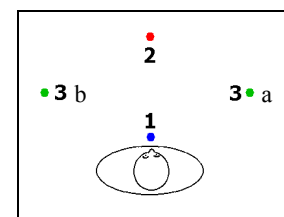


Figure 1b:
Localization of
discourse referents

In (3), the 1st person possessive pronoun POSS₁ points towards the signer's chest, while INDEX_{3a} localizes MOTHER at location 3a, which is the ipsilateral area of the signing space, i.e. the right side for right-handed signers (cf. figure 1b). This location is then used to pronominalize MOTHER in the second sentence. As explained above, the plain verb LIKE in the first sentence is not able to express agreement. By contrast, the agreement verb GIVE in the second sentence moves from location 3a towards location 1, that is, agreement verbs like GIVE agree with two of their arguments. Subject and object agreement seems to be very common across sign languages. Agreement in sign languages is locus agreement. Agreement verbs express referential indices

of their arguments by moving from a referential locus associated with the subject to a referential locus associated with the object. Hence, sign languages, just like spoken languages, use the same means for pronominalization and agreement. However, unlike spoken languages, sign languages do not use sequential agreement affixes but express referential indices simultaneously on the verb. (cf. Aronoff et al. 2005).

A third important property of agreement in sign languages is that it affects directly the phonological form of the verb. Agreement is expressed through the specification of the phonological features hand orientation and movement of the corresponding verb. Consequently, phonological properties of the verb may block the overt realization of agreement. This is the case with plain verbs: agreement with subject and object is prohibited because the beginning and endpoint of path movement and hand orientation are lexically specified (cf. LIKE in (3)). Even with agreement verbs, agreement may sometimes be blocked by phonological constraints: In some varieties of DGS, verbs like TRUST only agree with first person subjects and non-first person objects because the beginning of the path movement is lexically specified (i.e. the forehead of the signer). Note that in some varieties of DGS, the verb TRUST has been developed in a full subject-object agreement verb. In these varieties, the inflected form in (4b) would be grammatical.

- (4) a. $_1$ TRUST $_2$ but b. $*_2$ TRUST $_1$
 ‘I trust you’ ‘You trust me’

A fourth unique property of sign language agreement is the distinction between two different kinds of agreement verbs: regular and backward verbs. In backward verbs, the path movement begins at the position of the object and ends at the position of the subject. This distinction follows from the thematic restriction discussed below (cf. Meir 1998, 2002).

- (5) a. Regular verb: $_1$ HELP $_2$ b. Backward verb: $_2$ INVITE $_1$
 ‘I help you’ ‘I invite you’

The paper addresses the issues concerning verbal agreement in German sign language from a constraint-based perspective. In particular it aims at modelling agreement verbs in such a way that the interaction between phonological (manual) and syntactico-semantic relationships can be adequately described. We show that a constraint-based analysis offers an elegant analysis of the agreement in sign languages since it permits a direct manipulation of the relevant phonological features of the verb sign.

2 Agreement auxiliaries

Recall that in sign languages not all verbs can be inflected for agreement. Interestingly, many sign languages have developed means to overcome the agreement gap caused by plain verbs such as LIKE in example (3). They make either use of auxiliaries or they use non-manuals to express the agreement relations with plain verbs (Steinbach/Pfau 2007, Neidle et al. 2000). In the following, we only focus on agreement auxiliaries. Like agreement verbs, agreement auxiliaries express subject and object agreement by means of path movement and hand orientation. Agreement auxiliaries in sign languages differ from typical spoken language auxiliaries in that they are not used for tense, aspect, modality, or voice marking (so-called TAM auxiliaries). Their basic function is to mark subject/object agreement (agreement auxiliaries). Genuine agreement auxiliaries seem to be rare in spoken languages. The German auxiliary *tun* (‘to do’) in (6), which is frequently used in Colloquial German and in most German dialects, is an exception to this generalization. Unlike most auxiliaries in spoken

language, *tun* is not a TAM auxiliary and its use seems to be functionally very similar to agreement auxiliaries in sign languages (Steinbach/Pfau 2007).

- (6) a. *Sie tu-t ein Buch les-en* b. *Sie lies-t ein Buch*
 She do-3.SG a book read-INF She read-3.SG a book
 ‘She is reading a book’

Tun seems to be some kind of dummy auxiliary that is only used to express morphosyntactic features such as present and past tense and agreement, which can always be optionally expressed by the main verb. Hence, *tun* resembles the use of PAM (*Person Agreement Marker*) with uninflected agreement verbs as illustrated in (8) below.

The source of the DGS agreement auxiliary PAM is the noun PERSON (cf. figure 2). As opposed to PAM, PERSON does not exhibit a directional movement. Just like regular agreement verbs, the agreement auxiliary PAM expresses the agreement relation by path movement and orientation of the fingertips. PAM is used with plain verbs, cf. (7a), with adjectival predicates, cf. (7b), and with verbs like TRUST, which cannot be inflected for non-first person subject agreement and first person object agreement, cf. (7c).

- (7) a. MOTHER INDEX_{3a} NEIGHBOR NEW INDEX_{3b}
 LIKE 3aPAM_{3b}
 ‘(My) mother likes the new neighbor.’
 b. INDEX₁ POSS₁ BROTHER INDEX_{3a} PROUD 1PAM_{3a}
 ‘I am proud of my brother.’
 c. INDEX₂ TRUST 2PAM₁
 ‘You trust me’

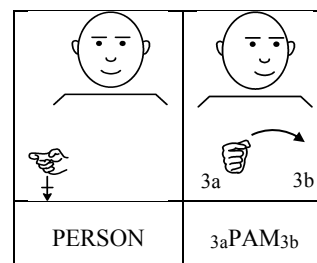


Figure 2: From noun to auxiliary in DGS

Note that there seems to be some variation in the positioning of PAM. In Southern German variants, PAM is inserted in postverbal position, whereas in other variants of DGS, it can be inserted in preverbal position (even before the object) as can be seen in (8) (Macht/Steinbach, to appear).

- (8) HANS INDEX_{3a} 3aPAM_{3b} MARIE INDEX_{3b} LIKE

Interestingly, with uninflected backward verbs like INVITE in (9), PAM moves from the position of the subject to the position of the object. Hence, as opposed to agreement verbs, PAM does not seem to express agreement with thematic source and goal arguments of the verb but with the subject and the object.

- (9) INDEX_{3a} INDEX_{3b} INVITE 3aPAM_{3b}
 ‘S/he invites him/her.’

Consequently, PAM can also be used with the following plain verbs, which do not select source and goal arguments, i.e. with verbs that do not express any transition from a to b.

- (10) DGS plain verbs that express agreement by means of PAM:
 BE-PROUD, BE-ANGRY, KNOW, LIKE, TRUST, WAIT, BE-INTERESTED-IN, LAUGH, ...

Note finally that PAM can be productively used to extend the argument structure of the main verb.

- (11) a. INDEX₁ LAUGH ₁PAM₂ b. INDEX₁ LETTER WRITE ₁PAM₂
 'I laugh at you.' 'I write a letter to you.'

3 A constraint-based analysis of agreement

The lexical restrictions concerning the phonological and semantic properties of the verbs discussed above and the observed interaction between their formal (phonological) and semantic (argument structural) properties support a constraint-based lexical treatment of verbal agreement in sign languages. Especially the thematic restrictions, which can be explicitly stated in the lexical entry, call for a lexical analysis (cf. Meir 1998, 2002; Cormier et al. 1998). Meir distinguishes between two different kinds of agreement, (i) thematic agreement (12a) and (ii) syntactic agreement (12b), and formulates the Agreement Morphology Principles basically saying that thematic agreement marks the direction of the path movement whereas syntactic agreement is responsible for the facing of the hands:

- (12) Agreement Morphology Principles (AMPs):
 a. The direction of the path movement of agreement verbs is from source to goal [...]
 b. The facing of the hand(s) is towards the object of the verb.

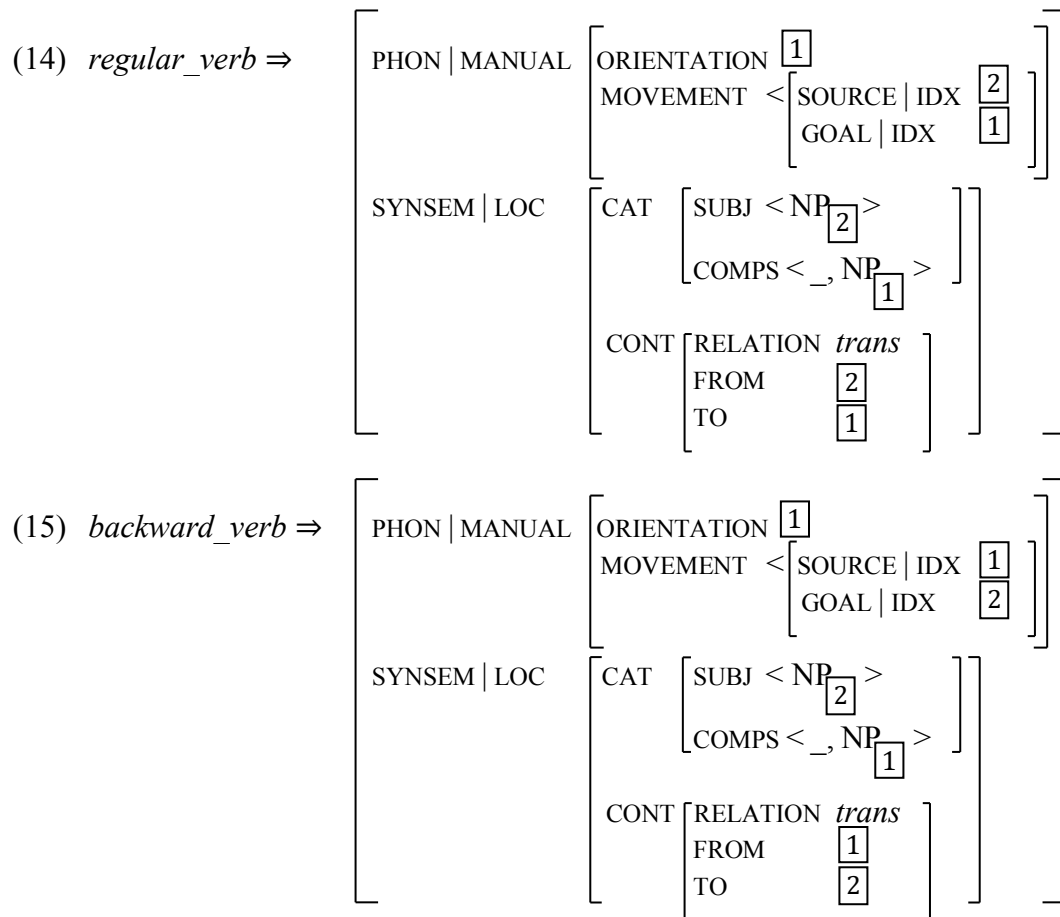
The AMPs account for both, regular and backward verbs, which share the facing of the hands but differ in the direction of the path movement. According to (12a), the direction of the path movement is controlled by the thematic roles source and goal (the arguments of FROM and TO following the componential analysis of Jackendoff 1990). The facing of the hands, on the other hand, is controlled by the indirect (or dative) object.

To account for these facts we stipulate a verbal subtype *agreement-verb* which is partitioned by two subtypes called *regular-verb* and *backward-verb*. Adapting Safar/Marshall (2004) we assume the following partial description of the PHON-value for all verbs of type *agreement-verb* in the lexicon:

$$(13) \textit{agreement_verb} \Rightarrow \left[\begin{array}{l} \text{PHON} \mid \text{MANUAL} \left[\begin{array}{l} \text{ORIENTATION} \quad [1] \textit{ref} \\ \text{MOVEMENT} \quad \left\langle \begin{array}{l} \text{SOURCE} \mid \text{INDEX } \textit{ref} \\ \text{GOAL} \mid \text{INDEX } \textit{ref} \end{array} \right\rangle \end{array} \right] \\ \text{SYNSEM} \mid \text{LOC} \mid \text{CAT} \mid \text{COMPS} \langle _ , \text{NP}_{[1]} \rangle \end{array} \right]$$

The phonological features MOVEMENT and ORIENTATION depend on the referential loci of the discourse referent of the subject and object. As will be shown below, the orientation of the hands (i.e. (12b)) is always constraint by the indirect object marked by tag [1]. By contrast, the thematic restrictions are relevant for the specification of the beginning (SOURCE) and endpoint (GOAL) of the movement (i.e. (12a)). The latter is a remnant of the gestural origin of agreement, i.e. the concrete gestural expression of a transfer from source to goal. In addition, it accounts for the difference between regular and backward agreement verbs.

Since backward verbs only differ from regular verbs in their spatial relations, the principles in (12) and the general lexical entry for agreement verbs correctly predict that with regular agreement verbs, the path movement begins at the position of the subject (source) and ends at the position of the object (goal). By contrast, backward agreement verbs show the opposite specification because with backward agreement verbs, the source of the transfer is the object and the goal the subject. The lexical restrictions for both types of agreement verbs are given in (14) and (15).



Recall that with plain verbs the relevant phonological features (ORIENTATION and MOVEMENT) are lexically specified and hence not available for agreement inflection. Therefore, PAM insertion is the only option for plain verbs to express agreement overtly. PAM can either be added to the lexical entry of the plain verb (for a lexical analysis of auxiliaries see Ackerman/Webelhuth 1998) or it subcategorizes for a plain verb and inherits all relevant selectional properties necessary to express agreement. In addition, PAM can be productively used to extend the argument structure of the main verb as illustrated in (11) above. In this case, the main verb only selects one argument. The second (object argument) is introduced by PAM. Consequently, the argument structure extension triggers a corresponding transitive interpretation of the verb (i.e. ‘laught at’, ‘write to’ or ‘wait for’). The paper will give a full-fledged analysis of both constellations described using argument composition as proposed e.g. by Hinrichs/Nakazawa (1989).

In sum, the analysis illustrates that a constraint-based implementation offers an elegant account of the modality specific properties of sign language agreement. Especially the interdependence of phonological, syntactic, and semantic properties of the verb and the simultaneous realization of agreement can be implemented in a straightforward way.

Ackerman/Webelhuth. 1998. A theory of predicates. CSLI; **Aronoff et al.** 2005. The paradox of sign language morphology. Language 81; **Cormier et al.** 1998. Locus agreement in American Sign Language. In Lexical and constructional aspects of linguistic explanation. CSLI; **Hinrichs/Nakazawa.** 1989. Flipped out aux in German. CLS 25; **Jackendoff.** 1990. Semantic structures. MIT Press; **Lillo-Martin/Meier.** 2011. On the linguistic status of ‘agreement’ in sign languages. TL 37; **Macht/Steinbach.** to appear. Regionalsprachliche Merkmale in der Deutschen Gebärdensprache. In Sprache und Raum. De Gruyter Mouton; **Meir.** 1998. Syntactic-semantic interaction of Israeli Sign Language verbs: The case of backward verbs. SL&L 1; **Meir.** 2002. A cross-modality perspective on verb agreement. NLLT 20; **Neidle et al.** 2000. The syntax of American Sign Language. MIT Press; **Safar/Marshall.** 2004. Sign language generation in an ALE HPSG. In Proceedings of the 11th HPSG-Conference. CSLI Publications; **Steinbach/Pfau.** 2007. Grammaticalization of auxiliaries in sign languages. In Visible variation. Comparative studies on sign language structure. Mouton de Gruyter; **Steinbach/Onea.** 2016. A DRT analysis of discourse referents and anaphora resolution in sign language. JoS 33.