Verb Agreement in Sign Languages and Beyond

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8. Verb Agreement in Sign Languages and Beyond[1)]

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Abstract

Verb agreement in sign languages has characteristics very different from those of syntactic agreement in spoken languages. Those characteristics can be shown to follow from an Optimality Theoretic system with a constraint against overt syllables and the lexicon with under-specification. The constraint is a realization of a universal tendency in natural language to reduce articulation efforts, and its high ranking in sign languages is due to the well-known fact that sign syllables take more time to articulate than syllables in spoken languages. The analysis predicts that in language acquisition, verb agreement should arise once children have become fluent in signing and capable of phonological computation based on universal constraints ranked appropriately for sign languages. It also predicts that the existence of children with such abilities are the necessary and sufficient conditions for emergence of verb agreement in newly-born sign languages.

8.1. Introduction

Padden (1983) has reported that American Sign Language (ASL) has three types of verbs: (i) verbs that are articulated in one and the same form regardless of the referents of the subject and the object; (ii) verbs that describe the location or movement of the theme argument by placing/moving the strong (i.e. dominant) hand at/to an appropriate location; and (iii) verbs that change the direction of the hand(s) depending on the referents of their arguments. Subsequent research has shown that other sign languages have the same three types of predicates. In what follows, the three types of verbs will be called PLAIN VERBS, LOCATIONAL VERBS, and AGREEMENT VERBS, respectively. This chapter presents an analysis of the third type, and uses the traditional term VERB AGREEMENT for the adjustment of the direction (orientation) of the hand(s) that agreement verbs require.

In sign languages, each referent involved or talked about in a conversation will be assigned a particular position in space, called the REFERENTIAL-LOCUS (R-locus) of the referent. The pronoun referring to a referent is expressed by pointing at the referent's R-locus.[2)] An event where an item is transferred to a recipient is described with the dominant hand moving toward the R-locus of the recipient. Padden (1983) reports that the movement path for agreement verbs need not be as precise as the path of the theme argument of

locational verbs. The latter verbs use space as a continuum so that a slight change in location signifies a different location. Agreement verbs and pronouns use R-loci, which are discreet patches of space assigned to referents.

Verb agreement in sign languages is known to have properties very different from those of syntactic agreement in spoken languages (see, for example, Padden 1983; Mathur 2000; Meir 2002). While spoken languages vary from inflectional languages to isolating languages, no sign language, except for some very young sign languages, has been reported to lack verb agreement. Agreement is observed only with a subset of the verbs in sign languages, and the semantic characteristics of agreement verbs across sign languages cannot be accidental. They are typically verbs of transfer, verbs that take an animate object, and symmetrical predicates. Furthermore, agreement with the (indirect) object is obligatory while agreement with the subject is not, and there is no indication of involvement of a functional category in verb agreement in sign languages. While agreement in spoken languages involves ϕ-features and there is no phonological condition on the elements in agreement, verb agreement in sign languages is realized as the hand(s) aligned in the same direction as the personal pronoun for the referent of the object.

Those observations raise four questions:

(1) Q1. Why do all mature sign languages show verb agreement, while spoken languages vary from inflectional languages to isolating languages?
Q2. Why is it limited to a subset of verbs, typically verbs of transfer, verbs with an animate object, and symmetrical predicates?
Q3. Why is it the case that agreement with the object is obligatory, and agreement with the subject is not.
Q4. Why does it use the same R-loci as the corresponding pronouns?

Section 8.2 presents an analysis of verb agreement in sign languages, which leads to answers to the questions listed above. The analysis is based on Optimality Theory, and derives the differences between spoken languages and signed languages from the differences in ranking of constraints common across the two types of language. Section 8.3 discusses the emergence of verb agreement in language acquisition and in young sign languages. Section 8.4 presents some other predictions of the proposed analysis, followed by a conclusion in Section 8.5.

8.2. An Optimality Theoretic Analysis of Verb Agreement in Sign Languages

8.2.1 Semantic Characteristics of Agreement Verbs

Let us first discuss the second question because it leads us to answer the other questions: Why is agreement typically observed with verbs of transfer, verbs that take an animate object, and symmetrical predicates? The first two groups of verbs can easily make reversible sentences. For example, the verb *help* takes an animate object as in *A boy helped a girl*. If one switches the subject and the object, the result, *A girl helped a boy*, is equally plausible. In irreversible sentences such as *A boy ate an apple*, switching the subject and the object results in implausible content. Verbs of transfer and verbs that take an animate object are

likely to make reversible sentences, and therefore are a possible source of misunderstanding in conversation. Likewise, symmetrical predicates can lead to misunderstanding in a conversation in which there are more than two possible referents.

In human languages, there are two ways to avoid this kind of misunderstanding. One is to use different verbs. For example, Japanese has two verbs for 'give'. *Ageru* is used when the agent is closer to the speaker, and *kureru* is used when the recipient is closer to the speaker. The distinction gives the addressee a clue on the direction of transfer, even if the arguments are not overtly expressed. Another possibility is to make the arguments explicit by the use of overt pronouns, as in *He helped her*. While overt pronouns in spoken languages are often ambiguous with respect to their referents, as in the case of *He helped him*, pronouns in sign languages are articulated by pointing to the R-loci of the intended referents, and therefore should be a perfect tool for disambiguation. Instead of overt pronouns, however, verb agreement shows up. This consideration leads to the hypothesis that verb agreement in sign languages is incorporation, or cliticization, of an overt pronoun to a verb. This hypothesis is implemented in 8.2.2., followed by discussion in 8.2.3. on why verb agreement in sign language shows the properties that it does.

8.2.2 An OT Analysis of Verb Agreement

In both spoken and signed languages, researchers have found phonological regularities that can be attributed to reducing articulatory efforts. Kirchner (2004) proposes a phonological constraint he calls "LAZY," which requires that articulatory effort be minimized. He argues that Lenition (various types of phonological weakening including spirantization—stops becoming fricatives) can be explained by various rankings among this constraint LAZY and the constraints that favor preservations of relevant distinctions in the Optimality Theoretic phonology. For example, languages in which LAZY is ranked higher than Preservation of [-continuant] in the input as in (2a) will have spirantization, while languages with the opposite ranking as in (2b) will not allow spirantization.

(2) Spirantization of alveolar stop in spoken languages:

(a)

	/d/	LAZY	Preserve [-continuant]
	d	* * !	
☞	ð	*	*

(b)

	/d/	Preserve [-continuant]	LAZY
☞	d		* *
	ð	* !	*

Napoli *et al.* (2014) argue that the effort-minimizing constraint plays a role in sign languages, reducing the movement of joints in casual conversation to the extent that it does not hinder lexical recognition.

I propose one variant of LAZY, which requires that syllables not be articulated. This constraint, henceforth *σ, is responsible for syllable reduction in colloquial speech of spoken languages like (3) from English and Japanese.

(3) a. Auxiliary reduction in English:

Not reduced	Reduced
I am	*I'm*
he is	*he's*
they are	*they're*

b. Phonological reduction of aspectual compound verbs in Tokyo Japanese

Not reduced	Reduced	
tabe-te oku	*tabe-toku*	'eat in advance'
tabe-te iru	*tabe-teru*	'be eating'
tabete-simau	*tabe-tyau*	'eat up'

The constraint *σ should play a significant role in sign languages, because sign syllables take time to articulate, as discussed in classical works by Bellugi and Fischer (1972) and Klima and Bellugi (1979). It is also well known that signs are usually monosyllabic, and that native signers prefer short sentences. Those observations suggest that expressions with multiple syllables increase the load on the processor as well as the articulators of sign languages. In Optimality Theoretic terms, the constraint *σ should be ranked high in sign languages.

Before discussing the effects of this constraint, let us briefly consider phonological specifications in the lexicon, using three signs from Japanese Sign Language (JSL) for examples. First, the plain verb YOMU 'read' has its handshape, position, movement, and orientation as in (4a). Second, a pronoun has only the handshape and orientation as in (4b), and the orientation is the direction of the R-locus of its referent. (Its handshape might be the default value for signs with an orientation.) Third, the agreement verb SETSUMEISURU 'explain' has its specifications for handshape, position, and movement, but I assume that its orientation is left unspecified as in (4c).

(4) Phonological specifications in the lexicon

	a. YOMU 'read'	b. pronoun	c. SETSUMEISURU 'explain'
Handshape[3)]	V	1	B
Position	neutral		on the weak hand
Movement	twice downward		twice downward
Orientation	tips toward the weak hand	R-locus of its referent	

For agreement verbs, the citation form is realized with the orientation [forward] (henceforth: FWD) as discussed in Mathur (2000). It is the default value, because it requires the least effort. On the other hand, when a pronoun is next to an agreement verb, the R-locus of the pronoun can be linked to the verb and fixes its orientation.

Now let us see how verb agreement can be analyzed as a phonological effect of *σ. Here I need another constraint. I call it AVOID AMBIGUITY and use the symbol *& for it. This constraint penalizes outputs that are ambiguous.[4)] The constraint *σ penalizes each of the output candidates according to the number of its overt syllables. If *σ and *& are not ranked with respect to each other, the optimal output for the verb phrase consisting of

the verb SETSUMEISURU 'explain' and its pronominal recipient object will be selected as follows. Here, $PT_{OBJ.}$ and $R\text{-}loc_{OBJ.}$ indicate the pronominal object of the verb and its R-locus, respectively. The orientation of the verb sign is indicated in parentheses following the verb, as in <SETSUMEISURU (FWD)> and <SETSUMEISURU ( )>, the latter case being the verb form with the orientation unspecified.

(5) input: $PT_{OBJ.}$ <SETSUMEISURU ( )> 'explain to him/her'

	outputs	*σ	*&
	(a) < SETSUMEISURU (FWD)>	*	*!
	(b) $PT_{OBJ.}$ < SETSUMEISURU (FWD)>	**!	
☞	(c) < SETSUMEISURU ($R\text{-}loc_{OBJ.}$)>	*	

Though the input verb phrase contains a pronominal object, articulating the verb and the object pronoun results in two syllables, so the second candidate (5b) loses to the other two with one syllable each. The first candidate (5a) lacks the information on the object, and therefore violates the Avoid ambiguity constraint. This leaves the third candidate (5c), with the R-locus of the object realized in the orientation of the verb.[5] It is not perfect, but it is the optimal candidate. This is how an agreeing form is selected under this analysis.

I have assumed that agreement verbs have their hand orientation unspecified in their input form. This leads to a crucial difference between agreement verbs and plain verbs. Plain verbs in sign languages are mainly transitive verbs that take an inanimate object or intransitive verbs.[6] Transitive verbs that take an inanimate object are not likely to make reversible sentences, and can take a null argument instead of an overt pronominal object without risking misunderstanding. In such cases, as well as in cases of intransitive verbs, the underlying specification for hand orientation can be fixed. Such verbs show the behavior of plain verbs, as the verb YOMU 'to read' in (4a). I will discuss how children come up with an unspecified hand orientation for verbs like SETSUMEISURU 'to explain' in Section 8.3.

8.2.3 Consequences of the Proposed Analysis

Let us now turn to the other questions raised in Section 8.1. They are repeated here.

(6) Q1. Why do all mature sign languages show verb agreement, while spoken languages vary from inflectional languages to isolating languages?
Q3. Why is it the case that agreement with the object is obligatory, and agreement with the subject is not.
Q4. Why does it use the same referential loci as the corresponding pronouns?

We already have answers to the first and the last questions. All mature sign languages have verb agreement because sign syllables take so much time to articulate that reducing the number of syllables by ranking *σ high is well-motivated in any sign language. Verb agreement in sign languages uses the same referential loci as the corresponding pronouns because the agreement is incorporation of (the orientation of) the object pronoun into the

syllable of the verb root.

On Q3, the discussion so far has concentrated on object agreement. There are cases where agreement with one argument is sufficient for disambiguation purposes, as in cases with only two potential referents for the subject and the object. Agreement with the subject seems to involve factors beyond the scope of this chapter, such as Referential Shift and whether the sentence describes a scene from a bird's-eyed view or a scene involving the signer as a participant of an event. Fine-grained research is necessary to see when subject agreement is necessary, optional, or ungrammatical. However, there are at least reasons to believe that agreement with the object should have priority over agreement with the subject. One is that a verb and its object form a constituent, call it VP, which excludes the subject. If VP is a domain to be spelled out, the object and the verb are spelled out as a single syllable as in (5) above, and this happens before the subject has a chance to be spelled out. Another factor is that the orientation of a sign is manifested by the direction that the extremities of the signing hand(s) point to, and object agreement is expressed with the same extremities pointing at the R-locus of the object. Object agreement, therefore, is sufficient for the articulatory purpose to select an orientation. Subject agreement, on the other hand, is realized by adjusting a part closer to the torso, and this by itself is not sufficient for determining the orientation of the verb's sign. When the verb agrees with the subject in addition to the object, the orientation of the sign will be more parallel with the line connecting the referents of the subject and of the object. This, however, may require more articulatory effort than simple object agreement, depending on the particular verbs and where the intended referents are located. In cases where object agreement is sufficient to disambiguate the sentence, it is natural that the hand configuration reflecting subject agreement is dropped in accordance with the effort-minimizing constraint discussed in 8.2.2. above.

8.3. The Emergence of Verb Agreement

I have proposed a mechanism that determines verb agreement in sign languages. Let me now turn to how this mechanism arises, in language acquisition by children and in newly-born sign languages.

8.3.1 Predictions

The analysis proposed in the previous section assumes that the base form of the verb SETSUMEISURU 'explain' has its orientation unspecified as in (7a). The base form could have the orientation FWD as in (7b), or some other direction as in (7c).

(7) Possible base forms for SETSUMEISURU 'explain'

	(a)	(b)	(c)
Handshape	B	B	B
Position	on the weak hand	on the weak hand	on the weak hand
Movement	twice downward	twice downward	twice downward
Orientation	unspecified	FWD	some other direction

We now examine the consequences of using those alternatives as inputs into a more complete Optimality Theoretic phonology with Faithfulness, whereby output candidates are evaluated in the extent to which they retain the properties of the input. Faithfulness has three parts: Maximality (MAX) requires that nothing be dropped, Dependence (DEP) requires that nothing be added, and Identity (IDENT) requires nothing be altered. Following Smolensky (1996) and Itô *et al.* (1995), I assume that children start with Faithfulness ranked lower than other constraints.

As we have seen, if (7a) with the unspecified orientation is the input, the agreeing form is selected as the most optimal as in (8). (DIR stands for any direction other than FWD and R-$loc_{OBJ.}$) Faithfulness plays no role here because the optimal candidate is determined by higher-ranked constraints.

(8) input (7a) $PT_{OBJ.}$ < SETSUMEISURU ( )>

outputs	*σ	*&	MAX	DEP	IDENT
<SETSUMEISURU (FWD)>	*	*!	* R-$loc_{OBJ.}$	* FWD	
$PT_{OBJ.}$ <SETSUMEISURU (FWD)>	**!			* FWD	
☞ <SETSUMEISURU (R-$loc_{OBJ.}$)>	*				
$PT_{OBJ.}$ <SETSUMEISURU (R-$loc_{OBJ.}$)>	**!				
<SETSUMEISURU (DIR)>	*	*!	* R-$loc_{OBJ.}$	* DIR	
$PT_{OBJ.}$ <SETSUMEISURU (DIR)>	**!			* DIR	

Now if the input is (7b) with the orientation FWD, or is (7c) with some other orientation, the result is the same: The agreeing form is the optimal output as the following tableaux show.

(9) input (7b) $PT_{OBJ.}$ < SETSUMEISURU (FWD)>

outputs	*σ	*&	MAX	DEP	IDENT
<SETSUMEISURU (FWD)>	*	*!	* R-$loc_{OBJ.}$		
$PT_{OBJ.}$ <SETSUMEISURU (FWD)>	**!				
☞ <SETSUMEISURU (R-$loc_{OBJ.}$)>	*		* FWD		* FWD-R-$loc_{OBJ.}$
$PT_{OBJ.}$ <SETSUMEISURU (R-$loc_{OBJ.}$)>	**!		* FWD		* FWD-R-$loc_{OBJ.}$
<SETSUMEISURU (DIR)>	*	*!	* FWD * R-$loc_{OBJ.}$	* DIR	* FWD-DIR
$PT_{OBJ.}$ <SETSUMEISURU (DIR)>	**!		* FWD	* DIR	* FWD-DIR

(10) input (7c) $PT_{OBJ.}$ < SETSUMEISURU (DIR)>

outputs	*σ	*&	MAX	DEP	IDENT
<SETSUMEISURU (FWD)>	*	*!	* R-$loc_{OBJ.}$ * DIR	* FWD	* DIR-FWD
$PT_{OBJ.}$ <SETSUMEISURU (FWD)>	**!		* DIR	* FWD	* DIR-FWD
☞ <SETSUMEISURU (R-$loc_{OBJ.}$)>	*		* DIR		
$PT_{OBJ.}$ <SETSUMEISURU (R-$loc_{OBJ.}$)>	**!		* DIR		
<SETSUMEISURU (DIR)>	*	*!	* R-$loc_{OBJ.}$		
$PT_{OBJ.}$ <SETSUMEISURU (DIR)>	**!				

The evaluations based on Faithfulness do not make a difference on the choice of the best output for each input, as indicated by shading of the corresponding cells. They do make a difference, however, when one turns to choosing the best input in language acquisition, as we do now.

Besides explaining the universality and variations among adult grammars, Optimality Theory aims to explain how a child finds the patterns of her language and the underlying form for each morpheme to be stored in her lexicon. Prince and Smolensky (2004) and Itô *et al.* (1995) propose a principle that the learner follows in finding the underlying form. Their LEXICON OPTIMIZATION basically says that if there are several potential inputs whose outputs all converge on the same phonetic form, the learner should choose (as the underlying form) the input that maps onto the output in the way least offensive to the grammar. In our case, the three possible inputs (7a), (7b), and (7c) converge on the same optimal output, but at different cost with respect to Faithfulness.

(11) Tableau des tableaux: Evaluating outputs of different inputs

	inputs	output	*σ	*&	MAX	DEP	IDENT
☞	(a) $PT_{OBJ.}$ <SETSUMEISURU ( )>	<SETSUMEISURU (R-$loc_{OBJ.}$)>	*				
	(b) $PT_{OBJ.}$ <SETSUMEISURU (FWD)>		*		*		*
	(c) $PT_{OBJ.}$ <SETSUMEISURU (other direction)>		*		*		*

The one that receives the fewest stars, that is, (7a) with an unspecified orientation should be chosen as the form to be stored in the lexicon.

As for the ranking among constraints, there seems no reason to re-rank Faithfulness (MAX, DEP, IDENT) over *σ or *&. In addition, children acquiring a sign language will find that even with full fluency (fast articulation), sign syllables impose heavy loads on the processor/articulators, so that *σ must be ranked high. Assuming that *& stays as highly ranked as *σ, the present analysis predicts that fluency in signing and the capability of phonological computation are the necessary and sufficient conditions for the development of verb agreement in acquisition, and that the existence of children with such ability is necessary and sufficient for the emergence of agreement in newly-born sign languages. In this context, I would like to review two previous studies.

8.3.2 Observations Reported in Previous Studies

Carol Padden and her colleagues have reported on emergence of verb agreement in young sign languages. Here I will discuss their research reported in Padden *et al.* (2010). They asked three groups of deaf people from the Israeli Sign Language community to describe scenes of transfer between two third-person referents. The subjects in the first two groups strongly preferred the forward movement. A sharp contrast was found between those two groups and the youngest generation, who used sideway or diagonal movements in more than 70% of their performance.

(12) Israeli signers describing actions of transfer (Based on Padden et al. (2010: 582–583))

Direction of hand movement Group of signers	forward	sideways	diagonal	no directional movement
11 older signers (age 65 or above)	almost 60%	fewer than 30%	8%	6%
9 younger signers (age 45–65)	almost 60%	fewer than 30%	16%	very few
4 youngest signers (age 30–40)	25%	42%	32%	very few

While the authors report that the second group had had linguistic models from the start and had interacted with deaf children and had used signing from childhood, they used the term "native or early I[sraeli]S[ign]L[anguage] signers" only for the youngest group. Assuming that they were the first generation of native signers, one could say that agreement emerged in the first generation of native signers, who may or may not have encountered examples of verb agreement in their care-takers' signs.

Second, Supalla (1991) reports on video descriptions by children who had been exposed only to Manually Coded English. Those children had learned all verbs as plain verbs, and the adults they had seen had never used space for referential purposes. Supalla reports the findings in (13) and cites examples of the children's performance in (14c).

(13) a. Verb roots were modified to signal grammatical relations using space.
b. Deictic pointing was used for pronouns.
c. Regular patterns were observed in each child's performance.

(14) 'He yells at her.' (Supalla 1991: 106f)

a. ASL:

(a) (b) (c)

b. Manually Coded English

HE YELL S AT HER

c. Child A Child B

In describing a situation in which a male person yells at a female person, Child A reduced the whole sentence into one syllable. It violates Faithfulness on the first location of the verb, and is different from the ASL form. However, this is exactly what JSL signers do with the verb meaning 'ask a question'. This child had figured out a form that is possible in human language. Child B used two syllables, but this child knew that the number of syllables could be reduced by using the R-locus of an argument for the orientation of the verb. The result was wrong for this particular sentence, but it is the correct form for a sentence with a first-person subject and a non-first-person object. His second sign has the same form and function as the indexical agreement auxiliary observed in sign languages such as German Sign Language and Greek Sign Language (Sapountzaki 2012). It is remarkable that those children who had not had any experience with a natural sign language knew the phonological system with *σ and *&.

8.4. Other Consequences

8.4.1 Syllable Reduction in Sign Languages

The constraint *σ predicts that sign languages have clipping and syllable reduction, and they do. It is well known that compound forms are often reduced to a single-syllable form. The perfective aspect marker in JSL, which consists of a hand movement and mouth gesture *pa*, can be incorporated into verbs of change of state, so that the verb and the aspect marker are articulated in a single syllable as in (15b)–(17b).

(15) a. RIKONSURU OWARI^{pa}
get divorced finish^{pa}
'have got divorced'

b. RIKONSURU^{pa}
get divorced^{pa}
'have got divorced'

(16) a. KIERU OWARI^{pa}
disappear finish^{pa}
'have disappeared'

b. KIERU^{pa}
disappear^{pa}
'have disappeared'

(17) a. KAERU OWARI^{pa}
go home finish^{pa}
'have gone home'

b. KAERU^{pa}
go home^{pa}
'have gone home'

These are not particularly new observations, but what they show is that sign languages do not need any mechanism specific for verb agreement. Verb agreement is a necessary consequence of the externalization of human language with universal constraints appropriately ranked for sign languages.

8.4.2 An Argument Against Pronominal Cliticization

Since the analysis of verb agreement presented in this article can be considered as pronominal cliticization, we examine one argument against analyzing verb agreement as pronominal cliticization.

Padden (1990) reports that in ASL a noun signed on the strong hand can be accompanied by the weak hand pointing at the R-loci of the referents as in (18), and that these R-loci can also appear on the noun on the strong hand as in (19).[7)]

(18) STRONG HAND: I SEE DOG DOG DOG
WEAK HAND: $_{a}$PT $_{b}$PT $_{c}$PT
'I saw a dog here$_{a}$, there$_{b}$ and there$_{c}$, too.'

(19) STRONG HAND: I SEE $_{a}$DOG $_{b}$DOG $_{c}$DOG
WEAK HAND:
'I saw a dog here$_{a}$, there$_{b}$ and there$_{c}$, too.'

She then compares them with (20) and (21) with the agreement verb GIVE.

(20) STRONG HAND: *WOMAN GIVE GIVE GIVE
WEAK HAND: $_{a}$PT $_{b}$PT $_{c}$PT
('The woman gave it to her$_{a}$, him$_{b}$, and her$_{c}$, too.)

(21) STRONG HAND: WOMAN GIVE$_{a}$ GIVE$_{b}$ GIVE$_{c}$
WEAK HAND: $_{a}$PT $_{b}$PT $_{c}$PT
'The woman gave it to her$_{a}$, him$_{b}$, and her$_{c}$, too.

Unlike the noun DOG in (18), the verb GIVE in (20) cannot be in the citation form with the pronoun on the weak hand. Padden argues that this difference shows that agreement on the verb is different from pronominal cliticization to nouns.

Now let us consider what the present analysis predicts. The lexical entry of the noun DOG has no room for orientation, because its articulation needs no orientation. Pointing R-loci by the weak hand in (18) can be analyzed as instances of Determiner, articulated simultaneously as the noun. They are incorporated into the nouns in (19). Either way, we have no violation of phonological constraints. On the other hand, the orientation of the verb GIVE is left unspecified in the lexicon, but it cannot be articulated without a specific orientation. While the citation form with the orientation FWD violates Faithfulness (DEP in particular), it is the least offensive form if the verb is articulated in isolation, because this orientation requires the least articulatory effort. When the verb is used in a sentence, however, the R-locus of its object can be employed to determine the orientation of the verb, in which case the verb appears in the agreeing form. Since this possibility does not violate DEP, it wins over the citation form, rendering the latter ungrammatical. Padden's observations on the contrast between nouns and verbs in (18) and (20) are thus expected under the proposed analysis.

8.5. Conclusion

The present article started with four questions on verb agreement in sign languages.

(1) Q1. Why do all mature sign languages show verb agreement, while spoken languages vary from inflectional languages to isolating languages?
Q2. Why is it limited to a subset of verbs, typically verbs of transfer, verbs with an animate object, and symmetrical predicates?
Q3. Why is it the case that agreement with the object is obligatory, and agreement with the subject is not.
Q4. Why does it use the same R-loci as the corresponding pronouns?

To answer those questions, I have proposed an Optimality Theoretic analysis with a constraint against overt syllables.

Since sign languages allow null arguments, the object of a plain verb need not be articulated if it is understood from the context. Verbs of transfer, verbs with an animate object, and symmetrical predicates are more likely to lead to ambiguity even if possible referents of the subject and the object are known to the interlocutors, because the subject and object are often reversible. Verbs of the latter kind, therefore, should prefer an overt object pronoun, which increases the number of syllables, and thus causes more violations of the constraint against overt syllables. Since syllables articulated with hands take more time and energy than syllables in spoken languages, the constraint against overt syllables should be ranked high in all sign languages. The additional violation can be avoided if the orientation of the pronoun is incorporated into the syllable of the verb. Among the possible inputs for an agreement verb that result in the same optimal form, the one with the underlying orientation unspecified is chosen in acquisition, because this option leads to the optimal form in the least offensive way. From this analysis, it follows that verb agreement necessarily uses the same R-loci as pronouns (Q4), and is observed with verbs of transfer, verbs with an animate object, and symmetrical predicates (Q2) in all mature sign languages with native speakers fluent in signing and computation in sign phonology (Q1). Object agreement fills in the orientation in the phonological specification of agreement verbs, and is therefore indispensable, while subject agreement alone would not determine the orientation of the verb sign. Agreement with both the object and the subject is possible, but requires more articulatory effort on the part of the signer, because it involves adjusting both the extremities and a part closer to the torso. Since the latter is heavier, non-agreement with the subject should be more optimal if it does not hinder sentence interpretation, according to the effort-minimizing constraint discussed in Napoli *et al.* (2014) (Q3).

On the basis of the proposed analysis, I have argued that verb agreement should come for free once children have acquired fluency in signs both physically and in computation for selecting the most optimal form according to the universal constraints appropriately ranked for sign languages. Verb agreement emerges in new sign languages once children attain full fluency. This explains why verb agreement arises from children who have been exposed only to signs without agreement. The discussion also demonstrates that the system of agreement unique to sign languages is based on the mechanism of language externalization that is common across modality.

Notes

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2) See Schlenker *et al.* (2013) for the semantic interpretation of R-loci in sign languages.

3) In this article, handshapes are indicated by ASL finger-spelling with the same hand-configuration. <V> indicates that the index and middle fingers are extended, <1> indicates that only the index finger is extended, and <B> indicates that all fingers are extended.

4) Kawasaki (2018) pursues an alternative analysis, in which Avoid ambiguity is a pragmatic constraint, and does not play a role in selecting the optimal output for the input with no specification for orientation in adult sign languages.

5) Word boundaries between the verb and its object are not respected in the prosodic structure in (5c), with the orientation of the object realized in the syllable corresponding to the verb. In this sense, this output violates the constraint that requires a word boundary to correspond to a prosodic domain (Selkirk 2011), but it does not affect the discussion that follows.

6) According to Mathur (2000), most of the exceptions to the generalization that verbs that take an animate object are agreement verbs are those with body-anchored articulation. I assume that adjusting the hand orientation leads to violation of a FAITHFULNESS requirement and is analyzed as less than optimal in such cases.

7) Padden (1990) uses PRO for PT in these examples.

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