Gestural Agreement*

Philippe Schlenker
(Institut Jean-Nicod, CNRS; New York University)

Emmanuel Chemla
(LSCP, CNRS)

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Abstract. We argue that a gesture replacing an English verb – a 'gestural verb'– displays some properties of 'agreement verbs' in American Sign Language (ASL). Specifically, gestural verbs involving (among others) slapping and punching can be realized as targeting the addressee (*SLAP-2*, *PUNCH-2*) if the object is second person, or as targeting some other position (*SLAP-a*, *PUNCH-a*) if the object is third person. This property is shared with ASL verbs that display object agreement. Strikingly, in both cases the object agreement marker can be disregarded under ellipsis and under the focus-sensitive particle *only*, a behavior which is shared with *phi*-features in spoken language, and is not entirely reducible to the presuppositional nature of the marker. The main findings are based on introspective judgments, but crucial examples are validated by an experimental approach. In sum, we provide initial evidence that English gestural verbs have a grammar, and that it partly mirrors that of some sign language constructions.

Keywords: agreement; gestures; sign language; agreement verbs; gestural verbs; pro-speech gestures; ellipsis; focus; iconicity

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1 Introduction

1.1 Goals

In sign language (e.g. American Sign Language (ASL) and French Sign Language (LSF)), a class of 'agreement verbs', (also called 'directional verbs', include in their realization one or several 'loci' corresponding to their object or subject argument. Loci are positions in signing space that are closely associated with variables/discourse references (e.g. Lillo-Martin and Klima 1990, Kuhn, to appear, Schlenker 2017) and display an overt distinction between first person, second person, and a variety of third persons (potentially with one separate locus for each individual mentioned). The loci that are 'indexed' (= targeted) by sign language directional verbs were argued to display some properties of grammatical agreement markers and/or pronouns (in particular in connection to Strong Crossover, see Lillo-Martin 1991, Lillo-Martin and Meier 2011). Other accounts emphasized the fact that directional verbs display some iconic properties (Kegl 2004, Liddell 2000, 2003). Liddell 2000, 2003 concluded from this observation that directional verbs have genuinely gestural characteristics.[1] Finally, Schlenker et al. 2013 (partly following Kegl 2004) attempted a synthesis of sorts by arguing that directional verbs include loci in their realization, but that these may simultaneously function as formal indices and as iconic representations of their denotations. In the semantics they provided, both the agreement-based and the iconic-based analyses were vindicated.

We argue that sometimes a gesture replacing an English verb displays some properties of 'agreement verbs' in ASL (in the English case, we talk of 'gestural verbs' because the relevant expressions occupy a syntactic slot in which a verb is otherwise needed, but this terminology should not pre-judge the debate about their grammatical status). Specifically, gestural verbs involving slapping and punching, as well as other verbs ('sending kisses to', 'shooting') can be realized as targeting the addressee (*SLAP-2*, *PUNCH-2*) if the object denotes the addressee, or as targeting some other position (*SLAP-a*, *PUNCH-a*) if the object is third person.[2] This property is shared with ASL verbs that display object agreement. Strikingly, in both cases the object agreement marker can be disregarded under ellipsis and under the focus-sensitive particle *only*, a behavior which is shared with *phi*-features quite generally – and is not entirely reducible to the presuppositional nature of the agreement marker. This suggests that non-trivial properties of sign language grammar can be replicated with spoken language gestural verbs – part of a broader class of 'pro-speech gestures' (= speech-replacing gestures[3]), which is only beginning to be investigated. Our main findings are based on introspective judgments (including those of colleagues who do not know any sign language). But we also develop a new quantitative approach to obtain judgments on our target sentences from (non-signing) naïve participants, and we use this method to validate some crucial examples.

Two disclaimers might be useful at the outset. First, it has been argued that in ASL the distinction between first and non-first person is grammaticalized (because it gives rise to morphological syncretisms), whereas the distinction between second and third person isn't (because deictic pronouns index loci whose position corresponds to their actual denotation, be it second or third person; Meier 1990[4]). Our claims about ASL are fully compatible with this claim, and in fact we will be concerned

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[1] Liddell 2003 (p. 139) writes: "Each individual verb has specific gestural characteristics associated with it. Each verb's directional characteristics are potentially distinct from those of any other ASL verb. Some verbs are unable to point, some point toward entities corresponding to their trajectors, some point toward entities corresponding to their landmarks, and some point to both. For those that do point, if they are directed at a person, they are directed at specific parts of the person (e.g. forehead, nose, chin, sternum). These are not general characteristics of gestural "accompaniments" to signing. These are specific, semantically relevant, properties of individual verbs."

[2] Some of these gestural verbs make reference to objectionable actions. We use them because at this early stage it proved non-trivial to find many gestural verbs that are readily understood and have the right formal properties.

[3] The term 'pro-speech gesture' is constructed with the prefix *pro* found in *pronoun* ('replacing a noun') and *proconsul* ('replacing the consul'): a pro-speech gesture is a gesture that replaces a spoken expression. Existing typologies also include *co-speech gestures*, which co-occur with spoken expressions they modify; and *post-speech gestures*, which follow expressions they modify and have their own time slot. See Schlenker 2016c for a discussion of this typology.

[4] See also Kuhn 2015 for a view in which loci establish an unlimited number of person distinctions, including among third persons.

with the behavior of *loci* rather than with person *per se*; in particular, when we talk of '2nd person agreement marker' in ASL, we just mean: directional verbs that target a second person locus. With respect to English gestural verbs, we have only studied differences in realization between speaker-, hearer- and third-person-denoting object markers. While this could be analyzed in terms of a person system, it is equally possible that we are just dealing with a locus-based system – possibly one with a single third person locus, or one with a variety of third person loci.[5] Our data are neutral on this matter, and we solely aim to show that some gestural verbs in English share key formal properties of ASL agreement verbs. Second, our claim is not at all that gestural verbs are common in English. We suspect that they are quite rare, and that gestural verbs with object agreement are even rarer. If so, it is all the more striking that non-signers who have rarely or possibly never seen such gestures still have fairly sharp intuitions about their acceptability and meaning.

1.2 Methods and transcription conventions

For ASL, old data are cited from earlier publications. New data were elicited using the 'playback method' (see e.g. Schlenker et al. 2013 and Schlenker 2014): repeated quantitative acceptability judgments and repeated inferential judgments were obtained from our ASL consultant on separate days, on videos involving minimal paradigms. Our consultant entered judgments on a computer, and then (redundantly) signed them on a video. Raw written data can be found in the Supplementary Materials. For legibility and simplicity, our transcriptions omit non-manuals, and our translations disregard irrelevant readings (see the Supplementary Materials for further details).

Glossing conventions are standard for sign language research, with *IX-a* encoding a pointing sign towards locus *a*, and with the subscript *a* on $JOHN_a$ indicating that the expression *JOHN* was signed in locus *a*, and similarly for the person classifier CL_a. Unless otherwise noted, loci are signed at a neutral height; high and low versions of a locus *a* are glossed as a^{high} and a^{low} respectively. Each example is preceded by the average score obtained on a 7-point scale, with 1 = worst and 7 = best. Unless otherwise noted, we kept in the same numbered example sentences that were contrastively assessed as part of the same video. Numbers following the examples (e.g. *ASL, 34, 1498* in (9)) are the codes of the corresponding videos, and they are followed by the number of judgments obtained for the relevant paradigm. When there was more than a 2-point difference across the judgments obtained for any given sentence, the individual judgments are included after that sentence. Readings described are justified by inferential judgments found in the Supplementary Materials.

For gestures, we used introspective judgments that are standard in linguistics (see for instance Sprouse and Almeida 2012 for a defense). But since these are less well established with gestures than with standard spoken examples, we sought to validate a sample of the most important results by way of an experiment with naïve participants recruited online, as described in Section 6 (as noted at the outset, we do not claim in any way that gestural verbs are common in production, and our experiment solely tested perception). Glossing conventions were chosen to be reminiscent of sign language: here too, we used capital letters to gloss elements produced manually. This choice should definitely not suggest that signs are gestures or conversely.[6] A gestural verb involving slapping was glossed as *SLAP-2* if it was realized towards the addressee, and as *SLAP-a* if it was realized towards a third person position – which we'll also call 'locus' for terminological simplicity. Refining the notation, we will write *SLAP(-2)* if we think that this form is both a second person and a neutral form, usable in all persons. Since it will prove convenient to illustrate the glosses with pictures, we will adopt the convention of writing, say, *SLAP-a_*  for a gestural verb *SLAP-a* that can be illustrated with this picture. (Pictures are for

[5] We believe on the basis of ongoing investigations that a plurality of third person loci can be used with English co- and pro-speech gestures.

[6] This point is worth emphasizing, for while it is obvious to competent linguists that sign languages are full-fledged - and extremely interesting - languages, and that they have a crucial role to play in the development of deaf children (e.g. Mellon et al. 2015), there are still attempts in some countries to assimilate them to mere gestural codes.

illustration only, except in the experimental part, where we reproduce anonymized screen captures from the relevant videos.)

1.3 Organization

In Section 2, we briefly remind the reader of the puzzling behavior of some person and gender features under ellipsis and *only* (there is already a vast literature on this topic and our summary is correspondingly succinct and informal). In Section 3, we consider horizontal and vertical specifications of ASL pronominal loci, and show (following the literature) that they too can be disregarded in the course of ellipsis resolution and under *only*. We show in Section 4 that the same results extend to the horizontal and vertical specifications of ASL agreement verbs. In Section 5, we argue that gestural verbs in English give rise to related phenomena, with a second vs. third person distinction, and a 'disappearing act' under ellipsis and *only*. Crucial gestural data (pertaining to their acceptability and meaning) are validated with a preliminary experimental approach in Section 6. We then refine the theoretical analysis: in Section 7, we argue that agreement markers on ASL directional verbs and on English gestural verbs couldn't just be treated as variables that are always interpreted; and in Section 8, we ask whether it is the grammatical nature of agreement markers that allows them to be disregarded under ellipsis and *only*. Concluding remarks are made in Section 9.

2 Feature 'disappearance' under ellipsis and *only*

Among the striking properties of locus specifications in sign language is their ability to be somehow disregarded under ellipsis and *only*. Such a phenomenon is well-known for *phi*-features in spoken language, as illustrated in (1)a-b, where both the third person and the gender features of *her* can be ignored under ellipsis resolution and in the 'focus dimension' of *only* (see Schlenker 2014, 2015b for a recent summary and some references). Specifically, the bound reading of (1)a could not be obtained if the ellipsis was resolved by copying the antecedent VP *with* the person and gender features of *her*: this would yield a covert version of the second sentence in (1)c, which only has a strict reading. Similarly, for (1)b to entail that *I* [= a male speaker] *didn't do my homework,* the ('focus') alternatives that are negated by *only* should not be of the form *x did her*$_x$ *homework*, but rather something like *x did pro*$_x$*'s homework*, where the person and gender features of the possessive pronoun are disregarded.

(1) [Uttered my a male speaker] In my study group,
a. Mary did her homework, and I did too.
=> available bound variable reading in the second clause
b. Only Mary did her homework
=> available bound variable reading, entailing that *I didn't do my homework*.
c. Mary did her homework, and I did her homework too.
=> no bound variable reading in the second clause

In sum, these facts suggest that whatever mechanism supplies the missing VP in (1)a on the basis of the antecedent can disregard the third person and feminine features that appear on *her*. Similarly, on standard theories of focus resolution (e.g. Rooth 1996), the meaning of *only F* is computed by negating some propositions obtained (in the 'focus dimension') by replacements of the focused term in *F*; here too, it would seem that this mechanism can ignore the third person and feminine features that appear on *her* in (1)b.

Why pronominal features can be ignored in this way is a topic of current debate. Two general directions have been explored (see Schlenker 2015b for relevant discussion in connection to sign language loci). According to *semantic analyses*, a feature *F* on a pronoun *pro* remains uninterpreted in the 'focus dimension' (Rooth 1996) *due to its semantics* (Heim 2005, Spathas 2007, Jacobson 2012) – with the assumption that not just *only*, but also ellipsis resolution is computed by way of this focus dimension. For *morpho-syntactic analyses*, a feature *F* on a pronoun *pro* can remain uninterpreted if *pro* is bound by an element with feature *F* – a mechanism sometimes called 'deletion under agreement' (see Heim 1991, 2008, Kratzer 2009, Schlenker 1999, 2003, Stechow 2004).[7]

[7] See also Merchant 2014 for a recent discussion of the behavior of gender (and plural) features in ellipsis contexts in Modern Greek.

Be that as it may, our goal is not to adjudicate among these theories, but to suggest that similar generalizations hold for ASL locus specifications and for some properties of 'gestural verbs' in English. Thus we will remain agnostic about the correct analysis of the phenomenon at hand in most of this piece.

3 Locus 'disappearance' in ASL I: pronouns

In Schlenker 2014, 2015b and Kuhn 2015, it was argued that locus specifications of ASL (and LSF) pronouns display the same 'disappearing act' as *phi*-features in English. The argument concerned both the horizontal position of loci (which determines the identity of a locus in contradistinction to other loci), and their vertical position (which optionally specifies the height/importance/power of the locus denotation).

3.1 Main data

The main points can be made on the basis of the paradigms in (2) and (3).

(2) *Context:* Tomorrow there is a swimming competition. A French team with a giant in it competes against a German team with a dwarf in it.
[FRENCH VERY[8] HEIGHT MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON NOT.
a. [7] **IX-a** = high locus, i.e. **IX-a^{high}**
Preferred reading: bound variable
b. [7] **IX-a** = normal locus
Preferred reading: bound variable
c. [5] **IX-a** = low locus, i.e. **IX-a^{low}**
Preferred reading: bound variable
'The very tall French man likes people who support him. The short German person doesn't.' (ASL, 17, 61; Schlenker 2014)

(3) *Context:* Tomorrow there is a swimming competition. A French team with a giant in it competes against a German team with a dwarf in it.
COMPARE [FRENCH VERY HEIGHT MAN]$_a$ [GERMAN SHORT-PERSON]$_b$ ONLY HEIGHT$_a$ LIKE PEOPLE SUPPORT **IX-a**.[9]
a. [7] **IX-a** = high locus, i.e. **IX-a^{high}**
Preferred reading: bound variable
b. [7] **IX-a** = normal locus
Preferred reading: bound variable
c. [5] **IX-a** = low locus, i.e. **IX-a^{low}**
Preferred reading: bound variable
'Comparing the very tall French man and the short German person, only the tall man likes people who support him.' (ASL, 17, 71; Schlenker 2014)

3.2 Horizontal specifications

Consider first the problem of horizontal specifications illustrated in (2)b. The question is how the bound variable reading of the elided clause can be obtained. The problem is that the overt sentence obtained by copying the antecedent (boxed) VP in the elided clause would yield a strict reading. There are several potential solutions to this problem.

(i) One is to take the first object pronoun *IX-a* to be a variable bound by a lambda-operator which is copied together with the antecedent VP. This yields the representation in (4), where the elided VP is barred and where t_a represents a (covert) trace of the subject.

[8] Here and elsewhere, *VERY* is the sign which is sometimes glossed as *WOW*.
[9] All loci were signed at a neutral height, except for *IX-a* in a. and c.

(4) [FRENCH VERY HEIGHT MAN]$_a$ **λa** t_a LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON NOT ~~**λa LIKE PEOPLE SUPPORT IX-a**~~.

But a weakened version of this analysis would work as well. In the literature on VP ellipsis of the 1970's, it was not taken to be necessary for an elided VP to be *fully* identical to its antecedent. Rather, Sag 1976 (p. 105) posited that for a VP to be targeted by VP-deletion, it was enough for its Logical Form to be an 'alphabetic variant' of the antecedent VP (an 'alphabetic variant' is obtained from an expression by uniformly replacing certain letters with others, making sure that binding relations do not change in the process). On this view, the indexing relations in (5) would allow for VP deletion despite the difference of indices, because the elided VP is an alphabetic variant of the antecedent VP, obtained by replacing

(5) [FRENCH VERY HEIGHT MAN]$_a$ **λa** t_a LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON NOT ~~**λb LIKE PEOPLE SUPPORT IX-b**~~.

(ii) Another view, propounded by Kuhn 2015, is that loci just aren't variables, but rather should be likened to purely formal features inherited by agreement. On this view, the availability of the bound variable reading of (2)a shows that these features need not be 'seen' by the process that resolves VP ellipsis.

(iii) A third view, developed in Schlenker 2015b, is that loci behave like first and second person features in being sometimes interpreted (relative to an assignment function rather than relative to a context), and sometimes inherited by agreement. On this view, one may posit that the locus *a* on *IX-a* is in fact inherited through agreement from the subject *via* a lambda operator, written as $\lambda x^{\#}$ to indicate that the locus *a* is not interpreted; we correspondingly write the pronoun as *IX-*$x^{\#}$.

(6) [FRENCH VERY HEIGHT MAN]$_a$ **λ$x^{\#}$** LIKE PEOPLE SUPPORT **IX-$x^{\#}$.** IX-b GERMAN SHORT-PERSON NOT ~~**λx LIKE PEOPLE SUPPORT IX-x**~~.

Turning to (3)b, all that needs to be said is that the VP involves a lambda-operator that binds the object pronoun, as in (7)a. And it also won't hurt if one prefers to treat the locus *a* as being inherited through agreement, as sketched in (7)b.

(7) a. ONLY HEIGHT$_a$ **λa** t_a LIKE PEOPLE SUPPORT **IX-a**.
b. ONLY HEIGHT$_a$ **λ$x^{\#}$** t_x LIKE PEOPLE SUPPORT **IX-$x^{\#}$**.

3.3 Vertical specifications

The space of possibilities is narrower for the vertical specifications illustrated in (2)a and (3)a because these specifications have been taken to make an intrinsic semantic contribution, unlike horizontally distinguished loci. More precisely, they have been taken to introduce a presupposition on the values of their denotations (Schlenker et al. 2013). This means that we must ensure that these features are not interpreted, which can be done as in (8) by taking them (in either Logical Form considered in (7)) to be pronounced but not interpreted.

(8) a. ONLY HEIGHT$_{a\,high}$ **λ$a^{\sout{high}}$** t_a LIKE PEOPLE SUPPORT **IX-$a^{\sout{high}}$**.
b. ONLY HEIGHT$_{a\,high}$ **λ$x^{\#\,\sout{high}}$** t_x LIKE PEOPLE SUPPORT **IX-$x^{\#\,\sout{high}}$**.

Since our goal is just to show that the same generalizations hold of sign language agreement verbs and of some gestural verbs, for most of this discussion we will be content to show that the *same generalizations* apply to *phi*-features, to the horizontal and vertical specifications of agreement markers found on some ASL verbs, and to related specifications of some gestural verbs in English. But we will briefly revisit the choice between various possible accounts in Section 7, both for ASL pronouns and for gestural verbs with agreement markers.

4 Locus 'disappearance' in ASL II: agreement verbs

While this has (to our knowledge) not been the object of systematic investigations in the literature, the behavior of pronominally used loci can be replicated with loci that are indexed by agreement markers in ASL directional verbs. This is unsurprising because both the realization of these agreement markers (which involve loci) and their behavior with respect to crossover phenomena makes them rather similar to anaphoric expressions (see Lillo-Martin 1991 and Schlenker and Mathur 2013). Still, these data are worth discussing in some detail because they are essential to our argument that some English gestural verbs share some grammatical properties of ASL agreement verbs.

4.1 Horizontal plane

A basic example involving the object agreement of the verb *GIVE* is displayed in (9). (Unless otherwise noted, the choice of the indicative (past or future) or of the conditional in the translations is driven by the particular realization of *GIVE*; quicker motions with more abrupt endings correlate with an indicative preference; these fine-grained differences do not affect the main point.)

(9) a. [6.7] IX-2 JOHN$_a$ THE-TWO-a,2 ONLY-CL-a MONEY IX-1 1-GIVE-a
'Of John and yourself, I would give money only to him.'
b. [7] JOHN$_a$ IX-a MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT.
'John, I would give money to. You, I wouldn't.'
c. [3.5] JOHN$_a$ IX-a MONEY IX-1 1-GIVE-a. **IX-2** IX-1 NOT 1-GIVE**-a**.
d. [7] JOHN$_a$ IX-a MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT 1-GIVE-2.
'John, I would give money to. You, I wouldn't give money to.'
(ASL, 34, 1498; 4 judgments)

(9)c shows that a (boldfaced) second person objet pronoun co-occurring with a (boldfaced) non-second person agreement marker (locus *a*) yields deviance (in fact, the sentence was re-interpreted to mean, depending on the session, *you present, I will not give him money, Because of you, I won't,* or even *I will not give you to John)*. This is of course unsurprising. Of interest is the fact that the elided conjunct in (9)b does not display the same behavior as the overt second conjunct in (9)c. This suggests that the object marker of the antecedent clause can be disregarded in the course of ellipsis resolution. A similar conclusion can be drawn about the computation of focus alternatives in (9)a: while *only F* is standardly taken to have a semantics that negates some alternatives *F'* to *F*, it seems that the computation of these alternatives can somehow disregard the non-second person object agreement marker on the verb.

We note for future reference that the same behavior is obtained when the antecedent of the object locus is signed without a designated locus, in a neutral position, while the object locus appears to the right of the signer. This seems to be connected to the fact, noted in Kuhn 2015, that a neutral antecedent may license the appearance of a locus on an expression that depends on it. This observation will matter when we turn to gestural verbs in English. Note that we do not know why (10)a is somewhat degraded, a fact which will recur in (12)a.

(10) a. [5.5] IX-2 POSS-2 YOUNG BROTHER ONLY BROTHER MONEY IX-1 1-GIVE-a.
'Of your younger brother and yourself, I would give money only to your brother.'
b. [7] POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT.
'Your younger brother, I would give money to. You, I wouldn't.'
c. [4.7] POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. **IX-2** IX-1 NOT 1-GIVE**-a**.
d. [7] POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT 1-GIVE-2.
'Your younger brother, I would give money to. You, I wouldn't give money to.'
(ASL, 34, 1558; 4 judgments)

4.2 Vertical plane

Similar conclusions can be drawn about the vertical specifications of loci. (11) shows that they can be ignored under ellipsis and *only* in case both the antecedent and the agreement marker are signed high (we provide judgments for a context in which the locus *a* is used to refer to a non-deictic denotation, but

similar judgments can be obtained if the 'tall brother' is standing to the right of the signer, so that the locus is used deictically).

(11) *Context*: the addressee is very short [much shorter than the speaker] and his brother is very tall. The brother is NOT present.

a. [7] IX-2 POSS-2 [HEIGHT BROTHER]$_{a^{high}}$ THE-TWO-a^{high},2 ONLY-CL-a^{high} MONEY IX-1 1-GIVE-a^{high}.
'Of your tall brother and yourself, I would give money only to him.'

b. [7] POSS-2 [HEIGHT BROTHER]$_{a^{high}}$ IX-a^{high} MONEY IX-1 1-GIVE- a^{high}. IX-2 IX-1 NOT.
'Your tall brother, I would give money to. You, I wouldn't.'

c. [3.5] POSS-2 [HEIGHT BROTHER] $_{a^{high}}$ IX-a^{high} MONEY IX-1 1-GIVE-a^{high}. **IX-2** IX-1 NOT 1-GIVE-**a^{high}**.
'Your tall brother, I would give money to. Because of you, I won't.'

d. [7] POSS-2 [HEIGHT BROTHER] $_{a^{high}}$ IX-a^{high} MONEY IX-1 1-GIVE-a^{high}. IX-2 IX-1 NOT 1-GIVE-2.
'Your tall brother, I would give money to. You, I wouldn't give money to.'
(ASL, 34, 1504; 4 judgments)

The paradigm in (12) displays less clear results for sentences in which the locus *a* on the antecedent *[HEIGHT BROTHER]$_a$* does not involve a high locus, whereas the object agreement marker on *1-GIVE-a^{high}* does. The examples pertaining to ellipsis (i.e. (12)b,c,d) behave as expected, with more variation than usual across judgments (ranging from 3 to 5) for the 'mismatch condition in (12)c. The general pattern is expected in view of (2)a above, which showed that a high locus can have an antecedent without one if it denotes a tall person. The acceptability of the first sentence of each discourse in (12)b,c,d behaves in the same way. The second sentence of (12)b (which contrasts with (12)c) indicates that under ellipsis the height specification of the antecedent VP can be ignored. On the other hand, acceptability of the sentence with *ONLY* in (12)a was lower (and variable), for reasons we don't understand – a problem we leave for future research.

(12) *Context:* the addressee is very short [much shorter than the speaker] and his brother is very tall. The brother is not present

a. [5.2] IX-2 POSS-2 [HEIGHT BROTHER]$_a$ THE-TWO-a,2 ONLY-CL-a MONEY IX-1 1-GIVE-a^{high}.
'Of your tall brother and yourself, I will/have give(n) money only to him.' (Judgments: 5, 4, 7, 5)

b. [6] POSS-2 [HEIGHT BROTHER]$_a$ IX-a MONEY IX-1 1-GIVE-a^{high}. IX-2 IX-1 NOT.
'Your tall brother, I would give money to. You, I wouldn't.'

c. [4.5] POSS-2 [HEIGHT BROTHER]$_a$ IX-a MONEY IX-1 1-GIVE-a^{high}. BUT IX-2 IX-1 NOT 1-GIVE-a^{high}.
'Your tall brother, I would give money to. But because of you, I won't.'

d. [6.2] POSS-2 [HEIGHT BROTHER]$_a$ IX-a MONEY IX-1 1-GIVE-a^{high}. BUT IX-2 IX-1 NOT 1-GIVE-2.
'Your tall brother, I would money to. You, I wouldn't give money to.'
(ASL, 34, 1526; 4 judgments)

With respect to ellipsis, expected results can also be replicated when the locus *a* solely appears on the agreement verb, while the antecedents are signed in a neutral position, both relative to the horizontal and to the vertical plane (this is the reason our transcription does not include a locus on the antecedent). The sentence with *only* is a bit less acceptable and gave rise to variable judgments, for reasons we do not understand.[10]

[10] Two remarks should be added.
1. Our consultant noted about (13)a: "this sentence seems to be structured to use space but then it isn't used. As a result the grammar is slightly off" (he noted on another occasion that there wasn't really an English influence but that the grammar was "slightly off").
2. Note that the verb *GIVE* can also target a neutral horizontal position, which we write without a locus suffix. But when this is the case, we do not know whether it can target a high position; the judgments we have in (i)b changed over time (we give judgments for the situation in which the brother is not present, which matters for (ib); our consultant notes that his preference for a translation in the indicative seems to be due to the high locus rather than to other aspects of the realization of *GIVE*). Note that the control sentence in (i)c is to some extent acceptable, but with an irrelevant reading, on which the object of *GIVE* is the addressee.

(13) *Context:* the addressee is very short [much shorter than the speaker] and his brother is very tall. The brother is not present
a. [5] IX-2 POSS-2 HEIGHT BROTHER ONLY BROTHER MONEY IX-1 1-GIVE-a^{high}.
'Of your tall brother and yourself, I will/have give(n) money only to your brother.' (Judgments: 6, 6, 5, 3)
b. [7] POSS-2 HEIGHT BROTHER MONEY IX-1 1-GIVE-a^{high}. IX-2 IX-1 NOT.
'Your tall brother, I would give money to. You, I wouldn't.'
c. [4.5] POSS-2 HEIGHT BROTHER MONEY IX-1 1-GIVE- a^{high}. **IX-2** IX-1 NOT 1-GIVE-a^{high}.
'Your tall brother, I would give money to. Because of you, I won't.'
d. [7] POSS-2 HEIGHT BROTHER MONEY IX-1 1-GIVE-a^{high}. IX-2 IX-1 NOT 1-GIVE-2.
'Your tall brother, I would give money to. You, I wouldn't give money to.'
(ASL, 34, 1530; 4 judgments)

In sum, given the right context, the horizontal and vertical specifications of ASL agreement verbs can be ignored under ellipsis and (for the most part) *only*. This behavior holds when the agreement markers have an NP antecedent with the same specifications, but also when the antecedent is neutral or doesn't introduce a locus at all (at least for the data concerning ellipsis; some of our limited data involving *only* are a bit degraded in situations in which the antecedent is less specified than the agreement features its controls).

5 Locus 'disappearance' with gestural verbs

We will now argue that some gestural verbs in spoken language can display something like object agreement markers, and that these too can be disregarded under ellipsis and *only*. Since the antecedents of these object agreement markers is non-gestural, these examples are particularly similar to sign language examples (discussed in (10)) in which the antecedents were signed in neutral position, without introducing a distinct locus. As mentioned, we do not claim that such gestural verbs are at all common, which makes it all the more striking that naive (non-signing) subjects have intuitions about them. (When we report introspective judgments, they include those of non-signers, and the main findings are experimentally confirmed with naive, non-signing subjects in Section 6).

5.1 Co-speech vs. pro-speech gestures

Much attention has been devoted to co-speech gestures, i.e. gestures that co-occur with spoken expressions they modify (see Schlenker, 2016b for a formal study of their semantic properties, and Ebert and Ebert 2014 for an alternative view). But they are part of a broader typology, which is only starting to be investigated. Schlenker 2016c argues for a tripartition that distinguishes co-speech gestures from post-speech gestures, which occur after the expressions they modify, and pro-speech gestures, which replace spoken words. Thus in all the sentences in (14), the addition of the gesture triggers the inference that the punishment was an objectionable action, involving a physical component. But in (14)a the gesture co-occurs with *punish* (boldfaced), in (14)b it follows the entire sentence, and in (14)c it fully replaces the verb.

Notation: A co-speech gesture is represented *before* the expression it modifies, and this expression is boldfaced. A post-speech gestures is represented after the expression it modifies, and is separated from it by a dash (–) to represent a pause. A pro-speech gesture appears in lieu of a word.

(i) POSS-2 HEIGHT BROTHER MONEY IX-1
a. [6] 1-GIVE 'Your tall brother, I would give money to.'
b. [5.5] 1-GIVE-high 'Your tall brother, I will/have give(n) money to.' (Judgments: 4, 6, 7, 5 [the last one on the assumption that the tall brother is not present])
c. [5.7] 1-GIVE-2 'Concerning your tall brother, the money, I give you.' (i.e. the money pertaining to your brother, I give you). (Judgments: 6, 6, 7, 4)
(ASL, 34, 1574; 4 judgments)

[11] An exception pertains to the object position of the expression *be like*, as in (i), from Davidson 2015. In this case, the object position is occupied by a gesture, not a word.

(14) a. Co-speech gesture: John will  **[punish]** his son.

b. Post-speech gesture: John will punish his son –  .

c. Pro-speech gesture: His son, John will  .

Schlenker 2016c proposes that pro-speech gestures make at-issue contributions (with some presuppositions added in some cases, as we will see), that post-speech gestures contribute 'supplements' in the same way as appositive relative clauses, and that co-speech gestures introduce presuppositions of a special sort; examples are given in (15). Arguments for these conclusions involve the interaction between gestures and logical operators, and require complex examples that we cannot go into here. (There are alternative accounts as well – in particular, Ebert and Ebert 2014 argue that *co-speech* gestures rather than post-speech gestures should be compared to supplements.)

(15) a. Possible analysis of (14)a
At-issue contribution: John will punish his son
Presupposition: If John punishes his son, slapping will be involved

b. Possible analysis of (14)b
At-issue contribution: John will punish his son
Supplementary contribution: This would involve some slapping.
≈ John will punish his son, which will involve slapping him.

c. Possible analysis of (14)c
At-issue contribution: John will slap his son

In this piece, we will not focus on co-speech but rather on pro-speech gestures, which have not been the object of many studies[11] . The reason for our choice is that independently from the issue of object agreement, co-speech gestures can be disregarded *in toto* under ellipsis, as argued in Schlenker 20015a.[12] For instance, in (16)a the VP *take off* is accompanied with co-speech gesture that we gloss as *TAKE-OFF-ROTATING*, which involves a rotating motion; the second conjunct doesn't give rise to the inference that the plane will take off by way of a rotating motion, which suggests that the co-speech gesture can be ignored in the second conjunct. By contrast, (16)b involves the same gesture, but now used as a gestural verb (the gesture may preferentially be accompanied with an onomatopoeia, possibly because this makes the iconic representation richer and more accurate[13]). And in this case it is clear that

[11] An exception pertains to the object position of the expression *be like*, as in (i), from Davidson 2015. In this case, the object position is occupied by a gesture, not a word.

(i) Bob was eating like [gobbling gesture].

While the gesture in (i) could be replaced with the word *this*, for the sentence to be acceptable with a comparable meaning, *this* would have to refer to an imitation. By contrast, the pro-speech gestures studied in this piece need not be introduced by a special construction, and they can be replaced with verbs that refer to normal actions.

Davidson 2015 also discusses a sign language construction, Action Role Shift, which has been analyzed as necessarily including an iconic component (Schlenker, to appear) or a gestural component (for Davidson, who takes some signs to make demonstrative reference to their own gestural form). In neither analysis are these pro-speech or pro-sign gestures: they are full-fledged words that are iconically or gesturally modulated.

[12] This issue is also investigated in work in progress by Jon Gajewski.

[13] The onomatopoeia might also help justify the absence of a spoken word. But this doesn't seem to be the whole story, since 'post-speech' gestures, which come after the words they modify, also seem conducive to onomatopoeias, as in (i), where – should be taken to stand for a short pause:

the specific semantic contribution of the gestural verb cannot be ignored in the course of ellipsis resolution, at least if the rotating motion is sufficiently large and salient (this particular observation is confirmed with experimental means in Section 6). This explains the deviance of (16)b, as it suggests that the plane will take off by way of a rotating motion.

(16) a. This helicopter will soon  , **[take off]**, and this plane will too.

b. #This helicopter will soon TAKE-OFF-ROTATING_  ., and this plane will too.

In sum, a gestural verb differs from co-speech gestures in that it is obligatorily preserved under ellipsis – unsurprisingly, since otherwise no predicate at all would be reconstructed in the second clause.

It might be less clear whether similar contrasts hold for examples involving *only*. Let us focus on examples in which the rotating motion is made large and clear. First, a co-speech gesture may certainly be ignored in the 'focus dimension' under *only*, as in (17)a, which can felicitously deny that the plane will take off (it would be uninformative or infelicitous for *only* to negate an alternative which asserts that the plane will take off by way of a rotating motion, or which presupposes that the take off would involve such a motion). What is not entirely clear to us at this point is whether the rotating component of the gestural verb in (17)b can also be so ignored. In other words, the question is whether we obtain a trivial reading on which the plane will not move upwards by way of a rotating movement, or whether we get an informative reading on which the plane won't take off.[14] We leave this empirical question for future research.

(i) This helicopter will soon take off –  .

See Schlenker 2016a for examples, involving a gesture of dozing off, which might not need to be accompanied by onomatopoeia.

[14] Two remarks should be added.

1. The projection of presuppositions should make itself felt in (16)b. First, *TAKE-OFF-ROTATING* triggers a presupposition that its argument is on the ground – which is unproblematic in the present context. Second, and more tentatively, in connection with (34) below we propose that *TAKE-OFF-ROTATING* triggers a presupposition that its argument is helicopter-like in involving a rotating motion. Now it has been argued (again tentatively) that a sentence of the form *[only DP] F* gives rise to the inference that alternatives to *DP* satisfy the presuppositions of *F* (e.g. Schlenker 2009). On this assumption, we predict for (17)b a presupposition that the plane is the kind of object that could move upwards by way of a rotating motion. Local accommodation of this presupposition would be needed to avoid infelicity in the case at hand. When local accommodation is applied, the result should be trivially true, since we will get a meaning akin to: *Only this helicopter will take off by way of a rotating motion*.

2. An informant tells us that "if the gesture is faster and the circular motion is smaller", he is more likely to obtain a reading on which it is denied (informatively) that the plane will take off; in other words, in this case the manner of motion seems to be ignored. By contrast, "if the gesture is slower and the circular motion is larger", he gets an uninformative reading on which the plane won't take off by way of a rotating movement. It would be interesting to test whether this correlates with the at-issue vs. not-at-issue nature of the contribution (see Potts et al. 2009 for related remarks pertaining to the 'disappearance' of expressive – and thus not-at-issue – material under ellipsis). The difficulty is twofold, however. First, we would have to explain why in this case *only* in (17)b seems to be more permissive than ellipsis resolution in (16)b. Second, it does not seem to be the case that *all* presuppositions can be ignored in the 'focus dimension' under *only* – for if this were the case, one would not get a presupposition that the plane is on the ground.

Let us add that an anonymous referee mentions that s/he shares the general judgments in (16)-(17), but that the two paradigms don't seem to differ in terms of whether the presupposition can be ignored. To the referee, (16)b becomes better "when the gesture is not that salient (and performed faster and smaller)", which mirrors our informant's observation about (17)b.

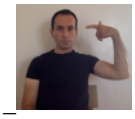
(17) a. [Talking about a helicopter and a plane]

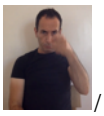
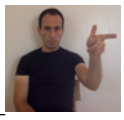
Only this helicopter will  **[take off]**.
=> the plane will not take off (with no implication that it would do so by way of a rotating motion)

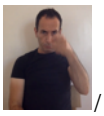
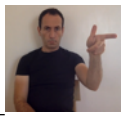
b. [Talking about a helicopter and a plane]
? Only this helicopter will TAKE-OFF-ROTATING_ 
=>?? the plane will not take off by way of a rotating motion?

5.2 Object agreement with gestural verbs: person

Turning to gestural verbs, we start with the observation that some of them can be modulated in ways that are reminiscent of object marking in sign language directional verbs. We shall use constructions in which the gestural predicate comes clause-finally, as acceptability seems to be ameliorated in this position. An example involves the gestural verb *SHOOT* in (18).

(18) a. I am going to SHOOT-1_  .[16]
'I am going to shoot myself.'

b. You, I am going to SHOOT(-2)_  / ?? SHOOT-a_  .
'I am going to shoot you.'

c. John, I am going to SHOOT(-2)_  / SHOOT-a_  .
'I am going to shoot John.'

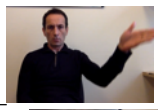
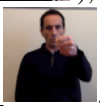
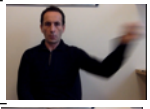
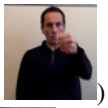
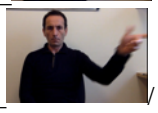
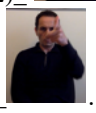
The first person, reflexive version in (18)a (without an overt reflexive pronoun!) is acceptable and unambiguous. In (18)b, the topicalized second person object pronoun forces the use of a 'shooting' gesture that targets the addressee; a shooting gesture sideways looks odd (some speakers might get a non-standard meaning, such as 'shooting from the side'). In (18)c, the gestural verb can target a position, glossed as *a*, which is neither that of the speaker nor of the addressee. While one could be tempted to gloss *SHOOT-a* as *SHOOT-IN-THIS-DIRECTION* or *SHOOT-FROM-THE-SIDE*, this would not do justice to the meaning of the gesture. Two cases should be compared. To the extent that *SHOOT-a* is acceptable in (18)b, it *does* yield this iconic inference, whereby the shooting action is understood to be towards the side. But as far as we can tell the third person example does *not* trigger such an inference, which motivates our analysis of *SHOOT-a* as involving a locus-like element. Still, due to the spoken modality, the antecedents of the object agreement markers in (18)b,c do not introduce loci, and thus these examples are particularly similar to the ASL cases discussed in (10).

A complication is that (something like) the second person form of the gestural verb can also serve as a neutral version of the verb (several sign language directional verbs also have a neutral version, as we noted in connection with *GIVE*). Thus we gloss this gesture as *SHOOT(-2),* adding a

[16] We believe *SHOOT-1* can also be used with a non-reflexive meaning, as in *John threatened to SHOOT-1*. But we are not sure whether the most natural realization has the gun gesture starting from the side or from a more central position. An informant can obtain this non-reflexive meaning with the gestural 'gun' coming from the side, but he is even more inclined to a non-reflexive interpretation when the gestural 'gun' is pointed from the front instead of from the side. (Importantly, for him *SHOOT-1* cannot be used as a neutral form appropriate for all objects irrespective of person.)

parenthesis around the second person marker in order to indicate that a version of the gesture can be used as unmarked, as in (18)c. There might well be fine-grained differences between the 'neutral' and second person versions of these gestural verbs, but we do not wish to rely on these subtleties in what follows – nor will we need to.

Possibly for pragmatic reasons, *SLAP* and *PUNCH* might be less natural with a first person object marker (see fn. 16 for *SHOOT-1*), but they too allow for some directional modulations, as seen in (19). In this case as well, something like the second person version seems to do double duty as a neutral form. In order to have a point of comparison for sentences involving ellipsis, we consider cases in which two clauses with gestural verbs are conjoined.

(19) a. Your brother, I am going to SLAP-a_  (/ SLAP(-2)_ ),
and then you, I am going to ??PUNCH-a_  / PUNCH(-2)_  .
b. Your brother, I am going to PUNCH-a_  (/ PUNCH(-2)_ ),
and then you, I am going to ??SHOOT-a_  / SHOOT(-2)_  .

Now the crucial observation is that when the gestural predicate occurs (with a bound variable) under ellipsis-like constructions and in the scope of *only*, third person locus specifications can be ignored. We talk of 'ellipsis-like constructions' because we will discuss both VP-ellipsis in the strict sense, as in (20)b, and the construction in (20)a, called 'stripping', which for our purposes displays the same properties but has the advantage of being less wordy. We will henceforth use the term 'ellipsis' in a broad sense, to include stripping constructions.

(20) Your brother, I am going to PUNCH-a / SLAP-a / SHOOT-a, and then
a. ['stripping'] you, too.
b. [VP-ellipsis] you, I will as well.

(21) ['Only'] Your brother and you both betrayed me, but it's only your brother that I am going to PUNCH-a / SLAP-a / SHOOT-a.

5.3 Object agreement with gestural verbs: height

The same generalizations hold when the 'locus' specifications of the gestural verb involve a vertical component, corresponding to the height of the argument denotations.[17] Note that we henceforth omit pictures; *high* versions of the gestures can be deduced from the earlier versions, realized at neutral height. For instance, *SLAP(-2)* targeting a neutral height as in (22)a can be transformed into *SLAP(-2)*^{high} by targeting a higher position, as is illustrated in (22)b.

(22) a. SLAP(2-)_ 
b. SLAP(-2)^{high} _  ,

The paradigm in (23) establishes that there are indeed semantic constraints on the use of high loci with gestural verbs: a high object agreement marker can be used if the corresponding argument

[17] This point was independently noticed by Amir Anvari (p.c).

denotes a tall person, but not if it denotes a short person. (We leave open whether neutral height can be used in all cases or only for arguments of intermediate height.)

(23) *Context:* The speaker is of normal height, and is talking to a very short person, whose brother is very tall.
a. Your giant brother, I am going to SLAP-a^{high}/ SLAP(-2)^{high}, and then you, I am going to ??PUNCH(-2)^{high} / PUNCH(-2)^{low}.
b. Your giant brother, I am going to PUNCH-a^{high} / PUNCH(-2)^{high}, and then you, I am going to ??SLAP(-2)^{high} / SLAP(-2)^{low}.
c. Your giant brother, I am going to PUNCH-a^{high} / PUNCH(-2)^{high}, and then you, I am going to ??SHOOT(-2)^{high} / SHOOT(-2)^{low}.

Now the paradigms in (24) and (25) suggests that these specifications can be ignored under ellipsis and under *only*.

(24) *Context:* The speaker is of normal height, and is talking to a very short person, whose brother is very tall.
Your giant brother, I am going to PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high} / SHOOT-a^{high} / SHOOT(-2)^{high}, and then
a. ['stripping'] you, too.
b. [VP-ellipsis] you, I will as well.

(25) *Context:* The speaker is of normal height, and is talking to a very short person, whose brother is very tall.
['only'] Your giant brother and you both betrayed me, but it's only him / your brother that I am going to PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high} / SHOOT-a^{high} / SHOOT(-2)^{high}.

Rather unsurprisingly, the gestural verbs with high loci trigger a presupposition that their object argument is tall, or positioned higher than the speaker. This is suggested by the fact that the height/positional inference triggered in (26) is projected in universal form under *none*-type quantifiers as in (27)a,b, which is a hallmark of presuppositional behavior (as shown with experimental means in Chemla 2009; (27)c is more complex to analyze because it involves presupposition projection under a Negative Polarity Item). Thus both their semantics and their behavior under ellipsis and *only* is reminiscent of ASL loci (and also of *phi*-features in English[18]).

(26) Your teammates, I am going to PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high}.
=> the addressee's teammates are taller than (or positioned above) the speaker

(27) a. Your teammates, I will never PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high}.
=> each of the the addressee's teammates is taller than (or positioned above) the speaker
b. None of your teammates will I ever PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high}.
=> each (or a significant majority) of the the addressee's teammates is taller than (or positioned above) the speaker
c. There isn't a single one of your teammates that I will PUNCH-a^{high} / PUNCH(-2)^{high} / SLAP-a^{high} / SLAP(-2)^{high}.
=> each (or a significant majority) of the the addressee's teammates is taller than (or positioned above) the speaker

5.4 Can all presuppositions be ignored in this way?

As mentioned at the outset, there are syntactic and semantic analyses of the 'disappearing act' of features (and locus specifications) under ellipsis and *only*. Since gender and possibly person features have a presuppositional semantics, one might be tempted to argue that it is the *presuppositional* nature of these contributions that allows them to be ignored. This might be so, but it is essential to add something else to constrain the theory, because some presuppositions cannot not be ignored in this way, as can be seen in (28)-(29).

[18] The behavior of English *phi*-features under ellipsis and *only* was discussed in Section 2. In addition, some or all of these *phi*-features are often given a presuppositional treatment, although this is the subject of current debates. See for instance Cooper 1983, Schlenker 2003, Heim 2008, Sauerland 2008 and Sudo 2013 for discussion.

(28) a. John takes care of his computer but Bill doesn't.
=> Bill has a computer.
b. (Talking about John and Bill)
Only John takes care of his computer
=> Bill has a computer

(29) a. As of last week, John continued to smoke, but Mary didn't.
=> As of last week, Mary used to smoke
b. Of my two siblings, only John continues to smoke.
=> my other sibling used to smoke

In fact, some presuppositions generated by gestural verbs display the same behavior and cannot be disregarded under ellipsis and *only* (we leave it open how these presuppositions are triggered in the first place; see Schlenker 2016a for discussion). Thus the inference seen in (30) projects out of the antecedent of a conditional in (31), and it triggers a universal inference when it appears under *none* in (32) – two hallmarks of presupposition projection. As is shown by (33), this particular presupposition cannot be disregarded under ellipsis.[19]

(30) Within a few minutes, the helicopter we took yesterday might TAKE-OFF-ROTATING_  .
=> the helicopter we took yesterday is currently on the ground

(31) If in a few minutes the helicopter we took yesterday were to TAKE-OFF-ROTATING_  , I'd be surprised.
=> the helicopter we took yesterday is currently on the ground

(32) None of your five helicopters will TAKE-OFF-ROTATING_  .
=> each of your five helicopters is on the ground

(33) The helicopter in front of us will soon TAKE-OFF-ROTATING_  , but the helicopter we took yesterday won't.
=> the helicopter we took yesterday is currently on the ground

It is also noteworthy that *TAKE-OFF-ROTATING* arguably triggers another presupposition, to the effect that the subject denotes the kind of thing that can take off in a rotating fashion. In particular, we can see that this inference 'projects' when the gestural verb appears in a question or in the scope of *never* or *none*. (This presupposition will turn out to be useful for the experimental investigation discussed in Section 6.)

(34) a. Will this thing ever TAKE-OFF-ROTATING_  ?
=> this thing is helicopter-like in taking off by way of a rotating motion

[19] An anonymous reviewer correctly notes that it would be interesting to test how ASL behaves with respect to presuppositional verbs that are comparable to *TAKE-OFF-ROTATING*, but this is a question we have to leave for future research.

b. This thing will never TAKE-OFF-ROTATING _  .
=> this thing is helicopter-like in taking off by way of a rotating motion

c. None of these things will ever TAKE-OFF-ROTATING_  .
=> each of these things is helicopter-like in taking off by way of a rotating motion

These facts suggest that even on semantic theories of the 'disappearing act' of some elements under ellipsis and *only*, provisions must be made to *distinguish phi*-features from other, non-grammatical elements with a presuppositional semantics. In this respect, agreement markers on gestural verbs resemble ASL loci and English *phi*-features more than they do non-grammatical presupposition triggers of the sort illustrated in (30).

6 Experimental approach: person

The foregoing remarks are based on introspective judgments, which are widely and successfully employed in linguistics, and have been the subject of rich methodological and experimental discussions (Sprouse and Almeida 2012). But introspective methods applied to pro-speech gestures are mostly new, and thus it is important to develop a systematic procedure to validate some of the judgments we discussed above. In this section, we report on an experiment conducted online to confirm some of the crucial judgments pertaining to object person agreement with gestural verbs in English. For reasons we explain below, follow-up studies would be needed, but this initial study still confirms that (some of) the judgments reported in this piece are not too far off the mark. Further experimental details can be found in the Appendix.

6.1 Goals

We sought to show three things:
(i) that third person object marking on gestural verbs is degraded when the object refers to the addressee;
(ii) but that third person agreement markers can be disregarded in the course of ellipsis resolution, investigated here by way of 'stripping' constructions;
(iii) and that, by contrast, some other properties of pro-speech gestures *cannot* be disregarded in the course of ellipsis resolution.
By design, this experiment says nothing about the vertical (height) specifications of agreement markers on gestural verbs.

6.2 Methods and materials

The method was developed and refined through a series of failed pilots discussed in the Appendix. The main experiment consisted in acceptability judgments, complemented in some cases with semantic questions to check that the 'stripping' construction was understood in the expected fashion. The raw data in csv format as well as an R script (see R Core Team 2016) for drawing the graphs and performing the main analyses presented in the text can be found at this address: https://osf.io/76kyu/

6.2.1 Procedure

Participants were directed from Amazon Mechanical Turk to an online experiment hosted by Qualtrics. After filling out a consent form they received instructions, then completed acceptability and comprehension questions pertaining to videos recorded by a native speaker of American English, anonymized screenshots of which are shown in Section 6.2.3. After completing the experiment, participants filled in a questionnaire (including demographic questions about participants' age, gender,

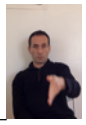
native language, and exposure to sign language). The final step was to validate their participation on Mechanical Turk.

6.2.2 Instructions

Instructions told subjects to assess how well some gestures fit with the meaning of sentences they appeared in, asking them to "imagine that the sentences are uttered by a speaker who wishes to be particularly expressive". The instructions emphasized that the subjects should focus on the shape and direction of the movement (this was essential, as explained in the Appendix):

In this survey, you will be shown videos of spoken sentences that include gestures (...). You will be asked how well the gestures fit with the meaning of the sentence (with 0 = worst and 10 = best). As you answer, **you should pay close attention to the shape of the gesture and to the direction of the movement.** In some cases, you will also be asked how you understood these sentences.

Three illustrative videos followed (recorded by one of the authors), with three different versions of the sentence in (35), involving the gesture *SLAP* in second person/neutral form, with an upward, downward or intermediate height movement. The goal was to get subjects to focus on issues of directionality without 'giving away' the second vs. third person distinction, which is why we used gestures with height rather than with person specifications. It is also noteworthy that we resorted to a 'default' use of a slapping gesture directed towards the addressee, interpreted as involving a third person object. Thus if anything, the instructions biased the subjects towards taking unmarked, “second person” forms to be normal for third person object markers.

(35) Your giant brother, I am going to SLAP(-2)^{high}_  / SLAP(-2)^{low}_  / SLAP(-2)^{middle}_ 

We made it clear that the first example might give rise to a high rating, that the second example might give rise to a low rating, and that judgments might be less clear and could vary across individuals for the third example. It was further explained that some videos involved two gestures, and that in such cases the questions would clearly indicate whether they pertained to the first gesture, or to the second, or whether they were general questions about the gestures (in the plural) that appeared in the relevant sentence. Finally, subjects were asked to use the scale so as to tease apart differences that they might find among videos that appeared on the same page, and they were warned that some videos might recur with modified questions.

6.2.3 Material and conditions

Material was made of videos recorded by a native speaker of American English following model videos recorded by one of the authors. Our model has extensive second language experience with American Sign Language and French Sign Languages; this does not interfere with our goals since, as stated at the outset, we only wished to study the perception of the relevant gestures, not their production. All videos were made of sentences with two parts. The first part always contained a gestural verb, matching with the content of the statement in that part of the sentence. The second part either contained another gesture, or an elided VP whose antecedent was the gestural verb. This second gesture, whether explicit or elided, could then either match or mismatch with the statement in that second part of the sentence. There were therefore in principle 2 (gesture or ellipsis) times 2 (match or mismatch) possible conditions.

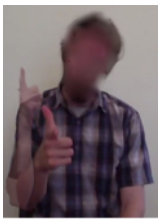
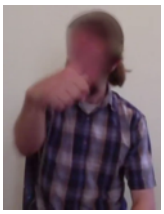
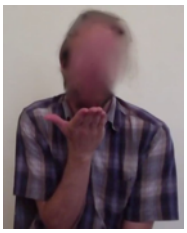
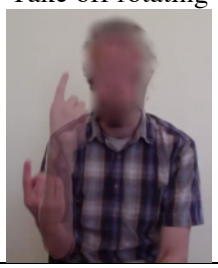
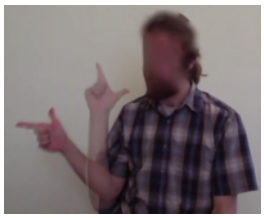
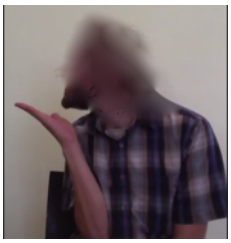
In the target conditions, the match/mismatch manipulation was used to test the effect of person marking, either under ellipsis (Ellipsis-Mismatch condition) or explicitly (Gesture-Mismatch condition). For a given gesture, when this was possible (with *SHOOT* and *PUNCH*) the model sought to vary only the target locus of the movement, and thus his eye gaze remained towards the camera; this was not possible in the *SEND-KISSES* condition because in the third person condition the model's face had to be turned towards the third person locus. Below we comment on aggregated results, but we note that we did not observe any qualitative difference across the different items.

We obtained the set of conditions described in the table in (36). The Ellipsis-Match was absent from the paradigm because, given the general set up, this would have required the introduction of a second third person locus – a possibility that has not been verified yet. The actual examples are transcribed in (38)-(40), with relevant gestures given in (37).

(36) Set of conditions in the target (person marking) conditions.

		First part of the sentence		Second part of the sentence		Examples		
		Statement	Gesture	Statement	Gesture	SHOOT	PUNCH	SEND-KISSES
Gesture	Match	3rd	3rd	2nd	2nd	(38)a	(39)a	(40)a
Gesture	Mismatch	3rd	3rd	2nd	3rd	(38)b	(39)b	(40)b
Ellipsis	Mismatch	3rd	3rd	2nd	Ellipsis	(38)c	(39)c	(40)c

(37) Screenshots of the gestures used in the target and control conditions, with two images displayed on top of each other when relevant to suggest motion

Target conditions (person marking)			Control conditions
SHOOT-2 	PUNCH-2 	KISS-2 	Take off rotating 
SHOOT-3 	PUNCH-3 	KISS-3 	Take off plane 

(38) SHOOT
a. Your brother, I am gonna PUNCH-3, then you, I am gonna SHOOT-2.
b. Your brother, I am gonna PUNCH-3, then you, I am gonna SHOOT-3.
c. Your brother, I am gonna SHOOT-3, then you, too.

(39) PUNCH
a. Your brother, I am gonna SLAP-3, then you, I am gonna PUNCH-2.
b. Your brother, I am gonna SLAP-3, then you, I am gonna PUNCH-3.
c. Your brother, I am gonna PUNCH-3, then you, too.

(40) SEND-KISSES
a. Your brother, I am gonna PUNCH-3, then you, I am gonna SEND-KISSES-2.
b. Your brother, I am gonna PUNCH-3, then you, I am gonna SEND-KISSES-3.
c. Your brother, I am gonna SEND-KISSES-3, then you, too.

Control conditions were also included to test whether non-agreement-related properties of gestures can be ignored in the course of ellipsis resolution. These conditions are described in (41). Screenshots of the relevant gestures can be found in the last column of the table in (37). The Gesture-Mismatch condition was not included, because it seemed that this would have been a very obvious violation and that the outcome would be self-evident if the Ellipsis-Mismatch condition was already rather unacceptable.

Getting into the details, on all theories, the ellipsis in (42)a should be acceptable. If gestures (with the possible exception of agreement markers) cannot be ignored in the course of ellipsis resolution, (42)b should be degraded (whereas (42)c should be fine). If there is great freedom in ignoring part of the meaning of a gesture in the course of ellipsis resolution – for instance its presuppositional contributions – one might expect (42)b to be acceptable.

(41) Set of conditions in the control (non-agreement related) conditions

		First part of the sentence		Second part of the sentence		Examples
		Statement	Gesture	Statement	Gesture	HELICOP/PLANE
Ellipsis	Match	*Helicopter*	*Helicopter*	*Helicopter*	Ellipsis	(42)a
Ellipsis	Mismatch	*Helicopter*	*Helicopter*	*Plane*	Ellipsis	(42)b
Gesture	Match	*Helicopter*	*Helicopter*	*Plane*	*Plane*	(42)c

(42) HELICOPTER
a. This helicopter is gonna **TAKE-OFF-ROTATING**, and that helicopter too.
b. This helicopter is gonna **TAKE-OFF-ROTATING**, and that plane too.
c. This helicopter is gonna **TAKE-OFF-ROTATING**, and that plane is gonna **TAKE-OFF**.

6.2.4 Task and presentation

Participants went through a series of webpages. Each page contained three videos corresponding to the three conditions within a given paradigm (38), (39), (40), or (42) (see Sprouse & Almeida, submitted and Marty et al., in progress for arguments showing the benefit of a joint presentation of minimal pairs or minimal paradigms for acceptability judgments). On a given page, the order of presentation of the conditions remain fixed, and was as in (38) for sentences testing *SHOOT,* as in (39) for sentences testing *PUNCH* and as in (40) for sentences testing *SEND-KISSES*. For each video, participants were asked the following questions.

Acceptability questions. Participants were asked to rate how well the gestures fit with the meaning of the sentence on a scale from 0 to 10. The experiment actually came in two versions with respect to these ratings:

• In the 'local' version, each video came with as many acceptability questions as there were gestures: question (43)a if there was a single gesture, questions (43)b and (43)c if there were two gestures. This made it possible to assess separately first vs. second person gestures in various positions, which was important to determine whether both were acceptable to the same degree.

(43) a. How well does the gesture fit with the meaning of the sentence (0 = worst; 10 = best)?
b. How well does the **1st** gesture fit the meaning of the sentence (0 = worst; 10 = best)?
c. How well does the **2nd** gesture fit with the meaning of the sentence (0 = worst; 10 = best)?
d. How well do the gestures fit with the meaning of the sentence (0 = worst; 10 = best)?

• In the 'global' version, there was a single question per video involving a plural (*the gestures*) referring to whatever gestures appeared in a sentence, as in (43)d. Such global judgments make it straightforward to compare the ellipsis condition in (38)c, where a single gesture is interpreted twice, to the controls in (38)a-b, where different gestures appear.

All participants went through the 'local' and the 'global' versions of the experiments, albeit either as a first block or as a second block. They thus saw all paradigms twice.

Ellipsis resolution questions. In the target agreement paradigm, the ellipsis condition was associated with an additional question to assess how they had resolved the ellipsis. For instance for (38)c, after the acceptability question, they were asked to choose a meaning between "*and then you, I will shoot too* (= the speaker will shoot the addressee)", the reading we expected; or "*and then you will shoot your*

brother too (= the addressee will shoot the addressee's brother)" – a reading we didn't expect but wanted to control for.

6.2.5 Participants and preprocessing

63 participants were recruited on Mechanical Turk, in exchange for a $1.00 payment. 61 of them completed the task.

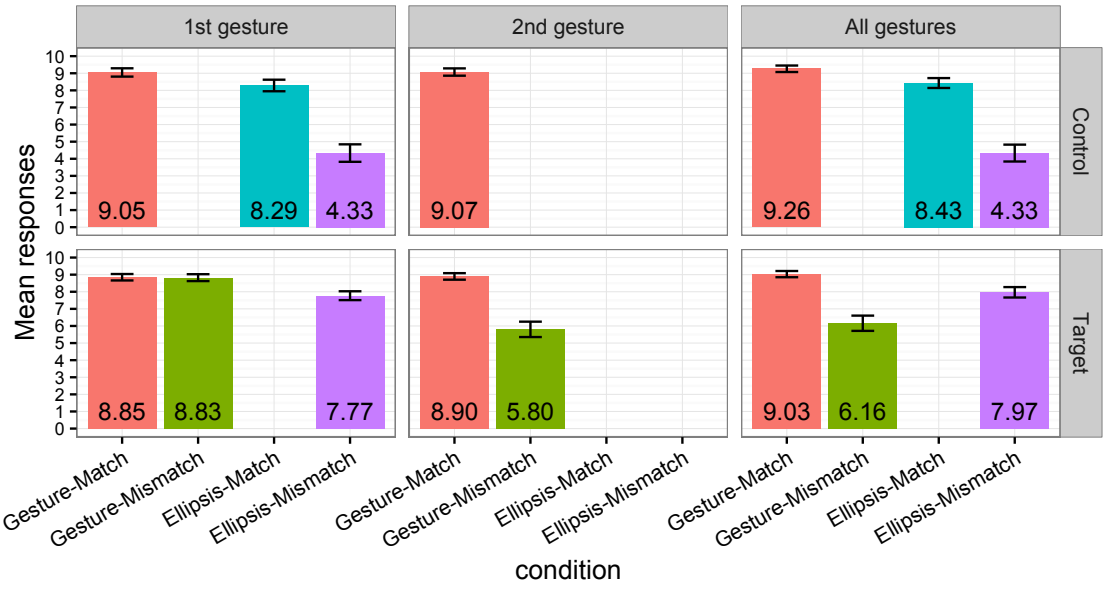
2 participants did not report English as their native language, and another 12 did not report an entirely null experience with sign language; the responses from these 14 participants were excluded from the analysis. Participants were asked a question about how they resolved the ellipsis (see above). In 12 cases out of 282, the answer was not appropriate. We disregarded the responses from the 5 participants who concentrated these answers.

With these very stringent inclusion criteria, the final group (n=42) included 29 males and 13 females, their age ranged from 21 to 60 years (mean: 33, disregarding an erroneous answer reporting age 1 yo). All of these participants correctly answered a question intended to check their level of attention ("What year was it two years ago?").

6.3 Main results and discussion

The graphs in (44) present the average responses across the different conditions. Most importantly, one can look at the "All gestures" panel and note that within the target conditions, the Ellipsis-Mismatch condition is not as degraded as the Gesture-Mismatch condition. This suggests that a mismatch in person marking yields a violation when it is overt, but is alleviated when it is under ellipsis. Below we provide a step-by-step and more detailed analysis of these results. For all statistical analyses, we report per subject parametric tests, i.e. standard anovas on the results aggregated over items. No item analysis would have been meaningful given the low number of items, but we note that we did not observe important differences across items (as announced above already, in particular in connection to the difference in terms of eye gaze orientation in the *KISS* item). Even though the parametric assumptions were not met, the number of participants and robustness of the reported effects justify that we not go into other types of analyses. Non-parametric analyses would have been more complicated (in particular to compute critical interactions) and we thus used parametric tests, relying on existing arguments and simulations showing that such tests are appropriate for Likert-scale data (see Norman, 2010, Gibson, Piantadosi and Fedorenko, 2011 and Kizach, 2014).

(44) Average results in all conditions. Error bars represent standard error to the mean after averaging across participants.



Let us discuss the main results in greater detail.

Result 0: As discussed in the list of exclusion criteria, the elided clause was mostly interpreted as intended (95% of the time).

Result 1: From the '1local' version of the experiment (whose results are shown in (44) in the '1st gesture' and the '2nd gesture' panels) one can see that both second and third person gestures were found to be highly acceptable in the conditions in which no clash is expected (this includes the Gesture-Match condition for the 2nd gesture, as well as all the Gesture conditions for the judgments restricted to the 1st gesture). No difference was found across second and third person gestures (e.g., the difference in rating between 1st gesture and 2nd gesture judgments in the Gesture-Match condition is not significant: $F(1,41)=.094$, $p=.76$), and similarly the control helicopter/plane gestures are equally acceptable (still comparing the 1st and 2nd gesture judgments in the Gesture-Match condition, but now in the control condition, we obtain: $F(1,41)=.032$, $p=.86$). This weakly validates the stimuli and the methodology in suggesting that verbal predicates were well tolerated (we write 'weakly validates' because *all* sentences involved gestures, hence subjects would naturally have given high ratings to the best of them, especially since they were explicitly asked to "use the full extent of the scale so as to reflect the intuitive differences you find among these gestures").

Result 2: In the target condition, focusing on the 'global' judgments of the sentences ("All gestures"), the mismatch-gesture condition was judged significantly lower than the match-gesture condition: $F(1,41)=42.6$, $p<10^{-7}$. This shows that there is a distinction between second and third person marking in gestural verbs with object marking.[20]

Result 3: The mismatch-ellipsis condition was more acceptable than the mismatch-gesture condition ($F(1,41)=16.0$, $p=.00026$). This suggests that third person agreement marker can *to some extent* be ignored in the course of ellipsis resolution.

Result 4: However, the mismatch-ellipsis condition was still a bit degraded relative to the match-gesture condition ($F(1,41)=15.2$, $p=.00035$). Several potential explanations could come to mind.

(i) One could think that third person agreement is less natural than second person agreement (either because it is intrinsically less acceptable, or because in two of our three classes of the model looked towards the camera while orienting the gesture in a different direction). Our results do not bear this out, as discussed above under Result 1.

[20] As mentioned at the outset, our results do not tell us whether the distinction is a broader one among an arbitrary number of loci, as is the case in ASL, or solely pertains to second vs. third person *per se*.

(ii) The ellipsis construction might be a bit degraded, and despite the fact that subjects were not asked to judge the acceptability of the sentence, but rather to assess how well the gesture fit with its meaning, this might have had a negative effect on the ratings.[21]
(iii) There could be a residual effect of the mismatch in the elided clause: it might be that although the relevant features of the copied VP can *to some extent* be ignored in the elided clause, they cannot be *fully* ignored.
Result 5: The control 'helicopter' paradigm in (42) led to sharp contrasts. Let us focus on the global judgments corresponding to the "All gestures" panel in (44).
Result 5a: The Ellipsis-Match condition was degraded compared to the Gesture-Match condition ($F(1,41)=9.21$, $p=.0042$), suggesting that Ellipsis *per se* could be contributing to the non-maximal rating of the Ellipsis-Mismatch in the person agreement target case. Accordingly, there is no significant interaction between the effect of the ellipsis and whether we are looking at target or control cases (interaction between Target/Control and Gesture/Ellipsis restricted to the conditions Gesture-Match-Target, Gesture-Match-Control, Ellipsis-Mismatch-Target, Ellipsis-Match-Control: $F(1,41)=2.28$, $p=.14$), suggesting that the effect may indeed be due to the ellipsis construction only, and not to the mismatch (which occurs only in the target condition in this comparison).
Result 5b: The degraded character of the Ellipsis-Mismatch condition is important in this control condition (compared to the Gesture-Match condition: $F(1,41)=86.3$, $p<10^{-10}$). Crucially, there *is* a significant interaction between Target/Control and the ellipsis effect between the Gesture-Match and the Ellipsis-Mismatch condition (interaction between Target/Control and Gesture/Ellipsis, restricted to Gesture-Match and Ellipsis-Mismatch conditions: $F(1,41)=49.4$, $p<10^{-7}$), suggesting that the mismatch situation due to the ellipsis is qualitatively much less marked in the target (person marking) condition.

6.4 Limitations and questions for future research

By construction, this study says nothing about height variations of agreement markers in gestural verbs. Thus the data briefly discussed in Section 5.3 are entirely based on introspective judgments and could be subjected to similar studies.[22] Our results pertaining to person have several limitations.
• First, the controls we used to show that not anything goes under ellipsis are particularly crude: the fact that *TAKE-OFF-ROTATING* is degraded under ellipsis when it is applied to a plane only shows that ellipsis cannot *fully* disregard the inappropriate components of the gesture. This leaves open the possibility that the directionality of a gesture may be disregarded, *whether or not it has a grammatical function of agreement*. Relatedly, one could argue that the reason why the ellipsis-mismatching effect is larger in the control condition than in the target condition is simply that the mismatch is larger to begin with. Unfortunately, the experiment did not contain a Gesture-Mismatch condition for the target cases, which would have allowed us to assess this directly. We start discussing more fine-grained paradigms to explore this question in Section 8. Refined models should also be explored to predict the quantitative impact of a violation under ellipsis based on its status without ellipsis.
• Second, our paradigms are not entirely minimal: ellipsis of a gestural verb is compared to overt gestural verbs without ellipsis. But the specific contribution of ellipsis to the judgments was not assessed independently. If ellipsis is independently *worse* than the other constructions, our results should only be strengthened, since we would have shown that *despite* this negative effect our crucial cases ((38)b, (39)b, (40)b) are relatively good, in a way that is comparable to the second case without person mismatch and without ellipsis. But if for whatever reason ellipsis is independently *better* than the other constructions, our results will be weakened (see the Appendix for an early pilot involving written sentences without gestures).

7 Going further I: against a pure variable-based analysis

As we noted in Section 3, there are several ways in which initial examples of locus mismatch under ellipsis (and *only*) could be handled in sign language; one possibility is to treat loci as variables, and to

[21] A pilot experiment without gestural verbs did not find ellipsis to be degraded, but this was on the basis of very different stimuli, involving written sentences rather than videos, and acceptability judgments on entire sentences.
[22] Besides object agreement, sign language verbs can display subject agreement. These could also be investigated with gestural verbs.

take ellipsis to require that the elided VP should just be an alphabetic variant of the antecedent VP. Interestingly, in the case of ASL loci, this solution can be shown to be insufficiently general because of data discussed in Kuhn 2015. And while it is very unclear that third person *gestural* loci could play the role of variables (because we have only investigated examples with a single third person gestural locus), we can still show that Kuhn's examples extend to the gestural domain, and thus equally rule out a pure variable-based analysis.

7.1 Kuhn's argument[23]

Kuhn shows that under *only* the loci-as-variables view undergenerates, as in (45). (Kuhn's ASL examples are assessed on a 7-point scale, just like ours.)

(45) 7 IX-a JESSICA TOLD-ME IX-b BILLY ONLY-ONE$_{(b)}$[24] FINISH-TELL POSS-b MOTHER POSS-b FAVORITE COLOR.
'Jessica told me that only Billy told his mother his favorite color.'
Can be read as: bound-bound, bound-free, free-bound, or free-free. (Kuhn, 2015, based on the judgments of two consultants)

Let us unpack this example. *JESSICA* is associated with locus *a* by way of the initial pointing sign *IX-a*. Then *BILLY* is associated with locus *b* by way of the pointing sign *IX-b*. Finally, the possessive pronouns *POSS-b* and *POSS-b* both index that same locus *b*. Now let us focus on the (available) 'bound-free' reading, on which the boxed possessive is read as bound by *ONLY-ONE* while the underlined possessive refers to Billy. For the boxed possessive *POSS-b* to be bound, *ONLY-ONE* must somehow bind this variable, say by way of a Logical Form akin to (46), with the assumption that *IX-b BILLY* comes with a requirement that *b* denotes Billy, and that there is an empty copula preceding *ONLY-ONE* to yield a meaning such as: 'Billy is the only person who...'. (Unless otherwise noted, our Logical Forms are based on the kind of syntax/semantics interface discussed in Heim and Kratzer 1998, among others.)

(46) IX-b BILLY ONLY-ONE λb t_b FINISH-TELL POSS-b MOTHER POSS-b FAVORITE COLOR

Now here is the main argument: if the boxed possessive *POSS-b* is bound by *λb*, the underlined pronoun *POSS-b*, which is lower in the structure, shouldn't be able to get a deictic reading on which it denotes Billy (nor could it denote further salient individuals – a possibility which is not tested in Kuhn's paper).[25] The key is that (46) has the general form in (47): since we know by the meaning of the sentence that *POSS-b* is bound by *λb*, it must be the case (because of how binding works) that *POSS-b* is also bound by *λb*. But this fails to deliver the mixed reading on which *POSS-b* rigidly refers to Billy.

(47) … λb [… POSS-b … POSS-b …]

7.2 Replicating Kuhn's argument with ASL agreement verbs

As one might expect, Kuhn's conclusion can be replicated with ASL agreement verbs. In order to avoid complexities that arise in Kuhn's original example due to the theoretical possibility of covert movement, we constructed a sentence in which both two object agreement verbs are embedded within (what should be) a *wh*-island, introduced by *WONDER IF*, as in (48). We provide in (49) preliminary data that

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[23] This summary is virtually identical to a paragraph from Schlenker 2015b.

[24] Two remarks should be added. First, we keep Kuhn's transcription, but his *ONLY-ONE* corresponds to what we would transcribe here as *ONLY-CL_one*. We treat the latter expression as pronominal when it is signed in a locus that was established earlier, and thus had a prior reference; this decision should be revisited in future research. Second, in Kuhn's video *ONLY-ONE* is in fact localized, and thus a more correct transcription would be: ONLY-ONE$_b$ in Kuhn's notation, and *ONLY-CL_one_b* in ours; this is the reason we have added $_{(b)}$ as a subscript to *ONLY-ONE* in (45). (Thanks to J. Lamberton for discussion of this point, and to J. Kuhn for sharing his video.)

[25] The same issues arise in examples with ellipsis. But these arguably involve independent problems: in ellipsis resolution, it has been argued that a Logical Form with a bound variable representation can give rise to a strict reading in the elided clause (Fox 2000, Schlenker 2005). This is the reason the present discussion solely appeals to strict readings under *only*.

suggest that extraction out of the subject position is indeed degraded under *WONDER IF,* although less so than one might expect.[26]

(48) *Context:* As part of an escalating feud between two families, a young man was punched by a masked aggressor. The speaker thinks that the victim could be the target of far worse attacks, but that his younger (teenage) brother won't be targeted.

[Talking to the younger (teenage) brother:]

POSS-2 BROTHER IX-b YESTERDAY IX-a GUY PUNCH-CL-b.

THE-TWO-OF-YOU-2,b ONLY IX-b IX-1 WONDER IF

a. [7] **[THAT GUY PUNCH-CL-b]**
b. [7] **IX-a**

WILL **SHOOT-b** Q[27]. UNDERSTAND-UNDERSTAND IX-1 FEEL IX-2 SAFE.
=> someone punched the older but not the younger brother
=> the speaker wonders whether the older but not the younger brother will be shot

'Yesterday a guy punched your brother. But of the two of you [= your brother and yourself], it's only about him [= your brother] that I wonder whether
a. the guy who punched him
b. he [= the guy who punched your brother]
will shoot him. See, I think you are safe.

(a. and b. were tested in separate videos. a.: ASL, 34, 1736, 4 judgments; b.: ASL, 34, 1744, 4 judgments)

(49) *Context:* Someone seems to be in love with your sister.
a. [6.2] WHO IX-2 FEEL LOVE POSS-2 SISTER?
'Who do you feel loves your sister?' (possibly an English influence or a syntactic infelicity, see Supplementary Data)
b. [5] WHO IX-2 WONDER IF LOVE POSS-2 SISTER?
Intended: 'Which person is such that you wonder whether that person loves your sister?'
(ASL, 34, 1798; 4 judgments)

It is clear in view of the context and the reading obtained that *THAT GUY PUNCH-CL-b* is read as strict, and has the same contribution as the pronoun *IX-a*, referring to the 'puncher'. For if it were read as a bound variable, its presupposition should presumably 'project' and apply to the alternative of the addressee's brother, namely the addressee himself – an effect we already saw in (28)b. By contrast, the object agreement marker of the boldfaced *SHOOT-b* is clearly read as a bound variable, as this is needed to trigger the inference that the 'puncher' will *not* shoot the addressee.

Schematically, and using English words wherever possible, the crucial sentence in (48)a has the form in (50).

(50) only [your brother]$_b$ $\boxed{\lambda b}$ I wonder whether [[the guy who PUNCH-b] $\boxed{\text{SHOOT-b}}$]

---

[26] Extraction from the embedded object position is even less clear – a question that we leave for future research (we leave open whether null resumptive pronouns play a role in these facts). Still, for the present discussion what matters is whether the embedded *subject* could move covertly out of the embedded clause. If it could, one could derive from a version of (50) the Logical Form in (i), with the (covertly) moved subject outside of the scope of the lambda-operator $\boxed{\lambda b}$ – which would allow it to get a strict reading without impinging on the claim that loci are variables.

(i) [the guy who PUNCH-b] $\boldsymbol{\lambda x}$ only [your brother]$_b$ $\boxed{\lambda b}$ I wonder whether [$\mathbf{t_x}$ $\boxed{\text{SHOOT-b}}$]

[27] *Q* is the manual question marker.

The boxed VP has a bound reading. On the assumption that the locus *b* is a variable, it must be bound by a lambda-operator λb (also boxed), associated with *[your brother]*$_b$. The entire embedded clause is in the scope of this lambda-operator, and presumably no expression can 'escape' from its scope because of the *wh*-island. As a result, the underlined VP should also be bound by this operator λ*b*. But this incorrectly predicts that the underlined VP should have a bound reading. This suggests that the loci need not be both interpreted in this case.

There are of course many steps in the argument, and it would take more time and space to test them all, but we take this to be suggestive evidence that Kuhn's conclusion holds for agreement verbs as well. More importantly for our purposes, this also gives us a general model to test similar facts with gestural verbs, to which we now turn.

7.3 Replicating Kuhn's argument with gestural verbs?

We believe that a similar argument can be replicated with gestural verbs. Here we start our discussion with French examples, for two reasons. First, they allow for clitic object pronouns which come before the verb, with the result that gestural verbs can naturally come clause-finally, which seems to be their preferred position. Second, French has a construction which makes resumptive pronouns very natural under *wonder whether*, akin to: 'Your brother is the only person of-whom I wonder …'; English examples with resumptive pronouns under *wonder whether* appear to be a bit degraded.

Consider the French sentence in (51), which is somewhat similar to (48); here too, the context is designed to make salient a reading on which the boxed expression is bound whereas the underlined expression is strict.

(51) *Context:* As part of an escalating feud between two families, a young man was punched by a masked aggressor. The speaker thinks that the victim could be the target of far worse attacks, but that his teenage brother won't be targeted.

[Talking to the teenage brother:]

De vous deux, il	n'	y a	que	ton	frère	dont	je	me demande	si
Of you two, there	*NE*	*Y have only*		*your*	*brother*	*of-whom*	*I*	*me wonder*	*if*

le type	qui,	hier,	l' a PUNCH-a ne	va pas	le SHOOT-a.	
the guy	*who,*	*yesterday*	*him has PUNCH-a NE*	*will not*	*him SHOOT-a*	

=> only your brother is an x such I wonder whether the guy who punch your brother won't shoot x

'Of the two of you, it's only your brother that I wonder whether the guy who, yesterday, punched him won't shoot him.'

As in the ASL example in (48), the gestural verbs are embedded within a *wh*-island, introduced by 'I wonder whether' (*je me demande si*). As was the case for (48), the crucial sentence of (51) has the form in (52).

(52) only [your brother]$_F$ λa I wonder whether [[the guy who PUNCH-a him] won't SHOOT-a him]

The boxed VP has a bound reading. On the assumption that the locus *a* is a variable, it must be bound by a lambda-operator λ*a* (also boxed) introduced by *your brother*. The entire embedded clause is in the scope of this lambda-operator, and no expression can 'escape' from its scope because of the *wh*-island. As a result, the underlined VP should also be bound by this operator λ*a*. But this incorrectly predicts that the underlined VP should have a bound reading.

As shown in (53), a similar example can be constructed in English but is a bit degraded, for reasons discussed at the outset (we modify the context in order to allow the gestural verbs to be non-finite, as past tense uninflected gestural verbs might be less acceptable).

(53) *Context*: As part of an escalating feud between two families, a young man is in a tense interaction with an aggressor. The speaker thinks that the victim could be the target of far worse attacks, but that his teenage brother won't be targeted.

[Talking to the teenage brother:] ? Of the two of you, it's only your brother that I wonder whether the guy who is about to PUNCH-a him won't SHOOT-a him.

Despite the degraded character of the example, it seems clear that the underlined expression is read as strict whereas the boxed expression is read as bound – which makes the same point as our French example in (51).

We conclude that, given standard assumptions, it won't do to treat the third person locus indexed by these gestural verbs as a pure variable. This still leaves open several possibilities, which mirror those discussed in connection with ASL loci in Section 3. First, it makes considerable sense to posit that these are just agreement markers rather than variables/discourse referents: we only displayed a limited form of second vs. third person distinction, and thus at this point there is no evidence for a variable-like behavior of these markers (the situation is different in sign language because there is an arbitrary number of distinctions among third person loci). Second, if it turns out in future research that a variety of third person loci can be distinguished in spoken language, one could consider treating these markers as variables that display an agreement-like behavior in some circumstances, as was argued for ASL loci by Schlenker 2015b.

8 Going further II: why can agreement markers be disregarded?

While the previous section establishes that in some cases some object agreement markers are genuinely disregarded in the computation of ellipsis resolution and in the 'focus dimension' under *only*, it does not address the *source* of this behavior. We have already seen that not anything goes, since in (42)b the requirement introduced by *TAKE-OFF-ROTATING* (to the effect that its argument should move in a helicopter-like fashion) could not be disregarded in the course of ellipsis resolution. Still, there are two broad directions to explain the difference between gestural verbs with object agreement and *TAKE-OFF-ROTATING*.

• One view follows the standard treatment of agreement verbs in ASL (e.g. Schlenker 2014) in taking the relevant difference to be that agreement markers of gestural verbs have a specific grammatical status, related to that of *phi*-features.

• An alternative view is that these agreement markers are just properties of gestures that happen to be less salient than the 'rotating' motion we find with *TAKE-OFF-ROTATING*.

There might be some initial arguments for the latter view; as noted in fn. 14, an informant tells us that it becomes easier to disregard the 'rotating' component of the meaning of *TAKE-OFF-ROTATING* under *only* if the rotation is smaller – and we are not quite sure about ellipsis at this point. It is thus important to consider minimal pairs in which the very same gesture has a grammatical component in one case but not in the other. An example is given in (54), in the context of a video game in which one could shoot towards the center or towards the left.

(54) *Context 1:* The speaker is playing with John a shooter video game in which targets appear either in the center or on his left. The player must shoot the target as fast as possible, and it is thus advantageous to decide ahead of time where one will shoot.

I will  , and John (will) too.

In this case, it seems clear to us that the elided clause can only mean that John too will shoot towards the left: the directionality of the sideways gesture, interpreted here spatially rather than grammatically, seems to be preserved under ellipsis (although the data should of course be checked). But this is unsurprising: if the directionality were ignored, the elided clause would end up meaning simply that John too will shoot, which is uninformative given the context.

It is thus crucial to consider the sentence in a context in which this meaning *would* be informative, as in (55).

(55) *Context 2:* The speaker is playing with John a shooter video game in which targets appear either in the center or on his left. The player must shoot in the center, shoot on the left, or do nothing– and there is a heavy penalty for missing the target if one does shoot. Since speed is crucial, it is advantageous to decide ahead of time what one will do.

a. I will  , and John (will) too.

b. I will  , but John won't.

The judgments seem to us to be considerably less clear, and it might be that two possible readings exist (one on which the elided clause makes a claim about John shooting on the left, and one on which it makes a claim about John shooting). They should be investigated to come to a proper analysis of the behavior of gestural verbs with third person object agreement.[28]

9 Conclusion

While granting that more systematic empirical work is needed, we believe that our data paint an interesting picture. A simplified version of the locus system found in sign language seems to exist in the gestural domain. Specifically, the object agreement markers of sign language ('directional') verbs seem to have a counterpart in gestural verbs. Our discussion was primarily focused on the horizontal specifications of loci, pertaining to person, but we also displayed some data pertaining to vertical specifications, encoding the height of the denoted individuals.

With respect to person, the gestural distinctions we displayed were much simpler than those that are found in sign language: our examples only involved second, third and occasionally first person distinctions, whereas sign language displays numerous distinctions *among* third persons. Strikingly, both the horizontal and the vertical specifications of gestural verbs seem to share the behavior of ASL agreement markers in being sometimes disregarded under ellipsis and *only*. Thus the pro-speech gestures we investigated make it possible to replicate within spoken language a corner of sign language grammar. This does not explain *why* these agreement markers can sometimes be disregarded under ellipsis and *only*. One possibility is that they display the behavior of *phi*-features in general. If so, it is striking that this grammatical behavior is known by speakers of English despite the fact that their language otherwise does not display overt cases of object agreement (furthermore, the pro-speech gestures under study might be exceedingly rare in production, although we do not have data on this). But as we mentioned in Section 8, there are other theoretical possibilities as well, and much more fine-grained paradigms would be needed to distinguish among the competing analyses – not just with gestural verbs, but also with sign language agreement verbs, and possibly even with spoken language *phi*-features.

Within sign language, there has been a heated debate about the status of directional verbs. As mentioned at the outset, some researchers took these verbs to display *bona fide* agreement with loci (Lillo-Martin 1991, Lillo-Martin and Meier 2011), while others (Liddell 2000, 2003) took them to have genuinely gestural characteristics. If the gestural verbs studied in this piece genuinely display (object) agreement, there might be less difference than meets the eye between the two positions, since grammatical agreement might be found in gestures themselves. But in any event gestural verbs should be relevant for future debates on directional verbs.

[28] Importantly, if turns out that a reading can be obtained on which the direction of the movement can be disregarded under ellipsis, one will have to ask (i) whether other properties of gestures, as in our helicopter examples, can also be so disregarded, and (ii) whether whatever accounts for the special behavior of directionality could also account for the behavior under ellipsis of agreement verbs in sign language, and possibly also *phi*-features in spoken language. Regarding (i), we mentioned in fn. 14 that, for some informants, the rotating component of (16)b and (17)b if that aspect of the gesture the gesture is realized so as to be less salient.

Several additional issues could be explored in future research.

• We already suggested that there is a first vs. non-first person distinction with gestural verbs. Can the distinctions *among* third person loci that are found in sign language be replicated with gestural verbs?

• Can our findings be extended to other instances of pointing in spoken language? Besides deictic pointing, Anvari 2016 discusses various cases of 'co-nominal pointing' in which a pointing gesture co-occurs with a quantifier. Does co-nominal pointing too display person distinctions?

• Could our results be extended to pro-speech pointing, i.e. to cases in which a pointing gesture fully replaces an expression – presumably a pronoun?

• Far more generally, can further areas of sign language grammar be shown to be 'known' by non-signers using pro-speech gestures? (See Strickland et al. 2015 for general results of this sort using a very different paradigm.)

Appendix. Experimental investigation: earlier pilots

Earlier and failed or inconclusive pilots had the following general properties. Test sentences remained the same across pilots, but included the following differences:

Pilot 1 (created June 30, 2016): the acceptability question was of the form: "How natural is this sentence, as realized on the video right above? (0 = worst; 10 = best)". Instructions did not include videos varying the height of the gestures, as in the final experiment. The task included semantic questions about whether 'you understand the speaker to be referring to actions performed in non-standard ways?'. This was intended to detect judgments on which, say, *SLAP-a* with a second person object argument is considered as acceptable, but to mean that the slapping was done from the side. The question was hard to understand, and turned out not to be necessary, as in the final experiment clear acceptability differences were found across the target sentences.

Pilot 2 (created July 10, 2016): related to Pilot 1, but asked subjects: "How well do the gestures fit with the rest of the sentence?".

Pilot 3 (created July 15, 2016): this was a control experiment, replacing videos with written sentences without gestures, e.g. *Your brother, I am going to slap, then you, I am going to punch,* vs. *Your brother, I am going to punch, then you, too*. The goal was to determine whether ellipsis might on its own be degraded, which could have been combined with the results of Pilot 1 to obtain sharper judgments. Results did not seem promising (but as mentioned in the text, the independent contribution of ellipsis should be assessed in future research).

Pilot 4 (created August 5, 2016): related to Pilot 2, but with presentation of the sentences by pairs (overt person match vs. ellipsis, overt person mismatch vs. ellipsis) rather than by triples. Questions about "actions performed in non-standard ways" were eliminated.

Pilot 5 (created August 6, 2016): related to Pilot 2, but with modified instructions, related to those used in the final version of the experiment: subjects were explicitly asked to "pay close attention to the shape of the gesture and to the direction of the movement", and questions were of the form: "How well does the **1st** gesture fit with the meaning of the sentence?", "How well does the **2nd** gesture with the meaning of the sentence?", "How well does the gesture fit with the meaning of the sentence?".

Pilot 6 (created August 8, 2016): related to Pilot 5, but presentation was by triples.

The final experiment (created August 22, 2016, and reported in the main text) was related to Pilot 6, except that each subject saw two versions of the experiment: they saw the 'local' condition used in Pilots 5 and 6, and they also saw the 'global' condition in which the main question pertained, in the plural, to whatever gestures appeared in the sentence (= "How well do the gestures fit with the meaning of the sentence?").

Supplementary Materials. ASL raw data

Raw ASL data can be downloaded in .doc format at the following URL:

https://drive.google.com/file/d/0B7Mz-VKVeYNKcnRmSmxUai11YTg/view?usp=sharing

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