Iconic Features*

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Abstract. Sign languages are known to display the same general grammatical properties as spoken languages ('Universal Grammar'), but *also* to make greater use of iconic mechanisms. In Schlenker et al. 2013, it was argued that loci (= positions in signing space corresponding to discourse referents) can have an iconic semantics, in the sense that certain geometric relations among loci (subset and relative complementation, as well as high/low position relative to the signer) are preserved by the interpretation function. Here we ask whether plural and height specifications of loci display the formal behavior of *phi*-features in remaining uninterpreted in focus- and ellipsis-constructions (as in the bound readings of *Mary admires herself, and John does too,* and of *Only Mary admires herself*). Data from ASL and LSF show that plural and height specifications may indeed remain uninterpreted in these constructions; furthermore, there are cases in which a single high locus is construed iconically *and* left uninterpreted in the course of ellipsis resolution. We argue that our data are compatible with two theories. According to the Strong View, plural and height specifications of loci display exactly the behavior of spoken language features. According to the Weak View, our data just show that plural and height specifications share the behavior of features *and other non-assertive elements* in being separable from the referential terms they specify. Our LSF data are compatible with the Weak View; our ASL might provide support for the Strong View. While we only aim to open the debate about the featural status of iconic specifications, the question is of some importance: if features are innate and primitive elements of grammar, and if some of them have an intrinsically geometric semantics, the signed modality might play a greater role than is usually thought at the very core of Universal Grammar.

Keywords: sign language, features, iconicity, universal grammar

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Sign languages are known to display the same general grammatical properties as spoken languages ('Universal Grammar'), but *also* to make greater use of iconic mechanisms. In an attempt to reconcile insights of the 'formalist' and of the 'iconic' camps in sign language research[1], Schlenker et al. 2013 argued that loci (= positions in signing space corresponding to discourse referents) can *both* be logical variables and iconic representations of what they denote, in the sense that certain geometric relations among loci are preserved by the interpretation function. Specifically, they suggested that subset and relative complementation relations among plural loci as well as the high/low position of a locus relative to the signer can be preserved by the interpretation function. Still, these specifications were otherwise taken to have the same kind of semantics as *phi*-features in spoken language features. In particular, it was argued that height specifications have a presuppositional semantics, rather similar to that of gender features of pronouns. Should plural and height specifications of loci really be analyzed as features in the same sense as standard *phi*-features? A positive answer would have some import: if features are innate and primitive elements of grammar, and if some of them have an intrinsically geometric semantics, the signed modality might play a greater role than usually thought at the very core of Universal Grammar.

We begin to address this question by asking whether plural and height specifications of loci display the formal behavior of *phi*-features in remaining uninterpreted in focus- and ellipsis-constructions, as in the bound readings of *Mary admires herself, and John does too,* and *Only Mary admires herself (... therefore John doesn't admire himself)*. Data from ASL and LSF show that plural and height specifications may indeed remain uninterpreted in these contexts; furthermore, there are cases in which high loci are *simultaneously* interpreted iconically and left uninterpreted in the course of ellipsis resolution. We argue that our data are compatible with two theories. According to the Strong View, plural and height specifications of loci display exactly the behavior of spoken language features. According to the Weak View, our data just show that plural and height specifications share the behavior of features *and other elements* in being separable from the referential terms they specify. While we only aim to open the debate, we will see that our ASL data provide an argument for the Strong View, while our LSF data can only argue for the Weak View.[2]

1 Grammar and Iconicity in Sign Language Pronouns

1.1 Grammatical properties of sign language pronouns[3]

In many sign language, the relation between a pronoun and its antecedent is often mediated by *loci*. These are positions in signing space that can be introduced by noun phrases, and retrieved by pronouns (Sandler and Lillo-Martin 2006). Thus in the ASL example in (1)a, $BUSH_a$ and $OBAMA_b$ establish a locus by virtue of being signed in the corresponding position; in (1)b, the signs for *former senator* and *current senator* are immediately followed by the pointing signs *IX-a* and *IX-b* respectively, and these to establish the initial loci *a* and *b,* which are then retrieved by the pronouns (also signed as pointing signs *IX-a* and *IX-b*) which appear in the second sentence:[4]

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[1] See for instance Lillo-Martin and Klima 1990, Neidle et al. 2000, Sandler and Lillo-Martin 2006 for the 'formal camp', and Cuxac 1999, Taub 2001, and Liddell 2003 for the 'iconic camp'. Kegl 2004 (written in 1977) already incorporated iconic insights into the formal tradition with respect to the analysis of directional verbs. See Zucchi 2012 for an overview of sign language semantics, with a discussion of some verbs (of motion and location) which have highly iconic properties.

[2] In this paper, we primarily discuss examples in which the *vertical and diagonal position* of loci can be disregarded in focus and ellipsis constructions. In these cases, the semantic contribution of the vertical or horizontal specification of loci arguably triggers inferences akin to presuppositions triggered by *phi*-features. By contrast, we do not attempt to account for cases in which the *horizontal position* of loci might have to be disregarded in order to allow for bound readings. These cases might be different: two loci that are in different parts of the horizontal space usually correspond to different discourse referents, and thus the semantic contribution of spatialization might not be the same as that of horizontal and vertical position discussed in this paper. (Thanks to an anonymous reviewer for emphasizing the relevance of this question.)

[3] This section borrows from Schlenker et al. 2013.

[4] ASL sentences are glossed in capital letters. Subscripts correspond to the establishment of positions ('loci') in signing space. Pronouns are usually realized through pointing ('indexing') towards a locus, and they are also glossed

(1) a. IX-1 KNOW BUSH$_a$ IX-1 KNOW OBAMA$_b$. IX-b SMART BUT IX-a NOT SMART.
'I know Bush and I know Obama. He [= Obama] is smart but he [= Bush] is not smart.'
b. IX-1 KNOW [PAST SENATOR PERSON] IX-a IX-1 KNOW [NOW SENATOR PERSON] IX-b. IX-b SMART BUT IX-a NOT SMART.
'I know a former senator and I know a current senator. He [= the current senator] is smart but he [= the former senator] is not smart.'
(ASL; 4, 179)

Since there appears to be an arbitrary number of possible loci, it was suggested that these do not spell out morpho-syntactic features, but rather are the overt realization of formal indices (Lillo-Martin and Klima 1990, Sandler and Lillo-Martin 2006; but see Kuhn 2013 for an argument in favor a variable-free reinterpretation of loci). While pointing can have a variety of uses in sign language (Sandler and Lillo-Martin 2006, Schlenker 2011a), we will restrict attention to pronominal uses. Importantly, there are some striking similarities between sign language pronouns and their spoken counterparts – which makes it desirable to offer a unified theory:

–Sign language pronouns obey at least some of the syntactic constraints on binding studied in syntax. For instance, versions of the following rules have been described for ASL (Lilla-Martin 1991, Sandler and Lillo-Martin 2006, Koulidobrova 2011): Condition A; Condition B; Strong Crossover.

–In simple cases, the same ambiguity between strict and bound variable readings is found in both modalities (see Lillo-Martin and Sandler 2006; many more cases will be discussed below):[5]

(2) IX-1 POSS-1 MOTHER LIKE. IX-a SAME-1,a.
Ambiguous: I like my mother. He does too [= like my / like his mother] (ASL; 1, 108)

–Similarly, the same cases of 'donkey anaphora', or apparent binding without c-command, are found in sign and in spoken language (Schlenker 2011b).

It is thus a reasonable hypothesis that the pronominal systems of sign and spoken language share at least a common core.

1.2 Iconic properties of sign language pronouns

Still, as was argued in Schlenker et al. 2013 (following much earlier work, among others Kegl 2004 and Liddell 2003), there are clear iconic effects in sign language pronominals, and these do not appear to have an exact counterpart in spoken language. As announced, we will concentrate in what follows on plural and height specifications.[6]

- *Plural specification of loci*

It was shown in Schlenker et al. 2013, that the range of readings available for the English plural pronouns in (3) is replicated in ASL when a single default locus is used, but that the deviance of the 'complement set' reading can be obviated when embedded loci are used, as is illustrated in (4) (the main data were replicated for LSF in Schlenker et al. 2013). Throughout, ratings are given on a 7-point scale (with 7 = best; when examples are cited from Schlenker et al. 2013, we refer the reader to the original paper for raw scores).

(3) a. *Complement Set Anaphora:* #Most students came to class. They stayed home instead.
b. *Maximal Set Anaphora:* Most students came to class, and they asked good questions.
c. *Restrictor Set Anaphora:* Most students came to class. They are a serious group.

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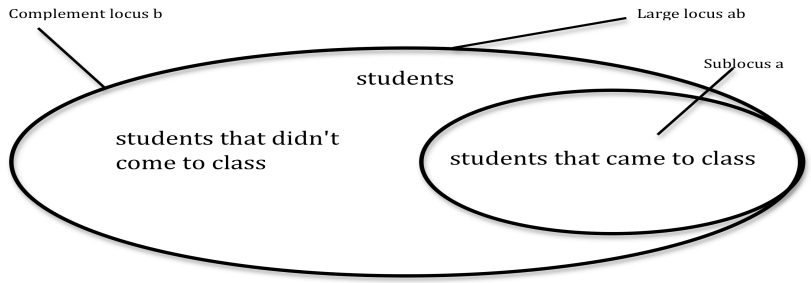
as *IX-a*, *IX-b*, etc. Each example or paradigm is followed by the name of the language, together with the reference of the relevant videos; thus the notation *(ASL; 4, 179)* following (1)a and (1)b indicates that both sentences are from ASL, and can be found in the video referenced as 4, 179 (when further references are included, they pertain to videos in which judgments were recorded). Further information about glossing conventions is given in Section 1.3.

[5] In order to provide a formal treatment of (2), we would need to posit a rule of 'locus erasure' – a point we will come back to in the conclusion.

[6] Schlenker et al. 2013 discuss one further case of 'formal iconicity', one in which directional verbs target different parts of structured loci, analyzed as simplified pictures rather than just as points. See also Meir et al. 2013 for a broader discussion of the interaction between iconicity and grammar.

(4) POSS-1 STUDENT IX-arc-ab MOST IX-arc-a a-CAME CLASS.
'Most of my students came to class.'
a. 7 IX-arc-b b-STAY HOME
'They stayed home.'
b. 7 IX-arc-a a-ASK-1 GOOD QUESTION
'They asked me good questions.'
c. 7 IX-arc-ab SERIOUS CLASS.
'They are a serious class.'
(ASL; 8, 196; 8, 197; 8, 206; 8, 224)

(5)



In (4)a, a large locus notated as *ab* (but signed as a normal plural locus) represents the set of all students. A sublocus *a* represents the set of students that came to class. And once the large locus *ab* and the sublocus *a* have been made available, the complement locus *b* becomes automatically available, and it denotes the students who didn't come to class.

Schlenker et al. (2013) hypothesized that assignment functions assign values to loci, and they further assumed that:

R1. geometric properties of plural loci (*qua* areas of space) guarantee that if a locus *A* and a sublocus *a* have been introduced, a complement locus *(A-a)* thereby becomes available;

R2. relations of inclusion and relative complementation among loci are preserved by the interpretation function *via* constraints on assignment functions.

To account for these data, Schlenker et al. posited that the grammar makes available (i) a discourse referent for the maximal set and the restrictor set, but (ii) no discourse referent for the complement set (see Corblin 1996, Geurts 1997, Nouwen 2003). In this respect, the grammar of ASL is similar to the grammar of English, as analyzed by Nouwen 2003. For this reason, when a default locus is used, ASL roughly behaves like English, and complement set anaphora is highly restricted (because of (ii)). In case embedded loci are used, however, ASL allows for complement set anaphora. But this is not due to an essential grammatical difference between sign and spoken language. Rather, the rules in R1 and R2 conspire to make available a locus that denotes the complement set. The reasoning is as follows:

–If *a* is a proper sublocus of a large locus *ab*, we can infer by R1 that *(ab-a)* (i.e. *b*) is a locus as well.

–By R2 we can infer that s(a) $\subset$ s(ab) [= preservation of inclusion by assignment functions] and that s(b) = s(ab)-s(a) [= preservation of relative complementation].

In this analysis, then, it was essential that plural loci have some intrinsincally geometric properties, namely subsethood and relative complementation, which can be preserved by assignment functions. But it was not determined whether in *other* respects plural specification of loci behave like *phi*-features.

❑ *Height specifications of loci*

While loci are usually established in a single horizontal plane, in some contexts they may be signed high or low. Our point of departure lies in the inferences that one obtains when high or a low loci are used to refer to an individual. An ASL example without quantifiers, from Schlenker et al. 2013, is given in (6) (similar ones were described for LSF; we refer the reader to the original paper for raw scores for the ASL and LSF examples).

(6) YESTERDAY IX-1 SEE R [= body-anchored proper name]. IX-1 NOT UNDERSTAND IX-a$^{\text{high / normal / low}}$ (ASL)
a. 7 High locus. Inference: R is tall, or powerful/important
b. 7 Normal locus. Inference: nothing special
c. 7 Low locus. Inference: R is short
'Yesterday I saw R [= body-anchored proper name]. I didn't understand him.' (ASL; 11, 24; 25)

As can be seen, the relevant inferences are preserved under negation, which provides initial motivation for treating them as presuppositional in nature.

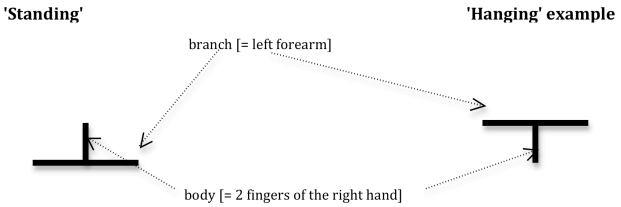
Importantly, high and low loci can appear under binding, with the expected results from a presuppositional perspective: bound variables with high or low loci in a nuclear scope are acceptable to the extent that the restrictor ranges over individuals that satisfy the relevant properties, as illustrated in (7)-(8) (here too, similar examples were described for LSF):

(7) NO TALL MAN THINK IX-1 LIKE IX-a
a. 7 High locus
b. 6 Normal locus
c. 3 Low locus
'No tall man thinks that I like him.' (ASL; 11, 27; 11, 31; e12.07.24)

(8) NO SHORT-PERSON THINK IX-1 LIKE IX-a
a. 2 High locus
b. 6 Normal locus
c. 7 Low locus
'No short person thinks that I like him.' (ASL; 11, 28; 11, 32; e12.07.24)

As argued in Schlenker et al. 2013, it will not do to treat height specifications of loci as contributing information about an *intrinsic* property of their denotations, for instance in terms of being tall or short. Rather, in at least some of their uses they provide information about the spatial position of the upper part of a person's body. This is shown by the paradigm in (10), where the signer attempted to keep the middle of the initial classifier representing a philososopher at a constant height, as shown in (9). But the *orientation* of the denoted person – in standing or hanging position – had consequences for the acceptability of high and low loci: the same tall philosopher could be referred to with a high locus when he was in standing position, and with a low locus when he was in hanging position.[7]

(9) Rough position of the index and middle finger of the dominant hand and of the non-dominant hand in examples (10)



(10) *Context:* People have conversations in the weirdest of positions. (ASL; simplified from Schlenker et al. 2013)

TREE BRANCH VERY TALL LINGUIST PERSON CL-_____$_a$ SAME VERY TALL PHILOSOPHER PERSON CL-_____$_b$. IX-a$^{1/2/3/4/5}$ UNDERSTAND IX-b$^{1/2/3/4/5}$.
'[A very tall linguist]$_a$ was (a) standing on (b) hanging from a branch and [a very tall philosopher]$_b$ was (a) standing on (b) hanging from a branch. He$_a$ understood him$_b$.'
Levels (1 = top; 5 = bottom)
a. CL-_____ = CL-stand
translation = 'standing on' (ASL; 10, 106; 109; 137; 11, 16)
1. 5.33 2. 6.33 3. 6.67 4. 5 5. 3

b. CL-_____ = CL-hang
translation = 'hanging from' (ASL; 10, 105; 108; 136; 11, 18)
1. 3 2. 3.33 3. 5.67 4. 7 5. 4

In this paradigm, the sentence is kept constant, except for two parameters: the classifiers in loci *a* and *b* may correspond to a person in standing or hanging position, as represented in (9); and the pronouns *IX-a*

[7] Schlenker et al. 2013 discuss a third condition (in lying position).

and *IX-b* index 5 different levels in each case. While extreme positions are dispreferred, the heights that can be targeted are a bit higher in the 'standing' than in the 'hanging' condition. In essence, the interpretation function seems to be preserving a certain ordering: if a locus *i* is above a neutral locus *n*, the denotation of *i* must be above the denotation of *n* on some salient ordering; and when talking about people in physical situations, it would seem that the salient ordering in question is often given by the relative positions of their upper bodies. This was captured in the following parts of the analysis developed in Schlenker et al. 2013:

(11) *Height specifications* (3rd try)
Let c be a context of speech, s an assignment function and w a world (with c_w = the world of c).

If *i* is a locus, n is a locus with neutral height, h is a measure of the heights of loci in signing space, h_c is a measure (given by the context c) of heights of objects in c_w, and $\alpha_c > 0$ is a parameter given by the context c,

$[[\text{IX-i}]]^{c,s,w} = \#$ iff s(i) = # or $\mathbf{|i - n| \neq 0}$ **and** $\mathbf{h_c(s(i)) - h_c(s(n)) \neq \alpha_c(h(i) - h(n))}$. If $[[\text{IX-i}]]^{c,s,w} \neq \#$, $[[\text{IX-i}]]^{c,s,w}$ = s(i).

In words: the height difference between the denotations s(i) and s(n) should be proportional to the height difference between the loci i and n, with a multiplicative parameter $\alpha_c > 0$; in particular, this imposes that orderings be preserved (with the more stringent constraint that distances be preserved *modulo* the parameter α; weaker conditions were also explored in Schlenker et al. 2013). Since bodies are not points, further hypotheses were needed to determine which parts of locus denotations mattered in the relevant ordering; an initial hypothesis is that when it comes to people, their upper bodies matter:

(12) Partial hypothesis (slightly modified from Schlenker et al. 2013)
When evaluating the height of loci denotations,
a. the position of c_a is assessed by considering the real or imagined position of the upper part of the body of c_a in c_w;
b. if s(i) is a person, the position of s(i) corresponds to the position of the upper part of the body of s(i) in c_w.

It was further shown in Schlenker et al. 2013, that the same generalizations hold of ASL reflexive pronouns indexing loci of different heights. For this reason, it is not possible to argue that index pointing alone is affected by height specifications; ASL reflexives, which index loci in a different way (thumb upwards, rather than pointing towards the locus), are subject to the very same locus specifications.

In the present piece, we will argue that (i) the projection-based semantics hinted at in Schlenker et al. 2013 is needed in order to account for the heigh specifications of loci; but that (ii) height specifications share one crucial property of the *phi*-features that have been investigated in spoken languages, in that they can be ignored in the process of ellipsis resolution and focus alternative computation. (The analysis in (11), which solely makes reference to heights, will prove insufficient to capture the fine-grained behavior of loci, and a semantics based on geometric projections will have to be developed as we go [in Section 5.3])

1.3 Elicitation: the 'Playback Method'[8]

Before we introduce our findings, we should say a word about our elicitation method. In ASL and LSF alike, it involved three steps.
(i) First, we elicited sentences of interest with a deaf native signer (Deaf child of Deaf, signing parents). Our emphasis was on the construction of controlled paradigms, usually of two to four sentences. All examples were videotaped.
(ii) Second, we showed the resulting videos to the same signer, asking him to rate the sentences on a 7-point scale.
(iii) Step (ii) was usually repeated several times, often on separate days, in order to assess the stability of our informant's judgments. Unless otherwise noted, ASL judgments are based on a single native Deaf signer (Deaf child of Deaf, signing parents), with repeated judgment tasks on separate days; LSF judgments are based on two native signers (Deaf children of Deaf, signing parents). All the ratings for sentences that didn't appear in earlier publications are found in Appendix II.

Ratings were normally on a 7-point scale, with 7 = best and 1 = worst; when there were different numbers of trials per informant, the first rating gives equal weight to all trials, and the second rating [in

[8] This description is similar to that of Schlenker et al. 2013.

square brackets] gives equal weight to all informants. Thus *1.3 [1.2]* right before a sentence means that the average rating across trials was 1.3, and across informants 1.2. (The present piece is emphatically not an experimental paper, but we hope that our methods could pave the way for one if and when necessary.)

In the following, sign language sentences are glossed in capital letters. Non-manual markings are omitted. Subscripts correspond to the establishment of locations ('loci') in signing space. Letters are assigned from right to left from the signer's perspective. Pronouns, glossed as *IX* (for 'index'), can point back towards previously established loci. In such cases, the locus is suffixed to the pronoun, so that *IX-a* is a pronoun that points towards (or 'indexes') locus *a*; the numbers *1* and *2* correspond to the position of the signer and addressee respectively (importantly, as discussed in connection to (1)b above, indexes can also be used to *establish* a locus). *IX-arc-a* refers to a plural pronoun indexing locus *a,* and *rep* is used when a sign is repeated. An expression signed in locus *a* is transcribed with *a* as a subscript; this is in particular the case of classifiers, e.g. CL_a stands for a classifier signed in locus *a*. When an expression indexes a default locus, we write it without a letter index (e.g. *IX* rather than *IX-a*). Specifications are sometimes added to distinguish different classifiers – e.g. *CL-hang* stands for a classifier denoting a person in hanging position.

2 Uninterpreted features in English: ellipsis and *only*

On one standard theory, some or all *phi*-features have a presuppositional semantics (see for instance Cooper 1983, Schlenker 1999, 2003a,b, Rullmann 2004, Heim 2008, Sauerland 2008, Sudo 2012). In order to argue that some *phi*-features are the result of agreement, we must find cases in which these features are morphologically present but could not be interpreted – which isn't trivial. Consider for instance (13)a, with some possible Logical Forms in (13)b-c. While *her* agrees in features with *Mary*, this is a context in which these features *can* be interpreted: a standard presuppositional semantics for gender features predicts that the deictic analysis in (13)b as well as the bound analysis in (13)c give rise to a presupposition which *is* satisfied by the denotation of the subject.

(13) Let c be the context of utterance, w the world of evaluation (which could be the world of c, c_w), and let s be an assignment function that encodes the referential intentions of the speaker of c. We further assume that Mary is a female individual in the world of the context c and that Mary had homework to do in world w. # encodes presupposition failure.
a. Mary did her homework.
b. *Deictic Logical Form:* Mary did her_i homework,
where the index *i* denotes Mary (i.e. s(i) = the individual Mary)
b'. $[\![\text{did her}_i \text{ homework}]\!]^{c,s,w} = \lambda x$: x is female in c_w and had some homework to do. x did x's homework in w, and hence $[\![\text{did her}_i \text{ homework}]\!]^{c,s,w}([\![\text{Mary}]\!]^{c,s,w}) \neq \#$.
c. *Bound Logical Form:* Mary $\lambda i\ t_i$ did her_i homework
c'. $[\![\lambda i\ t_i \text{ did her}_i \text{ homework}]\!]^{c,s,w} = \lambda x$: x is female in c_w and had some homework to do. x did x's homework in w, and hence $[\![\lambda i\ t_i \text{ did her}_i \text{ homework}]\!]^{c,s,w}([\![\text{Mary}]\!]^{c,s,w}) \neq \#$.

(14) Let c be a context of speech, w a world, and s be an assignment function (with c_a = the author of c; c_w = the world of c). If *f* is a feminine feature and *i* is in index,
$[\![\text{pro-f}_i]\!]^{c,s,w} = \#$ iff s(i) = # or s(i) is not female in the world of c. If $[\![\text{pro-f}_i]\!]^{c,s,w} \neq \#$, $[\![\text{pro-f}_i]\!]^{c,s,w} = s(i)$.

Specifically, in (13)b the coreferential reading can only be obtained if the sentence is evaluated with respect to an assignment function s for which s(i) is Mary; and in such a case, the presuppositional contribution of the gender feature of *her* can be interpreted without difficulty (= no presupposition failure is triggered). The same situation arises in (13)c, though in a more complicated way: in standard trivalent theories of presupposition, assuming the lexical entry in (14), the constituent *λi t_i did her_i homework* has the meaning in (13)c', a partial functions that yields a failure if it is 'fed' an argument x which is not a female that had homework to do. But since the denotation of *Mary* is assumed to be such a female, this problem does not arise.

By contrast, two cases have been discussed in the literature in which features arguably do go uninterpreted.

- *Ellipsis*

Consider ellipsis first. (15)a-b have readily available bound variable readings, but the homologous sentences obtained in (15)a"-b" by making the elided clause overt lack such a reading.

(15) In my study group,
a. Mary did her homework, and John did too.
=> available bound variable reading in the second clause

a'. Mary λi t_i did her_i homework, and John λi t_i did **[do ~~her~~$_i$ homework]** too
a". Mary did her homework, and John did her homework too.
=> no bound variable reading reading in the second clause
b. I did my homework, and John did too.
=> available bound variable reading in the second clause
b'. I λi t_i did my_i homework, and John λi t_i did **[do ~~my~~$_i$ homework]** too
b". I did my homework, and John did my homework too.
=> no bound variable reading in the second clause

The facts in (15)a"-b" are unsurprising if gender and first person features are semantically interpreted (for instance as presuppositions on the value of variables). By contrast, the availability of a bound variable reading in (15)a-b is surprising if VP ellipsis is taken to be resolved by a process that reconstructs a VP that is representationally parallel to its antecedent; it would seem that *phi*-features escape this parallelism requirement. While one might try to do without a representational component altogether in the theory of ellipsis, there are independent obstacles to such an account; for as shown by Rooth 1992, the availability of a bound variable reading in (16)a but not (16)b suggests that the presence of a bound variable in the former but not in the latter makes a crucial difference (the expression *is less than or equal to itself* is intended to be read as downstressed).

(16) a. 5 is (obviously) less than or equal to itself, and (of course) 7 is too.
=> true
b. 5 is (obviously) less than or equal to 5, and (of course) 7 is too.
=> false
c. 5 is (obviously) less than or equal to 5, and (of course) the same is true of 7.
=> true
d. 5 is (obviously) less than or equal to 5, and (of course) 7 is less than or equal to itself too.
=> true
(slightly modified from Rooth 1992)

Rooth proposes that a non-representational theory can provide a natural account of (16)d within a theory based on focus, but that it doesn't suffice for (16)b. As illustrated in (17), Rooth's theory makes use of a squiggle operator ~, which introduces a presupposition to the effect that its right argument (= the index 1 in (17)) should denote a proposition that belongs to the focus value of its left argument (= the clause *[$7_{2,F}$[t_2 is less than or equal to itself$_2$ / 7]]*).

(17) [5 is less than or equal to 5]$_1$ and [$7_{2,F}$[t_2 is less than or equal to itself$_2$]] ~ 1]]

This condition is satisfied in (17): the proposition that 5 is less than or equal to 5 is indeed a proposition (i.e. a semantic object) which is an alternative to the proposition that 7 is less than or equal to itself. According to Rooth, this correctly accounts for the acceptability of (16)d. Now if ellipsis resolution in (16)b didn't have a representational component, we would obtain the same result and make the incorrect prediction that the sentence has an apparent bound variable reading. Since this is not the case, Rooth concludes that ellipsis resolution is sensitive to the form of the antecedent, and more specifically to the presence of bound variables in it. From our perspective, what matters is that once this assumption is in place, one must in addition posit that the representational component is somehow allowed to ignore the barred features in (15)a'-b', for otherwise a presupposition failure would obtain.

In (18)a-b, the same point is made with respect to the contribution of singular and plural features: the elided clause can be interpreted with a bound variable interpretation, but an overt version of the same sentence only yields a strict reading, as shown in (18)a"-b"

(18) *Context:* There is a swimming competition by teams of various sizes. Four German swimmers form a team, as does a single French swimmer.
a. The German swimmers think that they will win, and the French swimmer does too.
a'. [the German swimmers] λi t_i think that they$_i$ will win, and [the French swimmer] λi t_i does **[think that ~~they~~$_i$ will win]** too.
a". The German swimmers think that they will win, and the French swimmer thinks that they will win, too.
=> no bound variable reading
b. The French swimmer thinks that he will win, and the German swimmers do too.
b'. [the French swimmer] λi t_i thinks that he$_i$ will win, and [the German swimmers] λi t_i do **[think that ~~he~~$_i$**

will win] too.

b". The French swimmer thinks that he will win, and the German swimmers think that he will win, too.

It is also important to note that these results probably do not derive from a general quirk of presupposition projection: in (19), there is no clear contrast between the ellipsis construction and its fully explicit equivalent, as both trigger a presupposition that John cheated on the exam (and to the extent that the presupposition of the second conjunct can be 'locally accommodated', this seems to be the case irrespective of the presence of ellipsis).

(19) In my study group,
a. Mary regrets cheating on the exam, but John doesn't.
b. Mary regrets cheating on the exam, but John doesn't regret cheating on the exam.

While the details won't matter until Section 6, we can posit that the representational component of ellipsis resolution is insensitive to the barred elements in (15)a'-b'-(18)a'-b' because of a rule of optional *LF deletion of a feature F under binding by an element that carries F* (e.g. Heim 2008, Stechow 2002); we will talk of feature 'deletion' without necessarily being committed to all the details of this analysis.

❑ *Association with focus*

The same generalizations hold of the bound variable readings obtained under the focus-sensitive particle *only* in (20):

(20) In my study group,
a. only Mary did her homework (... therefore John didn't do his).
a'. only Mary λi t_i did ~~her~~$_i$ homework
a". Mary did her homework and the others didn't do her homework.
=> no bound variable reading
b. only I did my homework
b'. only I λi t_i did ~~my~~$_i$ homework
b". I did my homework and others didn't do my homework.
=> no bound variable reading

(21) *Context:* There is a swimming competition by teams of various sizes. Four German swimmers form a team, as does a single French swimmer.
a. Only the German swimmers think that they are the best (... therefore the French swimmer doesn't think that he is the best).
a'. only the German swimmers λi t_i think that ~~they~~$_i$ are the best.
a". The German swimmers think that they are the best and the French swimmer doesn't think that they are the best.
=> no bound variable reading
b. Only the French swimmer thinks that he is the best.
b'. only the French swimmer λi t_i thinks that ~~he~~$_i$ is the best
b". The French swimmer thinks that he is the best and the German swimmers don't think that he is the best.
=> no bound variable reading

In each of these cases, there is no inference that the alternatives to the subject satisfy the presuppositions imposed by the feature of the pronoun: in (20)a, there is no inference that all group members are females; in (20)b, we certainly don't get an inference that all group members are speakers. In (21)a, there is no inference that all the alternatives to *the German swimmers* are (non-singleton) pluralities; for if this were the case, given our context the sentence would be *trivially* true rather than informative, since *the French swimmer* couldn't be an alternative to *the Germany swimmers*. Similarly, in (21)b there is no requirement that the alternatives to *the French swimmer* be singular, as this would prevent one to draw the inference that *the German swimmers don't think that they (collectively) are the best* (all we could get is an inference that no German swimmer thinks that he – singularly – is the best, but this is insufficiently informative: if the German swimmers are egalitarian-minded, we can still draw from (21)b the inference that they don't think that they, collectively, are the best).

Here too, it would seem that other presupposition triggers pattern differently from *phi*-features:

(22) In my study group,
a. only Mary regrets cheating on the exam.

=> other members [possibly: all other members] of my study group cheated on the exam.
b. Mary regrets cheating on the exam but the others don't regret cheating.
=> other members [possibly: all other members] of my study group cheated on the exam.

Theory-neutrally, we get the same kind of inferences in (22)a as we do in (22)b – possibly that all the other group members satisfy the presupposition of *regret cheating on the exam*, and hence cheated on the exam.[9] This is in sharp distinction to the case of (20)a"-b" and (21)a"-b", which do not behave like (20)a-b and (21)a-b respectively: the latter have a bound variable reading in which the *phi*-features can presumably be ignored, but the former do not have such a reading.

The full analysis of focus-sensitive constructions goes beyond the present paper. Suffice it to say that a rule with the effects stated in (23) would have roughly correct results in standard presuppositional examples, such as (22), but not in (20)-(21).[10]

(23) $[\![\text{only } DP_F\ VP]\!]^{c, s, w} = \#$ iff (i) $[\![DP\ VP]\!]^{c, s, w} \neq 1$, or (ii) for some object x such that x is an alternative to $[\![DP]\!]^{c, s, w}$ in the context of speech c, $[\![VP]\!]^{c, s, w}(x) = \#$. If $\neq \#$, $[\![\text{only } DP_F\ VP]\!]^{c, s, w} = 1$ iff for every object x such that x is an alternative to $[\![DP]\!]^{c, s, w}$ in c, $[\![VP]\!]^{c, s, w}(x) = 0$.

Clause (23)(i) requires that *only* DP_F *VP* presupposes that *DP VP* – hence in (22)a a presupposition that Mary regrets cheating on the exam. Clause (23)(ii) requires that every alternative to the subject should satisfy the presuppositions of the predicate – hence a requirement in (22)a that every member of my study group cheated on the exam. With these assumptions in place, if the gender features of *her* were interpreted in (20)a, we would obtain a presupposition that every member of my study group is female – which is incorrect. This suggests that in this case too the gender features of *her* can be disregarded.

When we turn to ASL and LSF, it will prove difficult to test examples such as (18)b and (21)b, where it is a singular feature that must be disregarded. The reason is that what might initially be described as a singular pronoun appears in both languages to have plural-denoting uses; an example from ASL is given in (24), where the matrix subject is clearly plural but the embedded subject can be either plural or singular.[11]

(24) *Context:* Tomorrow there is an individual swim competition among 10 swimmers.
THREE-arc_a SWIMMER ALL THINK __ WILL BLOW-AWAY MOST OTHER SWIMMER
a. 7 __ = IX-a
b. 7 __ = IX-arc-a
'Three swimmers think that they will dominate most other swimmers.' (ASL; 14, 181; 14, 182; 14, 192)

This will leave us with examples such as (18)a and (21)a. Due to the interpretive contrast between the elided sentence in (18)a and its unelided counterpart in (18)a", the former sentence is a fairly convincing case of an uninterpreted feature. But things are different for (21)a, as the paraphrase in (21)a" is by no means syntactically minimal. In fact, it has been argued on independent grounds that the meaning of plural features is semantically underspecified, and allows plural variables to range over singleton individuals, as is the case in (25) – which is falsified if at least one of my students solved *one or several* difficult problems.

(25) None of my students has solved difficult problems (Spector 2007)

The non-singularity inference is thus taken by several authors (e.g. Sauerland 2005, Spector 2007) to be a pragmatic inference rather than a semantic one. Importantly, this singularity inference is not expected to arise in the scope of negative operators; and since *only* displays the behavior of such an operator (for instance in its ability to license NPIs in English), we will not learn much from the appearance of plural loci under *ONLY* in sign language; by contrast, ellipsis environments will prove informative.

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[9] We are glossing over some complexities of *regret*, in particular the fact that *John regrets Q-ing* plausibly presupposes lexically that *John believes that he Q-ed*; a further step of strengthening is then needed to derive the inference that John *in fact* Q-ed. In our context, the latter presupposition is rather clear, and hence we don't discuss how it is obtained from the weaker presupposition. (Note that we selected *regret* as a trigger because it triggers rather strong presuppositions.)

[10] See Schlenker 2009 (Appendix E) for a discussion of presupposition projection under *only* which is broadly compatible with this analysis.

[11] Note that this example does not involve Role Shift.

3 Uninterpreted plural features

We start by considering uninterpreted instances of plural features of the *arc* variety (= produced with a semi-circual motion of the index finger), which were shown in Schlenker et al. 2013 to have some iconic uses. As explained, if sign language plural features have the same underspecified semantics as spoken language plural features, the ellipsis test will be more informative than the *only* test; still, for completeness, and for comparison with height specifications, we include results for both tests.

3.1 Uninterpreted plural features in ASL

We considered two environments that arguably involve ellipsis because they have a missing VP: sentences of the form *DP SAME*[12], as in (26); and sentences of the form *DP NOT,* as in (27).[13]

(26) *Context:* Tomorrow there is a swimming competition. A team of 6 French swimmers competes against a single German swimmer.

7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-b[14] GERMAN SWIMMER SAME-a,b.
Preferred reading: bound variable (= the German swimmer likes people who support him)
'The 6 French swimmers like people who support them. The German swimmer does, too.' (ASL; 17, 37; 17, 39; 17, 60; 17, 68; 17, 140)

(27) *Context:* Tomorrow there is a swimming competition. A team of 6 French swimmers competes against a single German swimmer.

7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-b GERMAN SWIMMER NOT.
Preferred reading: bound variable (= the German swimmer does not like people who support him).
'The 6 French swimmers like people who support them. The German swimmer doesn't.' (ASL; 17, 36; 17, 38; 17, 59; 17, 67; 17, 139)

We believe it is important not to draw inferences on the basis of *SAME* alone. The reason is that *SAME* could be construed as a predicate meaning roughly *is similar* (in fact, *SIMILAR* is a standard gloss for it); if so, the construction under investigation might not involve VP ellipsis at all, but just some implicit arguments that must be resolved to determine to whom and in what respects the subject is claimed to be similar. The difference matters: as we saw in Rooth's contrast between (16)b and (16)c, non-elliptical constructions with *same* do not always offer a good diagnostic for the presence of bound variables. We will see in Section 6.1 that the presence of a bound variable in the antecedent is in fact crucial to obtain a bound variable reading, which might alleviate this worry. Still, missing VPs with *NOT* offer a useful complement to constructions based on *SAME*; for unlike *SAME,* it's unlikely that *NOT* on its own can serve as a predicate, as the word is clearly a negation. Thus it is likely that such constructions do genuinely involve ellipsis of a constituent that includes at least the VP.

While the context and the presence of the singular pronoun *IX-b* made it clear that there was a single German swimmer, the semantic question following was (erroneously) stated with a plural (= *do we infer that the German swimmers like [or: do NOT like] (i) people who support their own team? (ii) people who support the French team?)*. But it is thus worth noting that the bound variable reading was also available in examples that were constructed somewhat differently: in (28) and (29), the context was heavily biased towards a bound variable reading, and the sentences were acceptable; furthermore, when their interpretation was checked (with a singular, this time: *do we infer that the German swimmer,* etc.), it was indeed a bound variable one.

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[12] We primarily tested the agreeing version of *SAME* (with a Y shape, sometimes glossed as *SIMILAR,* as in http://www.signingsavvy.com/sign/SIMILAR/17/1). Initial tests with an alternative, non-agreeing version of *SAME* (with two index fingers brought together, as in http://www.signingsavvy.com/sign/SAME/368/1) yielded similar results (17, 25; 17, 26).

[13] We come back to these sentences as part of longer and more controlled paradigms in Section 6.

[14] *IX-b* seems to be partly merged with *GERMAN*.

(28) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer.

RS_____
EVERYONE LIKE WHAT PEOPLE LIKE IX-1. SO

IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT IX-arc-a. THAT_b GERMAN SWIMMER SAME-a,b.
Preferred reading: bound reading
'Everybody likes people who like him.[15] So the 11 French swimmers like the people who support them, and that German swimmer does too.' (ASL; 14, 227; 14, 228; 17, 1)

(29) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer.

RS_____
$[\text{FRENCH PEOPLE}]_a$ LIKE WHAT PEOPLE LIKE IX-1. WAIT(ONE) OPPOSITE COMPARE $[\text{GERMAN PEOPLE}]_b$ OFTEN HATE SELF-b.
RS_____
IX-b LIKE WHAT PEOPLE LIKE OTHER PEOPLE. SO

IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT IX-arc-a. IX-b GERMAN SWIMMER NOT.
Preferred reading: bound variable
'French people like people who like them, whereas Germans are often self-hating. So the 11 French swimmers like people who support them, but the Germanswimmer doesn't.' (ASL; 17, 23; 17, 24)

For completeness, we show that similar data can be found with *only* constructions, although for reasons outlined above (= the weak semantics of plurals in downward-monotonic environments) this is not particularly informative.

(30) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer.

RS_____
$[\text{FRENCH PEOPLE LIKE WHAT}]_a$ PEOPLE LIKE IX-1. WAIT(ONE) OPPOSITE COMPARE $[\text{GERMAN PEOPLE}]_b$ OFTEN HATE SELF-b.
RS_____
IX-b LIKE WHAT PEOPLE LIKE OTHER PEOPLE. SO
ONLY IX-arc-a ELEVEN FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.**
Preferred reading: bound variable
'French people often like themselves. By contrast, German often hate themselves. For this reason, only the eleven French swimmers like people who support them.' (ASL; 14, 241; 14, 242; 17, 11; 17, 20)

3.2 Uninterpreted plural features in LSF

We now extend our main results to LSF. There were some non-trivial differences of judgments between our two LSF informants when it came to bound variable readings. One, IJ, freely accepted bound readings in sentences that neither involved reflexive pronouns nor Role Shift, a context-shifting operation whereby the signer adopts another character's perspective. The other informant, IH, often dispreferred bound readings unless Role Shift or a reflexive was used. Importantly, the preference for strict readings was found even in the absence of any feature mismatch.[16] As we will see in Section 4.2, the same signer allowed for

[15] Here and in other constructions involving Role Shift and *WHAT* below, the sentence is a rhetorical question-answer construction, akin to: *What does everyone like? People who like me* – but crucially with the answer signed under Role Shift. (Thanks to anonymous referee for suggesting that this point be clarified.)

[16] An example of the difference between IH and IJ is given in (i) and (ii); note that the fact that *PERSON* is not repeated shows that we are talking about singular individuals. We provided more iterations of the judgments for IH than for IJ because the latter's acceptance of bound readings (including in cases of feature mismatch) wasn't in doubt in other examples. By contrast, it was important to establish that IH preferred strict readings *even* when the bound reading could be obtained without any feature mismatch.

bound variable readings with feature mismatch when reflexives were used with high loci. But this measure couldn't easily be used here, as he does not distinguish between a singular and a plural form of the reflexive.[17] Thus in the rest of this section, we will focus on IJ's judgments, and correspondingly add *IJ* as a superscript on the ratings.

As was the case for our ASL examples, we explored two environments that might trigger ellipsis, involving *SAME,* as in (31), and *NOT,* as in (32). For reasons already outlined in our discussion of ASL data, we think the examples with *NOT* are a better test of VP ellipsis than sentences with *SAME*. For informant IJ, both environments gave rise to bound variable readings (in fact, they were preferred).

(31) *Context:* There is a swimming competition by teams. The French team has a member. The German team has four.

7^{IJ} FOUR SWIM$_b$ GERMAN THINK IX-arc-b SWIM GOOD. PERSON$_a$ SWIM FRENCH SAME.
Reading^{IJ}: bound variable
'The four German swimmers think that they swim well. The French swimmer does, too.' (LSF; 29, 16; 29, 18; 30, 26; 30, 75; 30, 113 [IH 29, 29; 30, 85])

(32) *Context:* There is a swimming competition by teams. The French team has a member. The German team has four.

6.5^{IJ} FOUR SWIM$_b$ GERMAN THINK IX-arc-b SWIM GOOD. PERSON$_a$ SWIM FRENCH NOT.
Reading^{IJ}: bound variable[18]
'The four German swimmers think that they swim well. The French swimmer does not.' (LSF; 29, 17; 29, 19; 30, 27; 30, 76; 30, 114 [IH: 29, 30; 30, 86])

Context [= the same for (i) and (ii)]: There is a swimming competition by teams. The French team has only 1 member. The German team has 4.

(i) PERSON$_b$ SWIM GERMAN THINK IX-b SWIM GOOD. PERSON$_a$ SWIM FRENCH SAME.
IH: *strict reading* [3 judgments]; IJ: *bound variable reading* [1 judgment]
'A German swimmer thinks that he swims well. The French swimmer does, too.' (LSF; 30, 87; 30, 89; 30, 11; 31, 10; 31, 27)

(ii) PERSON$_b$ SWIM GERMAN THINK IX-b SWIM GOOD. PERSON$_a$ SWIM FRENCH NOT.
IH: *strict reading* [3 iterations]; IJ: *bound variable reading* [1 iteration]
'A German swimmer thinks that he swims well. The French swimmer doesn't.' (LSF; 30, 88; 30, 90; 30, 116; 31, 11; 31, 28)
(While the data above seem robust for IH, he did occasionally obtain bound variable readings in the absence of Role Shift or of a reflexive, hence more work is needed on this issue.)

[17] One might explore a slightly different strategy in the future. While for IH the reflexive pronoun appears to be number-neutral, it can co-occur with a normal plural pronoun, as shown by the rating in (ib').

(i) a. 5^{IH} SARKOZY LIKE SELF-a.
'Sarkozy likes himself.'
b. 4.5^{IH} SARKOZY LIKE IX-a SELF-a.
'Sarkozy likes himself.'
a'. 1.5^{IH} PERSON-rep POLITICIAN LIKE SELF-a.
'Politicians like themselves.'
b'. 6^{IH} PERSON-rep POLITICIAN LIKE IX-arc-a SELF-a.
'Politicians like themselves.'
(LSF; 31, 8; 31, 9; 31, 26)

Thus one could attempt to force bound variable readings while investigating cases of number mismatch by constructing sentences like (ib') with a plural pronoun co-occurring with a reflexive pronoun.

[18] Due to a typo in our written semantic question, the question involved an erroneous double negation for the bound variable option, namely: 'does one understand that the French swimmer does not think that he himself swims badly' (we meant 'well'). But it is clear in the LSF video recordings of IJ's answer that he understood the question as we meant it (29, 19; 30, 27; 30, 76; 30, 114).

We also tested environments with *ONLY*, and here too informant IJ allowed for bound variable readings in the presence of feature mismatch.

(33) *Context:* There is a swimming competition by teams. The French team has a member. The German team has four.

7^{IJ} FOUR PERSON-rep$_b$ SWIM$_b$ GERMAN ONE PERSON$_a$ SWIM FRENCH ONLY[19] IX-arc-b THINK IX-arc-b SWIM GOOD.
Reading^{IJ}: bound variable available (not necessarily the only available reading)[20]
'Only the four German swimmers think that they swim well.' (LSF; 30, 81; 30, 82; 30, 120 [IH 30, 93])

We conclude that with respect to ellipsis and alternative computation, ASL informant JL and LSF informant IJ allow for bound variable readings that require that a feature be disregarded (IH's preference for strict readings made it hard to test this phenomenon with him). It might thus be tempting to conclude that ASL and LSF plural features behave *in every respect* like their English counterparts. But as we saw at the outset, this isn't the case: when they are embedded within each other, plural ASL and LSF loci give rise to 'complement set' readings that are not available in English. Thus the conclusion should be that *despite* their ability to give rise to 'iconic' readings, plural ASL and LSF loci also display the formal behavior of *phi*-features. (As we will see in Section 6, we will not be able to conclude that they necessarily *are* features, but at least that they must be *separable* from the loci they apply to.)

4 Uninterpreted Height Features

While plural loci have a clear counterpart in English, this is not the case of high and low loci. We now suggest that these have in some respects the behavior of *phi*-features. First, as argued in Schlenker et al. 2013, their detailed semantics is (in one informant's ASL) resminiscent of that of gender features. Second, height specifications can be ignored in ellipsis and focus-sensitive constructions.

4.1 Height Features in ASL

4.1.1 Detailed Semantics[21]

The lexical entry Schlenker et al. (2013) gave for height specifications was indexical: in each case, the denotation of the relevant variable is constrained to have a certain property *in the world of the context* c rather than in world of evaluation w. The indexical ingredient of the rule is encoded in the underlined part of (34)a (which already appeared in (11)): the measure function h_c provided by the context c measures the height of denotations *in world c_w of the context c*. In this respect, the rule was modeled after a simple analysis of gender features, given in (34)b, whose indexical contribution is also uderlined.

(34) Let c be a context of speech, s an assignment function and w a world (with c_w = the world of c).

a. If *i* is a locus, *n* is a locus with neutral height, h_c is a measure (given by the context c) of heights of objects in c_w, and $\alpha_c > 0$ is a parameter given by the context c,

$[[\text{IX-i}]]^{c,s,w} = \#$ iff s(i) = # or $\mathbf{|i - n| \neq 0}$ **and** $\mathbf{h_c(s(i)) - h_c(s(n)) \neq \alpha_c(h(i) - h(n))}$.
If $[[\text{IX-i}]]^{c,s,w} \neq \#$, $[[\text{IX-i}]]^{c,s,w}$ = s(i).

b. If *f* is a feminine feature and *i* is in index,
$[[\text{pro-f}_i]]^{c,s,w} = \#$ iff s(i) = # or **s(i) is not female in the world of c**. If $[[\text{pro-f}_i]]^{c,s,w} \neq \#$, $[[\text{pro-f}_i]]^{c,s,w}$ = s(i).

The indexical nature of (34)b made an important difference in intensional environments, as shown in (35):

[19] This word can also be translated as 'unique'. It is a repeated version of the word found at http://www.lsfplus.fr/multidico/?signe=unique.
[20] The same problem as in fn. 18 arose when we first tested the sentence with IJ (30, 82), and it was corrected in the second test (30, 120). In the first trial, IJ took the sentence to be ambiguous; but unlike what the case in the videos discussed in fn. 18, he did not paraphrase the two readings, and hence it is not possible to check exactly how he understood the semantic question.
[21] This section directly borrows its material from Section 3.3. of Schlenker et al. 2013.

(35) Bill wore a dress and make-up and John didn't realize that he was a man. He said that he/#she looked great and that he/#she was staring at him. (Sharvit 2008)

The embedded pronouns *he/#she* have the semantics of variables, and given the discourse they refer to the individual Bill. If the feminine features were interpreted with respect to the world of evaluation, we would obtain a De Dicto reading and *she* would be acceptable, contrary to fact. The data thus suggest that these features are interpreted with respect to the world of the actual context rather than with respect to the worlds (or contexts) compatible with what John said.

Schlenker et al. 2013 argued that in their ASL data high loci have an analogous behavior: in (36)a, the 'high locus' component of *IX-b* can apparently not be read De Dicto, for if it could, the discourse would make perfect sense given the first sentence. The judgments can be explained if the 'high locus' component is obligatorily read *de re*, as is predicted by the indexical lexical entry in (34):

(36) POSS-1 COUSIN IX-a WRONGLY THINK POSS-1 YOUNG BROTHER TALL. IX-a THINK IX-b$^{high/normal}$ BASKETBALL PLAYER.
a. 3 High locus
b. 7 Normal locus
'My cousin wrongly think that my younger brother is tall. He thinks he is a basketball player.' (ASL; 10, 66; 67; 11, 11; 11, 79)

If *WRONGLY THINK* in (37) is replaced with *KNOW*, the sentence becomes acceptable with a high locus:

(37) POSS-1 COUSIN IX-a KNOW POSS-1 YOUNG BROTHER TALL. IX-a WRONGLY THINK IX-b$^{high/normal}$ BASKETBALL PLAYER.
a. 7 High locus
b. 7 Normal locus
'My cousin knows that my younger brother is tall. He wrongly thinks he is a basketball player.' (ASL; 10, 68; 69; 11, 12; 11, 80)

This is as expected given our semantics: the first sentence of (37) is factive, unlike its counterpart in (36); as a result, it establishes that the brother is tall in the world of the context, which licenses the use of a high locus in the second sentence.

As noted in Schlenker et al. 2013, the indexical analysis of gender features encounters difficulties in more involved examples, such as (38):

(38) My students wrongly think that I have a sister, and they are convinced that <u>she</u> is basketball player.

The problem is that the first sentence establishes that the speaker has no sister, and hence it isn't clear what it means for the denotation of the underlined pronoun to be female *in the actual world* (which individual is the pronoun supposed to denote in that world?). An analysis is needed to explain why this case allows for something more than the De Re reading we posited for our earlier examples. Descriptively, it appears that when the antecedent of the pronoun has no existential import with respect to the actual world, the gender features of the pronoun can be interpreted with respect to counterfactual worlds. The analysis of this phenomenon is a matter of debate (see Yanovich 2010 and Sudo 2012 for recent discussions). But it is interesting to note that the same data and hence difficulties arise with high loci, as shown by (39); importantly, the 4-sentence set was signed on a single video, and judgments were thus obtained in a contrastive fashion.

(39) a. POSS-1 BROTHER SHORT BUT POSS-1 STUDENT IX-arc-a THINK POSS-1 BROTHER TALL. IX-arc-a THINK IX-a$^{high\ /\ normal}$ BASKETBALL PLAYER.
1. 4 High locus
2. 7 Normal locus
'My brother is short, but my students think my brother is tall. They think he is a basketball player.'
b. IX-1 HAVE NO BROTHER, BUT POSS-1 STUDENT IX-arc-a THINK IX-1 HAVE TALL BROTHER. IX-arc-a THINK IX-b$^{high\ /\ normal}$ BASKETBALL PLAYER.
1. 7 High locus
2. 5.8 Normal locus
'I have no brother, but my students think I have a tall brother. They think he is a basketball player.'
(ASL; 10, 81; 82; 96; 11, 14; 11, 22; 11, 81)

The judgments in (39)a replicate the type of paradigm we saw in (36): a De Dicto interpretation of the contribution of the high locus appears to be degraded. By contrast, when the antecedent has no existential import with respect to the actual world, the De Dicto interpretation becomes available: in (39)b1, the 'high locus' component of *IX-b* is interpreted relative to the worlds compatible with respect to the students' beliefs.

Importantly, the semantic results discussed in this section show that there is a non-trivial interpretive property – namely, an indexical interpretation in some cases but not in others – which is common to height specifications and to gender features. While the results reported in Schlenker et al. 2013 were stable for one ASL signer, they would need to be replicated with other ASL signers, and they have yet to be tested in LSF or other sign languages. But even if the generalization could be established more strongly, it wouldn't prove that height specifications are the formal analogues of *phi*-features, only that they have an indexical semantics which is reminiscent of their behavior. It is thus interesting to ask whether height specifications of loci give rise to agreement-like phenomena, as *phi*-features do. We now turn to ellipsis and focus constructions and suggest that in these environments height specifications can be semanticaly ignored while morphologically present, just like *phi*-features.

4.1.2 Ellipsis and focus constructions

Strikingly, height specifications of loci can be ignored in ellipsis and focus constructions. As in the case of plurals, we investigated environments with missing VPs triggered by *SAME* and *NOT*, and we also explored examples with *ONLY*. For reasons noted above, we take examples with *NOT* to be of greater theoretical import than examples with *SAME*. In all cases, we found the same generalization:
–Both a high locus and a normal locus are acceptable to refer to a giant in an intial sentence. Using a low locus is of course degraded.
–A second sentence with *SAME, NOT* and *ONLY* preferably gave rise to a bound variable reading – despite the fact that in our examples this required that a high locus be ignored (because the second sentence directly or indirectly made reference to a short person).
The facts are illustrated in (40) (*SAME),* (41) (*NOT*), and (42) *(ONLY)*.

(40) *Context:* Tomorrow there is a swimming competition. A French team with a giant in it competes against a German team with a dwarf[22] in it.
[FRENCH VERY HEIGHT[23] MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON$_b$ SAME-a,b.[24]
a. 7 **IX-a** = high locus
Preferred reading: bound variable
b. 7 **IX-a** = normal locus
Preferred reading: bound variable
c. 4.5 **IX-a** = low locus
Preferred reading: bound variable
'The very tall French man likes people who support him. The short German person does, too.' (ASL; 17, 62; 17, 65; 17, 75)

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[22] Below we use *short person* instead of *dwarf* whenever possible. But when the context appeared in English in the document in which the informant entered his judgments, we have kept the original words, including *dwarf*.

[23] We asked the signer to use the vertical version of the sign for *MEASURE* rather than the standard word for *TALL* (seen for instance at http://www.signingsavvy.com/search/tall). The reason was that the latter sign involves a movement upwards and could be taken to introduce a morphological bias in favor of high loci. This is not the case of the sign used here.

[24] Slightly different results were obtained when agreeing *SAME* was replaced with a non-agreeing form (which can be glossed as *IDENTICAL*):
(i) [FRENCH VERY TALL MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON SAME.
a. 6 **IX-a** = high locus
Preferred reading: Session 1: bound variable; Session 2: strict
b. 6 **IX-a** = normal locus
Preferred reading: Session 1: bound variable; Session 2: bound variable or strict
c. 3.5 **IX-a** = low locus
Preferred reading: bound variable
(ASL, 17, 63; 17, 66, 17, 76)

(41) *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[25] HEIGHT MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT-PERSON NOT.
a. 7 **IX-a** = high locus
Preferred reading: bound variable
b. 7 **IX-a** = normal locus
Preferred reading: bound variable
c. 5 **IX-a** = low locus
Preferred reading: bound variable
'The very tall French man likes people who support him. The short German person doesn't.' (ASL; 17, 61; 17, 64; 17, 69; 17, 141)

(42) *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**.
a. 7 **IX-a** = high locus
Preferred reading: bound variable
b. 7 **IX-a** = normal locus
Preferred reading: bound variable
c. 5 **IX-a** = low locus
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; 17, 72; 17, 98; 17, 142)

4.2 Height Features in LSF

As noted, one of our LSF informants has a strong preference for strict readings unless the target sentence involves a reflexive pronoun or Role Shift. While he initially found reflexives less than perfect in the third person (preferring a strategy with Role Shift and a 1st person reflexive pronoun), these allowed us to obtain data on bound readings with height mismatches from both of our LSF informants; this is because reflexives pattern like normal pronouns in allowing for high and low indexing[26].

Examples with missing VPs give rise to the same generalizations as in ASL: bound readings are possible (in fact, due to the presence of the reflexive, they appear to be obligatory); and they also arise in the presence of a high locus specification that must be ignored in the resolution of ellipsis or in the computation of focus alternatives. By contrast with our ASL data, where use of a high locus was optional to denote a tall individual, high loci appear to be preferred in this case in our LSF data.

(43) GIANT$_a$ LIKE **SELF-a**. SHORT-PERSON$_b$ SAME.
a. 6 [6.2] **SELF-a** = high locus
Bound variable reading in 2 trials out of 3
b. 4 [4] **SELF-a** = normal locus
Bound variable reading in 2 trials out of 3
c. 1.3 [1.2] **SELF-a** = low locus
Bound variable reading in 2 trials out of 3
'The giant likes himself. The short person does, too.' (ASL; 28, 58; 28, 59; 28, 80; 31)

(44) GIANT$_a$ LIKE **SELF-a**. SHORT-PERSON$_b$ NOT.
a. 6 [6.2] **SELF-a** = high locus
Bound variable reading in 2 trials out of 3
b. 4 [4] **SELF-a** = normal locus
Bound variable reading in 2 trials out of 3
c. 1.3 [1.2] **SELF-a** = low locus

[25] Here and elsewhere, *VERY* is the sign which is sometimes glossed as *WOW* (thanks to an anonymous referee for this remark).
[26] This holds in ASL as well; the data we have in this respect parallel those with non-reflexive pronoun that were discussed in Section 4.1.2. ASL reflexive pronoun with height specifications are discussed in Section 5.1 below.

Bound variable reading in 2 trials out of 3
'The giant likes himself. The short person doesn't.' (ASL; 28, 60; 28, 61; 28, 81; 31, 2)

(45) $GIANT_a$ $SHORT\text{-}PERSON_b$ IX-a ONLY LIKE **SELF-a**.
a. 6 [6.2] **SELF-a** = high locus
Bound variable reading in 2 trials out of 3
b. 4 [4] **SELF-a** = normal locus
Bound variable reading in 2 trials out of 3
c. 1.3 [1.2)] **SELF-a** = low locus
Bound variable reading in 2 trials out of 3
'Among the giant and the short person, only the former likes himself.' (ASL; 28, 62; 28, 63; 28, 82; 31, 3)

Our data thus suggest that when bound variable readings are available to begin with, they remain available in case a high locus specification must be disregarded by ellipsis resolution or focus computation, which makes these specifications similar in this respect to *phi*-features.

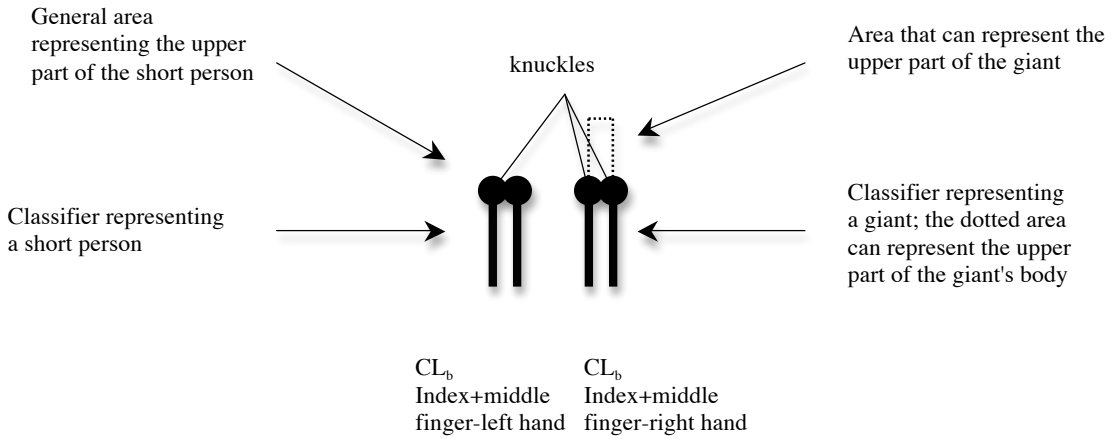
5 Correlating iconic use and feature deletion

In Section 4, we investigated the behavior of high, normal and low locus specifications to refer to people of different heights. While it was shown in Schlenker et al. 2013 that these features have highly iconic uses, the data of Section 4 do not show this. This leaves open two theoretical possibilities.
Possibility I: Height specifications display a dual behavior.
(i) In some cases, they behave as *phi*-features and are therefore erasable in *only* and ellipsis constuctions, but in that use they just characterize the height of the denoted individuals, with no iconic component (e.g. a high locus is constrained to denote tall individuas, a low locus is constrained to denote short individuals, but the semantics makes no reference to geometric projections).
(ii) In other case (discussed in Schlenker et al. 2013), height specifications have a genuinely iconic semantics, but they *fail* to display the grammatical behavior of *phi*-features, and thus cannot be disregarded in *only* and ellipsis constructions.
Possibility II: Height specifications display a unified behavior: in all cases, their display the grammatical behavior of *phi*-features and their semantics is iconic. In particular, height specifications can always be disregarded in *only* and ellipsis constructions, even when they have a highly iconic semantics.

In this section, argue against Possibility I and in favor of Possibility II. Specifically, we investigate ASL and LSF examples that make full use of the projective properties of loci, but which also involve contexts of feature deletion – and we show that one and the same token can simultaneously display a highly iconic and a highly grammatical behavior. This is achieved by considering sentences in which (i) the individuals mentioned are in various positions, represented by finger classifiers [so as to see the effect of fine-grained geometric requirements on the mapping between loci and their denotations], (ii) individuals of various heights are mentioned [so as to rule out a superficial analysis in terms of the morphology of the classifier rather than its denotation], and (iii) a clause with ellipsis is added which could not be interpreted without a process akin to feature deletion. For reasons we will come to, our results are somewhat clearer in LSF than in ASL.

In order to motivate the discussion of people in odd positions, we considered situations in which astronauts had to train in a variety of positions. The situations involved a tall and a short astronaut (or a giant and a short person), each represented (in each language) by a two-finger classifier, as in (46). We then described minimally different situations in which the individuals' bodies were rotated in different ways; we wanted to see whether the points indexed would then be displaced in accordance to a geometric projection.

(46) Giant and short astronauts: schematic representation (from the signer's perspective)



In line with (12)a, we will assume that a pronoun usually points towards the area of a locus which is the projection of the *upper part* of the body of the denoted individual. As a result, we expect that when the latter is rotated, so is the point targeted by the pronoun. We will argue that this prediction is borne out.

5.1 Deletion of iconic features in ASL

We start with the ASL paradigm in (47) (the first two sentences, which just set up the context, were signed once per video; the rest – starting with *IX-a HEIGHT* – was signed in versions and a. and b.):

(47) HAVE TWO ROCKET PERSON [ONE HEIGHT]$_a$ [ONE SHORT]$_b$. THE-TWO-a,b PRACTICE DIFFERENT VARIOUS-POSITIONS [positions shown].

IX-a HEIGHT IX-b SHORT, **CL$_a$-[position]-CL$_b$-[position].**
'There were two astronauts, one$_a$ tall, one$_b$ short. They trained in various positions [positions shown]. They were in [___] position.

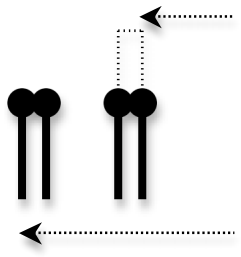
a. IX-a_upper_part LIKE SELF-a_upper_part. IX-b_lower_part NOT.
The tall one liked himself. The short one didn't.'

b. IX-a_upper_part LIKE SELF-a_upper_part. IX-b_lower_part NOT LIKE SELF-b_upper_part.
[intended:] The tall one liked himself. The short one didn't like himself.'
(ASL; 17, 178; 17, 179; 17, 180; 17, 181)

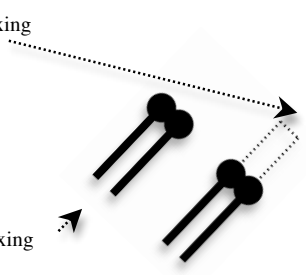
Our goal was to show that (i) 'tall person' indexing could be higher than 'short person' indexing; that (ii) the indexed position could rotate in accordance with the position of the denoted person on the assumption that there was a geometric projection between the structured locus and the denoted situation; and that (iii) this 'upper part of body' position could be ignored in the course of ellipsis resolution. Thus (47) (i) makes reference to a tall and to a short individual, and (ii) they are rotated as shown in (48); finally, (iii) the comparison between the second sentence of (47)a and the second sentence of (47)b makes it possible to assess whether copying the height features of the first sentence could lead to an interpretable result. We display in (48) the approximate target of upper part vs. lower part indexing in the various situations, with the same conventions as in (46), and with the finger classifiers rotated to represent different positions of their denotations.

(48) Tall vs. short person rotations – schematic representation from the **signer's perspective**

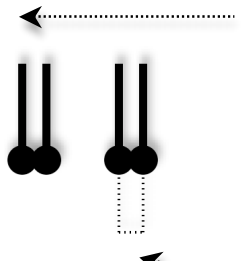
1. Vertical position, heads up



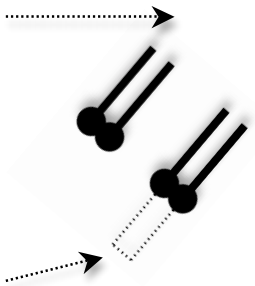
3. Diagonal position, heads up



2. Vertical position, heads down



4. Diagonal position, heads down



(49) Results

	Readings	1. Vertical, heads up	2. Vertical, heads down	3. Diagonal, heads up	4. Diagonal, heads down
a. IX-b_lower_part NOT	bound variable (all cases)	6	5.5	6.5	6
b. IX-b_lower_part NOT LIKE SELF-b_upper_part	bound variable (all cases)	3	3.5	3	3.5
Videos		17, 178; 17, 182; email	17, 179; 183; email	17, 180; 17, 184; email	17, 181; 17, 185; email

In the first sentence of each discourse (= *IX-a_upper_part LIKE SELF-a_upper_part*), the upper part of the locus is targeted by the pronoun *IX-a* and by the reflexive *SELF-a*. Importantly, however, it is not the case that the target locus is 'high' (in absolute terms) in all cases: as the denoted person is rotated, so is the structured locus (namely *a)* that denotes it – and as result, in 'upside down' situations the upper part of the locus is in fact *low* in signing space. The second sentence of each discourse comes in two versions, both starting with a subject pronoun (namely *IX-b_lower_part*) that targets the 'lower part' of locus *b* to denote a short person. In the first version (= a. in (47) and (49)), a bare negation *NOT* is found – presumably followed by an elided VP. The result is in all cases rather acceptable. In the second version (= b. in (47) and (49)), a full VP is found with a reflexive with an 'upper part' specification copied from the antecedent clause. This gives rise to a mismatch between the height specification of the subject *IX-b_lower_part* of the second clause and its object pronoun *SELF-b_upper_part* – and the result is in all cases deviant.

In this paradigm, then, (i) the locus *a* is used iconically, in the sense that its position in signing space depends on the precise position of the upper part of the body of the denoted individual. Furthermore, (ii) this does not seem to be the result of a purely morphological requirement whereby a particular part of the two-finger classifier must systematically be used for purposes of anaphora, since different levels can be targeted depending on whether the denoted individual is tall or short (in particular, it cannot be argued that

it is a simple morphological fact that indexing must in all cases target the knuckles of the finger classifier: when a tall person is denoted, other positions can be targeted). Finally, (iii) the height specification of locus *a* displays the behavior of a *phi*-feature in that it can be disregarded in the course of ellipsis resolution – for otherwise we couldn't explain the contrast between (47)a and (47)b (at least on the assumption that ellipsis has a strong representational component).

This paradigm is by no means perfect, however.

–First, 'lower part' indexing was really quite low, as very roughly represented in (48); for instance, in the 'upright' situation, *IX-b* targets a position *under* the classifier representing the short astronaut. From an iconic perspective, this is puzzling: one would expect that when a short person is denoted, the part of the classifier corresponding to the head is targeted – but certainly it shouldn't be *under* the classifier position in the 'upright' situation. It is possible, of course, that the initial introduction of the two classifiers (in bold in (47)) did not provide a faithful indication of the position of the relevant structured loci; or it could be that pointing just isn't that precise in that case.

–Second, we didn't attempt to assess how good 'upper part' indexing is relative to, say, 'neutral' indexing. We tried to do so in two richer paradigms, with partly unclear results (which is why they are not reported here). In particular, it seemed that in 'vertical, heads down' situations the expected effects (whereby 'upper part' indexing should target a *lower* position than 'lower part' indexing) were at best quite weakened.

–Third, more sophisticated methods – probably experimental ones – would be needed to assess in detail which points are targeted in each case. We leave this point for future research.

5.2 Deletion of iconic features in LSF

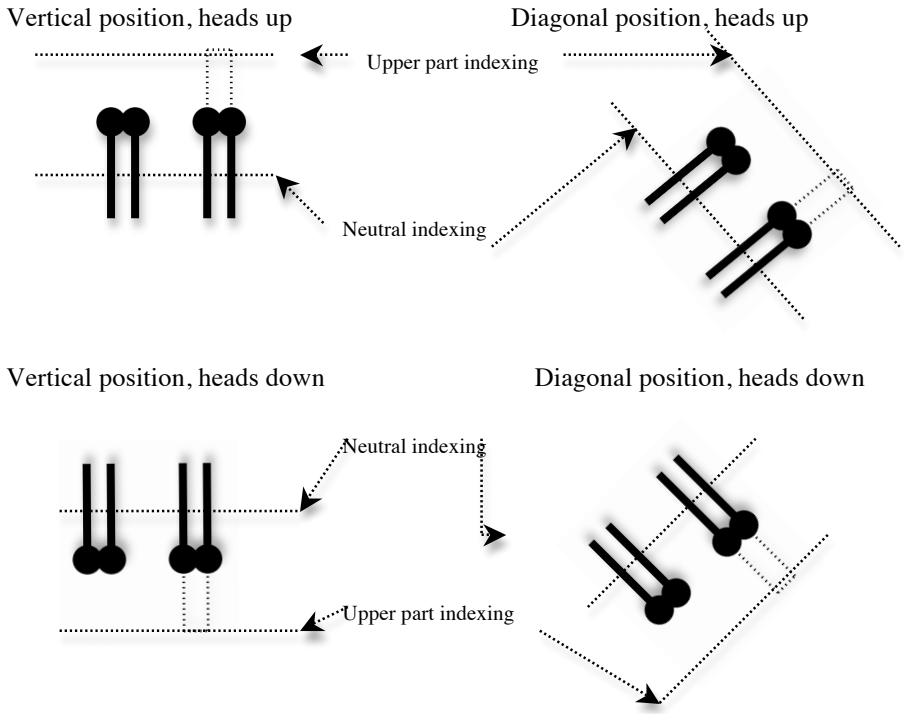
We now turn to LSF, where we partly obtained clearer results. The general context (which was not systematically repeated when the informant had seen earlier relevant examples) is described in (50):[27]

(50) TIME TRAINING GLOBE EARTH PERSON$_a$-moving ASTRONAUT IX-a MUST TRAIN POSITION FIXED [position 1 position 2 position 3].
'During training, astronauts must train to remain in fixed position in various situations relative to the earth' (LSF; 28, 120)

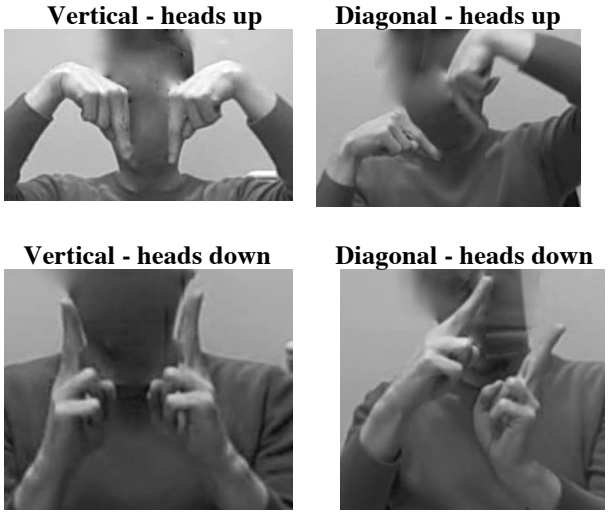
In all cases, the giant classifier was on the right and the short person classifier was on the left (from the signer's perspective), as is shown in (51); relevant frames of the classifiers appear (from the addressee's perspective) in (52).

[27] In hindsight, the context wasn't optimal, as it suggested that astronauts remained in upright position but that this was relative to various parts of the earth (above, below, etc.). The example sentences themselves included an explicit statement of the astronauts' precise body position, hence we do not think that this undesirable feature of the context had much effect on the results.

(51) Giant and short person: rotations – schematic representation from the **signer's perspective**



(52) Giant and short person: video frames from the **addressee's perspective**



Our target sentences are in (53). The first sentence was signed once per video, followed by three versions of the second sentence (for *GIANT* and *SHORT-PERSON*, we selected words that are signed at normal levels in signing space, so as not to introduce any morphological bias).

(53) *Context:* Giants are often self-satisfied.

PERSON$_a$ GIANT CL-two_fingers-[position]$_a$[28] PERSON$_b$ SHORT-PERSON CL-two_fingers-[position]$_b$ THE-TWO-a,b TRAIN.
CL-two_fingers-[position]$_a$-CL-two_fingers-[position]$_b$. IX-a LIKE SELF-a, IX-b NOT.
'A giant and a short person in [____] position were training [positions shown]. The giant liked himself, but the short person didn't.' (LSF; 30, 62; 30, 64; 30, 65; 30, 66)

We varied two parameters in the second sentence:

[28] This classifier remains present until *THE-TWO-a,b* is signed.

(i) the position of the classifiers (= [position] in (53)), which were in vertical or diagonal position, with heads up or heads down (hence 4 positions)

(ii) the precise point targeted by the giant-denoting pronouns *IX-a*/*SELF-a* on the one hand and the short person-denoting pronoun *IX-b* on the other, with three conditions:
a. giant = neutral; short person = neutral
b. giant = upper part; short person = neutral
c. giant = neutral; short person = upper part

(i) was similar to what we tested in ASL, except for the 'diagonal', heads down' situation (heads pointing downwards approximately 45 degrees to the right in LSF, and to the left in ASL [signer's perspective]). (ii) was somewhat different: we only tested two positions ('neutral' vs. 'upper part of the locus'): the central position remained roughly constant across conditions (towards the middle of the two fingers), and the 'upper part' position was higher in the 'heads up' conditions and lower in the 'heads down' conditions. In addition, by including a 'neutral - neutral' condition, we could assess the use of 'upper part' loci in a comparative manner, with reference to the acceptability of neutral height loci.

The results are in (54); due to initial differences across our two informants, we report the results separately.[29] The crucial data are in (54)b, where the 'upper part' specification that appears in the first clause appears to be ignored by the process of ellipsis resolution ((54)a is a control that is expected to be good on the assumption that neutral loci are always acceptable; and (54)c is a control that is expected to be deviant on the assumption that 'upper part' loci an unacceptable to refer to short individuals).

(54) Results

	Readings	1. Vertical, heads up		2. Vertical, heads down		3. Diagonal, heads up[30]		4. Diagonal, heads down	
		IJ	IH	IJ	IH	IJ	IH	IJ	IH
a. IX-a_neutral LIKE SELF-a_neutral, IX-b_neutral NOT.	bound variable (all cases)	6.3	6	6.3	6	6.7	6	6.3	6
b. IX-a_upper_part LIKE SELF-a_upper_part, IX-b_neutral NOT.	bound variable (all cases)	7	6	7	6	7	6	7	6
c. IX-a_neutral LIKE SELF-a_neutral, IX-b_upper_part NOT.	bound variable (all cases)	1	3.3	1	4	1	3.3	1	4
Videos		30, 64; 30, 67; 30, 71; 30, 124	30, 99; 31, 13; 31, 30	30, 65; 30, 68; 30, 72; 30, 125	30, 100; 31, 14; 31, 31	30, 62; 30, 63; 30, 70; 30, 123	30, 98; 31, 12; 31, 29	30, 66; 30, 69; 30, 73; 30, 126	30, 101; 31, 15; 31, 32

The following conclusions can be drawn at this point.
–For both informants, targeting the same (intermediate) position for *GIANT* and for *SHORT-PERSON* is a possibility.
–For informant IJ, there was a very sharp contrast when different heights were targeted; in such cases, the giant-denoting pronoun had to target the upper part locus and the short person-denoting pronoun had to target the neutral locus (the approximate positions of these lines are displayed in (51)). This is as is expected on a projective analysis, since a giant is taller than a short person.

[29] The difference is primarily due to the first test with informant IH; upon the second and third tests, patterns similar to those of IJ emerged.
[30] The contrast between 'neutral' and 'upper_part' conditions seems a bit greater than in the other sentences.

–For informant IH, there was such an effect in 'heads up' positions, and the effect was less consistent in 'heads down' positions.
–In all cases, the second sentence was read with a bound reading. This suggests that the height specifications of the first reflexive could be disregarded in the elided clause. Specifically: the fact that the 'giant = neutral; short person = upper part' condition is worse than the 'giant = neutral; short person = neutral' condition suggests that one cannot use 'upper part' indexing to refer to the short person. But then the acceptability of the elided clause in 'giant = upper part; short person = neutral' condition suggests that the reflexive is in that case copied *without* its 'upper part' features.[31]

To conclude this study, we asked both informants whether some body part represented the head of the short person, and if so which. The same types of responses were given by both informants: in the 'heads up' position, the knuckles represent the head. Interestingly, and contrary to what the simplified picture in (51) suggests, in the 'heads down' position a lower position was sometimes taken to represent the head – on the palm rather than on the fingers.[32] The explanation for this asymmetry is probably not hard to find. In the 'heads up' position, the palm was flexed and thus the largest area around the fingers that could represent a straight body were the two fingers themselves. By contrast, in the 'heads down' position, the palm was in the plane defined by the two fingers, and as a result a larger area could be taken to represent a straight body. Relevant frames of the videos are represented in (52).

While they would require a more rigorous investigation, our ASL and LSF data suggest several conclusions.[33]
1. Just considering the subject pronouns *IX-b*, which denotes the short person, it is clear that the point targeted by the pronoun is not at a fixed height in space, but rather that it targets a designated part of a structured locus. As the structured locus is rotated, the indexed point 'moves' in space in a corresponding fashion.
2. It is not possible to argue that in all cases this fact is purely morphological, i.e. that a classifier comes with a designated position – say the knuckles for the two-finger person classifier – which must be indexed for purposes of anaphora. The reason is that different points of the structured locus can be indexed depending on whether one refers to tall or to short people.
3. While there might be a slight preference for differential indexing across the short person vs. giant cases, it also seems to be possible to index both individuals in the same position relative to the classifier (roughly, the knuckle position).
4. In our examples, a reflexive *SELF-a* indexed the same position as the giant-denoting pronoun *IX-a*. In the second sentence, the subject pronoun *IX-b* had to index a position appropriate for a short person. Neverthless, the elided clause could be interpreted with a bound reading, *even in cases in which there was a mismatch between the position of locus a and the position that the elided pronoun SELF-b would have been expected to index*.

We conclude that in these examples we see a highly iconic use of loci, but also a rule akin to feature deletion that allows some features to be ignored in the course of ellipsis resolution.

5.3 Refining the iconic semantics

The semantics for pronouns in (11) turns out to be insufficient to handle the 'rotation' cases discussed here. The heart of the matter is that this semantics only makes reference to the preservation by the interpretation function of the relative height of loci, whereas what we need is a requirement that a structured locus should be the projection within the signing space of the object it denotes. As it happens, Schlenker et al. 2013 did have to make use of structured loci, but for another phenomenon, namely directional verbs (in this, they

[31] We do not have an explanation for the fact that informant IH is more tolerant of the 'wrong' indexing in 'heads down' positions; but we note that instances of 'partial iconicity', whereby some rotations were not fully effected, were also found in another domain, that of directional verbs, as discussed in Schlenker et al. 2013 (Section 4.2.2.).
[32] Initially, both IJ and IH distinguished in this way between the 'heads up' and the 'heads down' situations. IH remained consistent. By contrast, in a separate session, IJ gave the same answer in all situations, with the knuckles representing the head. (Target videos: 30, 62; 30, 64; 30, 65; 30, 66; judgments in videos 30, 74; 30, 102; 30, 127; 31, 33.)
[33] More sophisticated methods would be needed to assess in a quantitative fashion the precise points that are indexed in various conditions. For instance, in some videos it might be that the signer targeted an excessively high position in the 'short person - upper part' condition, which might introduce a bias in the examples.

followed insights of Kegl 2004 and Liddell 2003). The idea was that even though pronouns usually index a *point*, the latter is part of a larger *structured locus,* hence an enrichment of the theoretical framework. Technically, assignment functions assign values to area loci, as specified in (55)a. We now add (55)b to make it clear that area loci may but need not be different from point loci, and that an iconic semantics is only imposed in case the area locus does not reduce to a point. The resulting system allows both for loci as simple variables (without iconic requirements), and for loci as iconic variables.

(55) a. Assignment functions assign values to **areas** of space ('area loci', which may have an instrinsic 'head' and 'foot' position) rather than to **points** of space ('point loci'). Lower-case letters (e.g. *a*) designate point loci; capital letters (e.g. *A*) designate area loci; assignment functions assign values to variables and to capital letters. (We extend this notational convention to *1*, *2,* which are traditionally used to designate the speaker and addressee; we take these to stand for point loci, the corresponding area loci being *I* and *II*.) (modified from Schlenker et al. 2013)
b. An area locus *A* may but need not be distinct from the corresponding point locus *a;* only in the former case ($A \neq a$) will an iconic semantics be imposed.
c. If a point locus *a* is not signed at a neutral height, one can usually infer that it is part of a larger structured area locus *A* (and hence that $A \neq a$, with the effect that an iconic semantics will be enforced).[34]

We will propose, as a very first approximation, the rule in (56). In case a pronoun indexes a human-denoting point locus *i* belonging to a larger structured locus *I*, the rule will trigger a presupposition failure unless (i) the structured locus *I* is the projection onto the signing space of the denotation s(I) of the locus (according to some salient projection); and in addition (ii) the point locus *i* corresponds within *I* to the upper part of the body of s(i) according to the same projection.

(56) *Pronouns*
Let c be a context of speech, s an assignment function and w a world (with c_a = the author of c; c_w = the world of c). We assume that c determines a projection π_c from the salient situations in c_w to the signing space of c_a.

If *i* is a locus and π_c a projection from the salient situations in c_w to the signing space of c_a,

$[[\text{IX-i}]]^{c,s,w}$ = # iff s(I) = # or [I ≠ i and s(I) is human and it is not the case that (I is the projection of s(I) in the signing space of c_a according to π_c, and i is within I the projection of the upper part of the body of s(I))]. If $[[\text{IX-i}]]^{c,s,w} \neq$ #, $[[\text{IX-i}]]^{c,s,w}$ = s(I).

With the simple assumptions in (57), we can provide an elementary illustration, as in (58) (as is customary, we write $like'_w(x)(y)$ for the value of the verb *like* evaluated at world w and taking as object argument x and as subject argument y):

(57) a. $[[\text{like}]]^{c,s,w} = \lambda x\ \lambda y$: # iff x = # or y = #; 1 iff x ≠ # and y ≠ # and $like'_w(x)(y) = 1$
b. For all loci i, $[[\text{SELF-i}]]^{c,s,w} = [[\text{IX-i}]]^{c,s,w}$

(58) Let c be the context of speech, w the world of evaluation and s an assignment function. We assume that the point locus *a* is part of larger structured locus *A*, and that it denotes human x, i.e. s(A) = x.
$[[\text{IX-a LIKE SELF-a}]]^{c,s,w} = [[\text{like}]]^{c,s,w}([[\text{SELF-a}]]^{c,s,w})([[\text{IX-a}]]^{c,s,w})$
= # iff $[[\text{SELF-a}]]^{c,s,w}$ = # or $[[\text{IX-a}]]^{c,s,w}$ = #; 1 iff $like'_w([[\text{SELF-a}]]^{c,s,w})([[\text{IX-a}]]^{c,s,w}) = 1$;
= # iff A ≠ a and it is not the case that [the structured locus *A* is the projection of individual x (= s(A)) in the signing space of c_a according to π_c, and point *a* is within *A* the projection of the upper part of the body of individual x]. If $[[\text{IX-a LIKE SELF-a}]]^{c,s,w} \neq$ #, $[[\text{IX-a LIKE SELF-a}]]^{c,s,w} = like'_w(x)(x)$

This is very preliminary, for several reasons. First, much more need to be said about the workings of projections, possibly using the framework of Greenberg 2012. Second, such details would be needed to ensure that (56) can capture as a special case the results about height preservation in vertical position formalized in (11) (these involved the preservation modulo a multiplicative parameter of height differences among loci – a requirement which is absent from (56) as it stands). Third, the problem discussed in (39) above with respect to the purely indexical (context-dependent, not world-dependent) character of (11) will arise with (56) as well. Fourth, (56) is too narrow because it only handles constraints on pronouns denoting

[34] Clauses (55)b-c are additions to Schlenker et al. 2013. One of their consequences is that loci signed at a neutral height need not be part of a larger structured locus, and thus that they may have a non-iconic semantics; if so, such loci may be used to refer to tall and short individuals. (Some of these modifications were prompted by the remarks of an anonymous referee.)

humans. Finally, more work would be needed to determine under what conditions a point locus is assumed to be part of a larger structured locus; the conditions stated in (55) are only a first approximation. We leave the necessary refinements for future research.

6 Two Interpretations

We will now argue that these data can be interpreted in two ways, one strong and one weak. The key issue is this: in the literature, it is often implicitly assumed that rules of deletion in ellipsis and in focus environments are *characteristic* of (some) features. This incorporates two claims: (i) that some features can be ignored in these environments; (ii) that non-featural elements cannot be so ignored[35]. As we will see, there seem to be exceptions to (ii) in ASL and LSF (and we are not at all certain that (ii) fully holds of French and English either).

(59) **Strong View vs. Weak View**
Observation: In ASL and LSF, plural and height specifications can be deleted in ellipsis and *only* environments.
a. Strong View: Deletion is true of some features and of no non-featural elements. Therefore in ASL and LSF plural and height specifications of loci are features.
b. Weak View: Deletion is true of some features and possibly of some non-featural elements that are separable from variables. Therefore in ASL and LSF plural and height specifications of loci share an important property of features (their separability from the variables they appear on), but they need not be features.

As it turns out, our initial arguments do not suffice to support the Strong View. The reason is that both in ASL and LSF, some elements that are unlikely to be featural, such adjectives or numerals, can sometimes undergo apparent deletion. We sugggest that in some cases at least, a principle of 'liberal erasure', stated in (60), is at work (a related principle is developed independently in Sauerland 2013; we leave a comparison for future research).[36]

(60) Liberal Erasure (informal version)
If within its local context a complex expression *E* has the same denotation as a structurally simpler expression *E'*, then *E* can be replaced with *E'* for purposes of ellipsis resolution and alternative computation.

Let us give two illustrations.
–A pronoun *[pro$_i$ fem]* with feminine gender features will fall under (60) if the contribution of *fem* is purely presupposition, with for instance $[\![\text{fem}]\!]^{c,\,s,\,w} = \lambda x$: x is female in c_w . x (i.e. *fem* triggers a presupposition failure unless its individual argument is female in the word of the context; and when it does not trigger a failure, it yields the same result as the identity function). In this case, if the entire pronoun can be used felicitously, the denotation of *pro$_i$* must be female, and hence the contribution of *fem* is redundant.

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[35] Since such theories are motivated by the unexpected semantic behavior of features, researchers may be explicit about (i) [= features may be ignored] without being explicit about (ii) [= non-featural elements may not be ignored]. For analyses that are suggestive of the Strong View [= *only* features may be ignored], see for instance Heim 2008, Jacobson 2012, Schlenker 1999, 2003a, b, Stechow 2003.

[36] Sauerland's hypothesis is roughly stated as follows:

(i) "Obligatory, purely presuppositional **morphemes** don't contribute to alternative interpretation." Within a Roothian alternative semantics, let *a* be an element of type τ, and let id_τ be the identity function for objects of type τ (we write as as $id_{\tau\,/S}$ the identity function restricted to a set S of objects of type τ, i.e. the function which is only defined over S, and which is the identity function for arguments in that set). Then:
$[\![a]\!]^g_f$ = $\{id_\tau\}$ if for some $S \subseteq D$ $[\![a]\!]^g = id_{\tau\,/S}$, or for all x in the domain of $[\![a]\!]^g$, $[\![a]\!]^g(x) = 1$;
= $\{[\![a]\!]^g\}$ otherwise.

As stated, this hypothesis makes reference to *morphemes*, but it could be liberalized to make reference to any elements whatsoever. While it would account for the fact that *[pro$_i$ fem]* can in effect be 'replaced' with *pro$_i$* , the rule as stated would not derive the (potential LSF) fact that *the four French swimmers* can be 'replaced' with *the French swimmers*.

As a result, for purposes of ellipsis resolution and alternative computation, *[pro$_i$ fem]* can be replaced with *pro$_i$* .
–If we are in a context in which it is known that there are exactly four French swimmers, the denotation of *the four French swimmers* is identical to that of *the French swimmers*, and thus the latter expression can replace the former for purposes of ellipsis resolution and alternative computation.

As we will see, the problem takes a different form in our ASL and in our LSF data. In ASL, our informant has subtle but stable contrasts between plural and height specifications on the one hand, and non-featural elements on the other; in LSF, our data are not fine-grained enough to display such contrasts, or these contrasts do not exist.

6.1 ASL

We have several ASL cases that initially argue for the weak interpretation of our data: in several cases, it appears that 'redundant' elements can be ignored in the case of ellipsis resolution or focus computation. An example is given in (61); the context was intended to force a bound variable reading, and to compare the behavior of the plural pronoun *IX-arc-a* (= 'them') to the complex expression *IX-arc-a 11* (= 'the 11 of them'). On the assumption that only *features* can be disregarded in the course of ellipsis resolution, we would expect a bound variable to be possible with *IX-arc-a* (because the plural features can be disregarded) but impossible with *IX-arc-a 11* (because *11* is not featural, and hence cannot be disregarded – with the result that the number presupposition it triggers should clash with the properties of the singular subject of the second sentence).

(61) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes with a team of 12 German swimmers.

RS_____
EVERYONE LIKE WHAT PEOPLE LIKE IX-1. SO
'Every individual likes people who like him. So

a. 7 IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-arc-b 12 GERMAN SWIMMER SAME-a,b.
the 11 French swimmers like people who support them. The 12 German swimmers do, too.'
Preferred reading: bound variable

b. 5.5 IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a 11.** IX-arc-b 12 GERMAN SWIMMER SAME-a,b.
the 11 French swimmers like people who support the 11 of them. The 12 German swimmers do, too.'
Preferred reading: bound variable
(ASL; 14, 223; 14, 224; 17, 19)

(61)b appears to be somewhat degraded, but it does seem to have a bound variable reading. It is clear that the numeral *11* that appears in bold in (61)b must somehow be disregarded for this reading to be obtained, for otherwise the second sentence should have a meaning akin to *The 12 German swimmers also like people who support the 11 of them*; let us call this an instance of 'numeral mismatch', reserving the term of 'number mismatch' for cases in which some plural features must be disregarded. The same conclusion about the acceptability of numeral mismatch can be reached on the basis of examples with *NOT* and *ONLY,* as in (62)b and (63)b (though in our single trial on (62)b, the strict and the bound reading were thought to be equally available).

(62) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer.

RS_____
[FRENCH PEOPLE]$_a$ LIKE WHAT PEOPLE LIKE IX-1. WAIT(ONE) OPPOSITE COMPARE
[GERMAN PEOPLE]$_b$ OFTEN HATE SELF-b.
RS_____

IX-b[37] LIKE WHAT PEOPLE LIKE OTHER PEOPLE. SO
'The French like people who like them. By contrast, the German are often self-hating. They like people who like other people. So

a. 7 IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-b GERMAN SWIMMER NOT.
the 11 French swimmers like people who support them. The German swimmer doesn't.'
Preferred reading: bound variable
b. 7 IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a 11.** IX-b GERMAN SWIMMER NOT.
the 11 French swimmers like people who support the 11 of them. The German swimmer doesn't.'
Preferred reading: bound variable or strict [= equally available]
(ASL; 17, 23; 17, 24)

(63) *Context:* Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer.

RS_____
[FRENCH PEOPLE]$_a$ LIKE WHAT PEOPLE LIKE IX-1. WAIT(ONE) OPPOSITE COMPARE [GERMAN PEOPLE]$_b$ OFTEN HATE SELF-b.
RS_____
IX-b LIKE WHAT PEOPLE LIKE OTHER PEOPLE. SO
'The French like people who like them. By contrast, the German are often self-hating. They like people who like other people. So

a. 6.3 ONLY IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.**
only the 11 French swimmers like people who support them.'
Preferred reading: bound variable
b. 6.3 ONLY IX-arc-a 11 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a 11.**
only the 11 French swimmers like people who support the 11 of them.'
Preferred reading: bound variable
(ASL; 14, 241; 14, 242; 17, 11; 17, 20)

As it turns out, however, there is one type of paradigm in which our ASL informant found stable contrasts: plural and height specifications could be ignored by ellipsis and *ONLY* constructions, while two further types of non-assertive elements couldn't be. Consider for instance the case of negative ellipsis in (64):

(64) *Context:* Tomorrow there is a swimming competition. A team of 6 French swimmers competes against a single German swimmer.[38]

a. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support them. The German swimmer doesn't.'
Preferred reading: bound variable (all 4 trials)
b. 6.2 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a SIX.** IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support the six of them. The German swimmer doesn't.'
Preferred reading: strict (all 4 trials)
c. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **THE-SIX-arc$_a$**. IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support the six of them. The German swimmer doesn't.'
Preferred reading: strict (all 4 trials)
a'. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **POSS-a TEAM.** IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support their team. The German swimmer doesn't.'

[37] Note that this is an instance of a 'singular' pronoun used with a plural denotation.
[38] For all sentences, the semantic question was stated as follows: "Meaning: do we infer that the German swimmers do NOT like (i) people who support their own team? (ii) people who support the French team?"

Preferred reading: bound variable (all four trials)
b'. 6. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **POSS-a FRENCH TEAM.** IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support the French team [literally: their French team]. The German swimmer doesn't.'
Preferred reading: strict (all 4 trials)
c'. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **FRENCH TEAM.** IX-b GERMAN SWIMMER NOT.
'The 6 French swimmers like people who support the French team. The German swimmer doesn't.'
Preferred reading: strict (all 4 trials)
(ASL; 17, 36; 17, 38; 17, 59; 17, 67; 17, 139)

While all the sentences were deemed acceptable, their preferred readings were not the same: our informant obtained bound readings for (64)a and (64)a', and strict readings for all other cases. In particular, there was a contrast between number mismatch, as in (64)a, and numeral mismatch, as in (64)b, c (b. and c. differed in that in c. but not b. the numeral was incorporated to the pronoun). This is interesting: (64)a' just involves a bound variable, while (64)a involves a plural feature that must somehow be ignored by ellipsis. All other cases involve redundant modifiers.[39]

In a similar context, a bound reading was also obtained in a case of height mismatch between the elided clause and its antecedent, as seen in (65): high loci behave like plurals and *phi*-features more generally rather than like non-assertive modifiers (unsurprisingly, low loci are degraded).

(65) *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 TALL MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT NOT.
a. 7 high locus
Preferred reading: bound variable
b. 7 normal locus
Preferred reading: bound variable
c. 5 low locus
Preferred reading: bound variable
'The very tall French man likes people who support him. The short German man doesn't.' (ASL; 17, 61; 17, 64; 17, 69; 17, 141)

The same conclusions can be drawn on the basis of the sentences with *SAME* in (66)-(67).

(66) *Context:* Tomorrow there is a swimming competition. A team of 6 French swimmers competes against a single German swimmer.

a. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.** IX-b[40] GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support them. The German swimmer does, too.'
Preferred reading: bound variable
b. 6.2 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a SIX.** IX-b GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support the six of them. The German swimmer does, too.'
Preferred reading: strict
c. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **THE-SIX-arc$_a$**. IX-b GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support the six of them. The German swimmer does, too.'
Preferred reading: strict
a'. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **POSS-a TEAM.** IX-b GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support their team. The German swimmer does, too.'

[39] As seen in the complete ratings, our ASL informant also noted on several occasions that a strict reading was available (but less strong) for (64)a-a', and one one occasion he noted that a bound variable reading was available (but less strong than the strict reading) in (64)b.
[40] *IX-b* and *GERMAN* appear to be partially merged.

Preferred reading: bound variable
b'. 6.7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **POSS-a FRENCH TEAM.** IX-b GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support the French team (literally: their French team). The German swimmer does, too.'
Preferred reading: strict
c'. 7 IX-arc-a 6 FRENCH SWIMMER LIKE PEOPLE SUPPORT **FRENCH TEAM.** IX-b GERMAN SWIMMER SAME-a,b
'The 6 French swimmers like people who support the French team. The German swimmer does, too.'
Preferred reading: strict
(ASL; 17, 37; 17, 39; 17, 60; 17, 68; 17, 140)

(67) *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 TALL MAN]$_a$ LIKE PEOPLE SUPPORT **IX-a.** IX-b GERMAN SHORT SAME-a,b.
a. 7 high locus
Preferred reading: bound variable
b. 7 normal locus
Preferred reading: bound variable
c. 4.5 low locus
Preferred reading: bound variable
'The very tall French man likes people who support him. The short German man does, too.'
(ASL; 17, 62; 17, 65; 17, 75)

For reasons mentioned above, examples with *ONLY* are not very informative to assess the deletion of plural features; but we did test them for high loci, and the same generalizations appear to hold as in ellipsis environments.

(68) *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 TALL MAN$_a$ GERMAN SHORT-PERSON$_b$ ONLY TALL$_a$ LIKE PEOPLE SUPPORT
'Comparing the very tall French man and the short German man, only the former (literally: only the tall man) likes people who support
a. 7 **IX**-a-high
him.'
Preferred reading: bound variable
b. 7 **IX**-a-normal
him.'
Preferred reading: bound variable
a'. 7 **POSS-a TEAM**
his team.'
Preferred reading: bound variable
b'. 6.7 **POSS-a FRENCH TEAM**
the French team (literally: his French team).'
Preferred reading: strict
c'. 7 **FRENCH TEAM**
the French team.'
Preferred reading: strict
(ASL; 17, 73; 17, 74; 17, 99; 17, 143)

Two conclusions can be drawn. First, something like 'Liberal Erasure'appears to apply to a variety of categories that can *to some extent* be disregarded in ellipsis and focus constructions because their contribution is non-assertive. Second, however, in well-controlled paradigms our informant can ignore mismatches triggered by plural and height specifications much more easily than those triggered by other modifiers. If confirmed, this fact might suggest that in the context of these paradigms features can readily be deleted but other lexical elements cannot be. This would argue for the Strong View, according to which

plural and height specifications really do display the behavior of *phi*-features in ellipsis and focus constructions.

6.2 LSF

Our LSF data do not provide evidence for a contrast between plural and height specifiations on the one hand and other non-assertive elements on the other. We tried to contrast the behavior of *IX-arc-b* to that of *THE-FOUR*$_b$ (= a plural pronoun with an incorporated numeral), *7 IX-arc-b* and *IX-arc-b 7* ('the 7 of them', with the second order being dispreferred); no clear contrast ever emerged, and bound variable readings were usually available. We included a condition without any bound variable in the antecedent – and checked that they gave rise to strict readings only.

We only report below on the comparison between *IX-arc-b*, *THE-FOUR*$_b$, and a condition without variables (*TEAM GERMAN)*. In *SAME*- and *NOT*-type ellipsis as well as in *only* environments, informant IJ, who generally allowed for bound readings without reflexives, did not distinguish between number mismatch and numeral mismatch; by contrast, in the condition without a bound variable in the antecedent, he obtained a strict reading, as is expected given Liberal Erasure as stated in (60) (we only provide IJ's judgments below, since for reasons discussed above informant IH preferred strict readings irrespective of mismatch problems whenever a non-reflexive was used; his ratings are provided in Appendix II).

(69) *Context:* Tomorrow there is a swimming competition by teams. There is a German team with 4 members, and a French team with 3 members.

4 PERSON-rep$_c$ GERMAN / GERMAN PERSON-rep$_c$[41] KNOW PERSON-rep$_a$ LIKE
'The 4 Germans know people who like

a. 7^{IJ} IX-arc-c. 3 PERSON-rep$_b$ FRENCH SAME.
them. The 3 Frenchmen do, too.'
Preferred reading: bound variable
b. 7^{IJ} THE-FOUR$_b$. 3 PERSON-rep$_b$ FRENCH SAME.
the four of them. The 3 Frenchmen do, too.'
Preferred reading: bound variable
c. 6.5^{IJ} TEAM GERMAN. 3 PERSON-rep$_b$ FRENCH SAME.
the German team. The 3 Frenchmen do, too.'
Preferred reading: strict
(LSF; 27, 49; 27, 50; 27, 54 [IH 28, 2])

(70) *Context:* Tomorrow there is a swimming competition by teams. There is a German team with 4 members, and a French team with 3 members.

4 PERSON-rep$_c$ GERMAN KNOW PERSON-rep$_a$ LIKE
'The 4 Germans know people who like

a. 7^{IJ} IX-arc-c. 3 PERSON-rep$_b$ FRENCH NOT.
them. The 3 Frenchmen don't.'
Preferred reading: trial 1 = strict; trial 2 = bound variable
b. 7^{IJ} THE-FOUR$_c$. 3 PERSON-rep$_b$ FRENCH NOT.
the four of them. The 3 Frenchmen don't.'
Preferred reading: trial 1 = strict; trial 2 = bound variable
c. 7^{IJ} TEAM GERMAN. 3 PERSON-rep$_b$ FRENCH NOT.
the German team. The 3 Frenchmen don't.'
Preferred reading: trial 1 = strict; trial 2 = strict
(LSF; 27, 47; 27, 48; 27, 53; [IH 28, 1])

(71) *Context:* Tomorrow there is a swimming competition by teams. There is a German team with 4 members, and a French team with 3 members.

ONLY 4 PERSON-rep$_b$ GERMAN KNOW PERSON-rep$_a$ LIKE

[41] The first order (= *PERSON-rep$_c$ GERMAN*) was used in (69)a-b and the second order (= *GERMAN PERSON-rep$_c$*) was used in (69)c.

'Only the 4 Germans know people who like

a. 7^{IJ} IX-arc-b.
them.'
Preferred reading: trial 1 = strict; trial 2 = bound variable
b. 7^{IJ} THE-FOUR$_b$.
the four of them.'
Preferred reading: trial 1 = strict; trial 2 = bound variable
c. 7^{IJ} TEAM GERMAN.
the German team.'
Preferred reading: trial 1 = strict; trial 2 = strict
(LSF; 27, 51; 27, 52; 27, 55; [IH 28, 3])

While in *NOT* and *ONLY* conditions informant IJ displayed variation, he never found a contrast between the readings obtained with *IX-arc-b* and the *THE-FOUR$_b$*. By contrast, he was consistent in only obtaining a strict reading with *GERMAN TEAM*, as is expected.

Thus we cannot argue in favor of the Strong View on the basis of the LSF data (although they do argue for the Weak View). Needless to say, the fact that we didn't find a difference between number mismatch and numeral mismatch is no proof that it doesn't exist; it might be that it will become evident when more controlled paradigms are investigated.

6.3 A Proviso

Let us go back to our ASL data, which display some evidence for an erasure-like rule which specifically targets features, including ones that give rise to iconic effects. Our preferred interpretation is that these features themselves are interpreted iconically, since they display height distinctions whose precise realization is sensitive to the various rotations discussed in Sections 5.1. But an alternative interpretation was suggested to us by David Adger (p.c.). All our examples of rotations involved a person classifier. Thus it could be that the latter has an iconic semantics, while height features themselves only encode a small number of categorical, non-iconic distinctions, *realized relative to the position of the classifier*. For instance, we could posit that height features can just take three values (*neutral*, *high*, and *low*), and that these are realized relative to the position of an oriented classifier, with high loci appearing above the head of the classifier and with low loci appearing under its foot (with *above* and *under* interpreted with respect to a classifier-relative frame of reference). This alternative analysis might make for a neat division of labor between lexical and featural material (on the assumption that classifiers belong to the first category): lexical elements may make reference to geometric projections, and they may give rise to gradient distinctions; features, by contrast, may only have a categorical and non-iconic semantics.

To assess this alternative interpretation of our data, a follow-up study was conducted, which is reported in Schlenker 2013. In brief, examples were investigated in which (i) no classifiers were used, (ii) possibly gradient and iconic distinctions of height were realized, (iii) some height specifications were disregarded under ellipsis resolution, and (iv) rotations were performed as in Section 5.1. An example involving (i)-(iii) only is shown in (72).

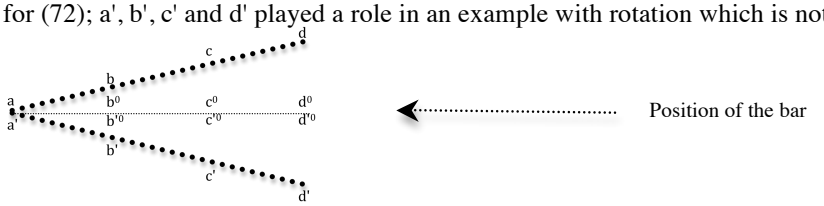
(72) SHOW HAVE 4 GYMNAST STAND BAR ORDER HEIGHT.

a. *SELF* signed at various, appropriate heights
6.5 IX-a PRESENT SELF-a WELL, IX-b MAYBE NOT PRESENT SELF-b WELL, IX-c NOT CLEAR, IX-d DEFINITELY NOT PRESENT SELF-d WELL.

b. *SELF* signed at a constant, low height
3.2 IX-a PRESENT SELF-a WELL, IX-b MAYBE NOT PRESENT SELF-b^0 WELL, IX-c NOT CLEAR, IX-d DEFINITELY NOT PRESENT SELF-d^0 WELL.

c. *SELF* signed low, only once (with ellipsis of the the second and fourth VPs)
7 IX-a PRESENT SELF-a WELL, IX-b MAYBE NOT, IX-c NOT CLEAR, IX-d DEFINITELY NOT.
=> bound variable reading
'During a show, four gymasts were standing on a bar, ranked by height. One [a short one] presented himself well; the second [taller one] possibly didn't present himself well; for the third [still taller] one, it was unclear; and the fourth [still taller] one definitely didn't present himself well.'
(ASL; 19, 253; 19, 254; 19, 265; 19, 282; 19, 293; averages above are over 4 ratings)

Schematic representation of the loci from the signer's perspective (only the upper part of the diagram is relevant for (72); a', b', c' and d' played a role in an example with rotation which is not reproduced here)



No classifiers are used, which establishes point (i). The pronouns index four different heights that reflect the height of [the heads of] their denotations, which begins to establish point (ii). (72)c shows that these height specifications are disregarded in the course of ellipsis resolution, for otherwise the elided occurrences of *SELF* taking *IX-b* and *IX-d* as antecedents would have the 'wrong' feature specifications: this should yield deviance, as in the control sentence in (72)b, which contrasts with (72)a; this establishes point (iii). Finally, in a separate example (not reported here), the discourse started as in (72), but an additional sentence asserted that at some point the gymnasts operated a vertical rotation – and the last sentence was a modified version of (72), with the additional loci a', b', c', d', which are symmetric to a, b, c, d, but now under the position of the bart– a highly iconic representation, which reinforced point (ii).[42] We thus had a total of at least 7 height distinctions, which makes it plausible that these are indeed gradient and iconic.

7 Conclusion

In sum, we have shown that plural and height specifications of loci have a dual face. On the one hand, they have a strong iconic component: in 'complement set' readings of plurals, relations of inclusion and relative complementation among plural loci are preserved by the interpretation function; in cases of 'change of position', high loci can appear at various positions in signing space depending on the position of (the head of) the individual they denote. On the other hand, these specifications display the behavior of grammatical features, in the sense that they can be disregarded by rules – ellipsis resolution and focus computation – which are known to have an ability to ignore *phi*-features. Furthermore, we showed in the case of height specifications that it is possible to correlate the two phenomena in examples that include a high locus which is both used iconically *and* disregarded by a rule of ellipsis resolution.

Still, there are two possible interpretations of our data. On the Weak View, these iconic specifications of loci just share with features the property of being *separable* from the variables they appear on. In this respect, they might just be like other expressions that are semantically redundant, and the finding would just be that iconic specifications are 'abstract enough' to be separable from the variables they attach to. Our LSF data are compatible with this weak interpretation. On the Strong View, plural and height specifications share a *characteristic* property of features. As we saw, it might well be that elements with a

[42] The ASL term for 'rotation' involved a rotating classifier, but a single one for the entire sentence, which makes it unlikely that it with respect to it that the various loci are located.

redundant contribution can to some extent be ignored by ellipsis and focus constructions. Still, in ASL our informant has stable contrasts between plural and height specifications on the one hand, and other redundant elements on the other – which might suggest that the former really are featural in the end. Be that as it may, the featural nature of plural and height specifications should be further investigated: if features are part of an innate inventory made available by Universal Grammar, it would be of some importance to know that some features have an intrinsically geometric interpretation.[43]

Some important questions remain for future research, both from an empirical and from a theoretical standpoint.

On an empirical level, can the same generalizations be replicated with more rigorous methods, involving more informants and a more precise assessment of the geometry of loci? Do they hold in sign languages that are not genetically related to LSF and ASL (which are both descended from Old French Sign Language)? Such refinements would be important in view of the contrast between our ASL data, where we found an argument for the Strong View, and our LSF data, where we didn't. It might be that with more fine-grained methods some distinctions will in the end arise in LSF (or they might disappear in ASL!).

On a theoretical level, can further arguments be found for the view that some specifications of loci are *both* iconic and featural? A natural extension of the present work might involve directional verbs. By definition, directional verbs target one or several loci whose denotations fill one or several of their argument slots; for this reason, they are thought to have an anaphoric or agreement component (e.g. Lillo-Martin and Meier 2011). At the same time, they have an iconic component: different directional verbs target different parts of a structured locus depending on their meaning, and 'rotation' arguments can be used to argue that these specifications are projective in nature (for instance, when the 'head' of a structured locus is targeted, the precise point that gets indexed will depend on the position of the denotation). Directional verbs lend themselves to two extensions of the present project. First, one could directly argue that their morpho-syntactic behavior shows that they are featural in nature – which of course presupposes a detailed understanding of this behavior, as well as a comparison with possible spoken language counterparts. Second, one could extend to the height specifications of directional verbs the arguments we developed in the text about ellipsis and focus environments. In principle, one could ask whether these featural specifications can be ignored in the same way as the height specifications of pronouns.

Finally, we saw in our distinction of the Weak vs. Strong Views that our analysis depends on a detailed understanding of the mechanism by which features (and possibly other elements) can be disregarded in the course of ellipsis resolution and focus computation. Two types of further connections could be established in future research. First, there are recent results on argument ellipsis in ASL (Koulidobrova 2011b), and these could indirectly shed light on VP-ellipsis as well. Second, the ability of ellipsis and focus constructions to 'disregard' some spatial properties of loci does not just concern vertical locus specifications, but also horizontal ones. To see this, consider again example (2), repeated as (73).

(73) IX-1 POSS-1 MOTHER LIKE. IX-a SAME-1,a.
Ambiguous: I like my mother. He does too [= like my / like his mother] (ASL; 1, 108)

The 1st person locus *1* and the 3rd person locus *a* are localized in the standard horizontal plane, and do not involve any high or low loci. Now if ellipsis is resolved by copying the antecedent VP, we obtain for the second sentence *IX-a SAME-1,a* ~~*POSS-1 MOTHER LIKE*~~. While this representation accounts for the strict reading, it fails to account for the bound reading. It would seem that the first person locus of *POSS-1* can somehow be disregarded in the course of ellipsis resolution. A similar problem would arise if we were dealing with two distinct 3rd person loci rather than with a 1st person and a 3rd person one. While horizontal specifications of loci are usually compared to *variables* rather than to *phi-features* (Lillo-Martin and Klima 1990), it seems that they too can be disregarded under ellipsis – and also under *only*, as shown and discussed in detail in Kuhn 2013. One should thus develop a unified theory of the behavior of vertical *and* horizontal specifications of loci under ellipsis and focus constructions.[44]

---

[43] One could of course have the view that some elements may be featural without being innate; if so, features need not be a part of Universal Grammar, and our results might not bear directly on the latter.

[44] We should end with a speculation. It might be surprising that we didn't find *more* of a bias against feature mismatch in ellipsis and focus environments. In spoken language, it would seem that feature mismatch is weakly dispreferred. Thus to my ear the bound reading is less easily available in (i)a (= gender mismatch) than it is in (i)b (= no mismatch):

Appendix I. Uninterpreted Plural Features in De Se Readings

In the main text, we discussed two cases in which *phi*-features initially appear to remain uninterpreted in English: ellipsis and focus-sensitive constructions. A third case of uninterpreted features was reported in the literature; it pertains to the De Se interpretation of some embedded pronouns. Specifically, it was observed (e.g. Sauerland, cited in Schlenker 2003) that in 'De Se' readings of attitude reports, some rules might be needed to guarantee that some features go uninterpreted. Consider (74)a:

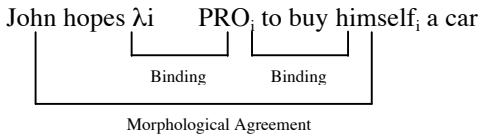
(74) a. John (a transsexual) hopes to become a woman, and he hopes PRO to buy himself (*herself) a car.
b. John hopes λi PRO_i to buy ~~him~~self$_i$ a car.

On a relatively standard treatment of De Se attitude reports, we should have the semantic result in (75):

(75) $[[(74)b]]^{f, s, w}$ = # iff for some <individual, world> pair <x', w'> compatible with what John hopes for in w, $[[\lambda i\ PRO_i$ to buy himself$_i]]^{f, s, w'}(x') = \#$. If $\neq$ #, $[[(i)b]]^{f, s, w} = 1$ iff for each <individual, world> pair <x', w'> compatible with what John hopes for in w, $[[\lambda i\ PRO_i$ to buy himself$_i]]^{f, s, w'}(x') = 1$.

With a standard possible worlds semantics for *hope*, the first sentence of the discourse in (74)a establishes that for each <individual, world> pair <x', w'> compatible with what John hopes for in w, x' is a woman in w'; but this means that a presupposition failure is incorrectly predicted for the sentence. The problem disappears if we posit that the gender features can be morphologically inherited from the matrix subject and ignored in the semantic component, as illustrated in

(76)



Now in this case there are some alternative solutions; for instance, Schlenker 2003 suggests that in (74)a *PRO* might be read both De Re and De Se; establishing a mechanism that ensures this is in principle feasible due to the widespread assumption that De Se readings entail the corresponding De Re readings, so that one can think of De Se readings as De Se readings *with additional requirements*.[45] But Sauerland noted long ago that there are some cases in which such a theory won't work (cited in Schlenker 2003; see Sudo 2012 for a recent discussion):

(77) We all sometimes believe that we're the only person in the world.

Each of the relevant individuals' belief would seem to be irreducibly singular, of the form: *I am the only person in the world*. It is hard in this case to see how the plural features can be interpreted. If they remain uninterpreted, the problem disappears, as in (78):

(i) a. Mary likes her mother, and John does, too
b. Peter likes his mother, and John does, too.

The reason for this weak effect could be superficial: maybe ellipsis resolution is a bit easier when the missing VP is *phonologically* identical to its antecedent. Interestingly, in the sign language cases under investigation, this surface phonological condition is not satisfied in the examples mentioned in this study: for reasons mentioned in the text, in each of our examples the bound variable in the antecedent came with its own locus, and the elided VP involved a different locus, appropriate to the subject of the second clause. Thus in *all* cases there was (at least) a phonological mismatch between the elided VP and its antecedent; this might explain why we did not find the same kind of (potential) contrast as between (i)b (= no mismatch) and (i)a (= gender mismatch). (On the other hand, we might expect that in *all* our sign language cases strict readings are preferred to bound readings due to locus mismatch. Our data are mixed: this was the pattern we discerned in LSF informant IH's judgments, since he preferred strict readings unless bound readings were made nearly obligatory by the presence of a reflexive pronoun. But we found no such pattern in our other informants.)

[45] Schlenker 1999 discusses possible cases in which De Se readings might fail to entail the corresponding De Re readings, but comes to no firm conclusion on the issue.

(78) We think λi ~~we~~$_i$ are the only person in the world

While this phenomenon is directly relevant to our present concerns, it raise two issues. First, the truly convincing cases only pertain to plural pronouns, and hence such examples wouldn't add much to our analysis of height features. Second, in ASL and LSF there is a competition between distributive and non-distributive plural pronouns. Only the latter were shown in Schlenker et al. 2013 to have an iconic semantics. But the relevant De Se reading of (78) is distributive, and it might be expected to be expressed using a distributive pronoun (or a different strategy altogether, namely one involving Role Shift, which can be thought of as an overt realization of context shift).

We present some preliminary data below. Our main goal was to assess whether there was a *contrast* between simple plurals and plurals co-occuring with numerals: if plural specifications are features, we might expect that they are subject to deletion, while numerals are not; and hence (*modulo* the issue of the competition with distributive pronouns) that embedded subject plurals but not embedded subject numerals might give rise to De Se readings in environments such as (78). This was tested both with the verb *SAY*, as in (79), and with the verb *THINK,* as in (80).

(79) *Context:* Tomorrow there is an individual swim competition among 10 swimmers.
THREE-arc SWIMMER ALL SAY __ WILL BLOW-AWAY MOST OTHER SWIMMER
'Three swimmers say that ___ will blow away most other swimmers.'
Meaning question: Does each of the swimmers say: (i) I will blow away the other swimmers (ii) We will blow away the other swimmers?
a. 7 __ = IX-arc-a
__ = 'they'
Reading: (i) or (ii) ('likely (ii)' was added in the first trial but not in the second)
b. 7 __ = THE-THREE-arc-a
__ = 'the three of them'
Reading: (ii)
(ASL; 14, 187; 14, 188; 17, 41)

(80) *Context:* Tomorrow there is an individual swim competition among 10 swimmers.
THREE-arc SWIMMER ALL THINK __ WILL BLOW-AWAY MOST OTHER SWIMMER
'Three swimmers say that ___ will blow away most other swimmers.'
Meaning question: Does each of the swimmers say/think[46]: (i) I will blow away the other swimmers (ii) We will blow away the other swimmers?
a. 7 __ = IX-arc-a
__ = 'they'
Reading: (i) or (ii) ('likely (ii)' was added in the first trial but not in the second)
b. 7 __ = THE-THREE-arc-a
__ = 'the three of them'
Reading: (ii)
(ASL; 14, 189; 14, 190; 17, 42)

The contrast is subtle but suggestive: the embedded subject numeral does not allow for its plural component to be disregarded, as one expects; but with a simple plural pronoun, 'feature deletion' seems to arise.

As things stand, we have not been able to replicate such contrasts in LSF: in the relevant contexts, simple plural pronouns patterns with numerals; distributive markers pattern differently, as suggested by (81) (the second sentence [*IX-a GERMAN SAME*] was intended to test whether a strict or a bound variable reading was obtained; informant IJ systematically obtained bound readings, while informant IH had some strict readings but wasn't fully consistent).

(81) *Context:* There is an individual swimming competition. A single swimmer will win. There are 4 French swimmers, a single German swimmer, and all are arrogant.

[4 SWIM FRENCH]$_b$ THINK __ WIN. IX-a GERMAN SAME.
'The 4 French swimmers think that they will win. The German swimmer does, too.'

[46] We erroneously used *say* in the first trial, and corrected this to *think* in the second.

a. 6.4 (6.2) __ = IX-arc-b
1st sentence suggests that each Frenchman thinks: 'We/the French swimmers will win.'

b. 6.4 (6.2) __ = THE-FOUR$_b$
1st sentence suggests that each Frenchman thinks: 'We/the French swimmers will win.'

c. 6.4 (6.2) __ = IX-b-rep
1st sentence suggests that each Frenchman thinks: 'I will win.'
(ASL; 30, 22; 30, 23; 30, 28; 30, 77; 30, 92; 30, 119)

Appendix II. Ratings

Ratings are given on a 7-point a scale, preceded by the initials of the informant and date (in year.month.day format) in which they were obtained. Judgments are arranged by chronological order, and in each case we provide:
–Column 1: number of the example cited in the text (the video in which the sentence appeared is cited in the text and is not repeated below).
–Colums 2 and up: video on which the judgment was recorded, followed by the initials of the informant and date (in year.month.day format), followed by the rating. For instance, the first rating below means that:
the judgment corresponding to example (24)a in the text was recorded in video 14, 182; this judgment was given by informant JL on October 20, 2012 (i.e. 12.10.20), and the rating obtained was of 7.

When semantic questions were added, they are explicitly mentioned (in English translation for semantic questions that appeared in French)

(24)a	14, 182	[JL 12.10.20]=	7	14, 192	[JL 12.10.21]=	7
b			7			7

Meaning: do we infer that the German swimmers like (i) people who support their [= the Germans'] own team? (ii) people who support the French team?

(26)	17, 39	[JL 13.05.07-2]=	7	i	17, 60	[JL 13.05.08]=	7	i (ii possible)	17, 68

[JL 13.05.14]=	7	i (ii possible)	17, 140	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii	

Meaning: do we infer that the German swimmers do NOT like (i) people who support their own team? (ii) people who support the French team?

(27)	17, 38	[JL 13.05.07-2]=	7	i	17, 59	[JL 13.05.08]=	7	i (ii possible)	17, 67

[JL 13.05.14]=	7	i (ii possible)	17, 139	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii	

(28)	14, 228	[JL 12.10.21-2]=	6	17, 1	[JL 13.05.06]=	6

Meaning [added 13.05.06]: Does one understand that the German swimmer likes (i) people who support the French swimmers? (ii) people who suppor the German swimmer?

17, 1	[JL 13.05.06]=	ii	

Meaning: do we infer that (i) the German swimmer doesn't like people who support him? (ii) the German swimmer doesn't like people who support the 11 French swimmers

(29)Judgment: a	17, 24	[JL 13.05.07]=	7	i

Meaning: do we infer that (i) the German swimmer doesn't like people who support him? (ii) the German swimmer doesn't like people who support the 11 French swimmers?

(30)Judgment: a	14, 242	[JL 12.10.22]=	7	i	17, 11	[JL 13.05.06]=	6	i	17, 20	[JL 13.05.07]=	6	i

Fn. 16 (i)

30, 89	[13.04.17 IH]=	6		30, 115	[IJ 13.04.30]=	7	31, 10	[IH 13.05.27]=	6		

Meaning: does one understand that the French swimmer thinks that (i) the German swimmers under discussion [second version: the-sg or the-pl German swimmer(s) under discussion] swim well? (ii) he himself swims well?

30, 89	[13.04.17 IH]=	i		30, 115	[IJ 13.04.30]=	ii	31, 10	[IH 13.05.27]=	i		

Fn 16 (ii)

30, 90	[13.04.17 IH]=	6		30, 11 6	[IJ 13.04.30]=	6		31, 11	[IH 13.05.27]=	6	

Meaning: does one understand that the French swimmer does NOT think that (i) the German swimmers under discussion [second version: the-sg or the-pl German swimmer(s) under discussion] swim well? (ii) he himself swims well?

b.	30, 90	[13.04.17 IH]=	ii	30, 116	[IJ 13.04.30]=	ii	30, 116	[IJ 13.04.30]=	i		

fn. 17

a.	31, 9	[IH 13.05.27]=	6	31, 26	[IH 13.06.04]=	4
b.			3			6
a'.			2			1
b'.			6			6

(31)	29, 18	[IJ 13.02.27]=	7	29, 29	[IH 13.02.28]=	6	30, 26	[IJ 13.03.22]=	7		

30, 75	[IJ 13.04.04]	7	30, 85	[13.04.17 IH]=	6	30, 113	[IJ 13.04.30]=	7	

Meaning: does one understand that the French swimmer thinks that (i) the German swimmers swim well? (ii) he himself swims well?

29, 18	[IJ 13.02.27]=	ii		29, 29	[IH 13.02.28]=	i			30, 26	[IJ 13.03.22]=	ii		

30, 75	[IJ 13.04.04]	ii		30, 85	[13.04.17 IH]=	i		30, 113	[IJ 13.04.30]=	ii		

(32)	29, 19	[IJ 13.02.27]=	7		29, 30	[IH 13.02.28]=	6		30, 27	[IJ 13.03.22]=	7		

30, 76	[IJ 13.04.04]	6	30, 86	[13.04.17 IH]=	6		30, 114	[IJ 13.04.30]=	6		

Meaning: does one understand that the French swimmer does NOT think that (i) the German swimmers swim well? (ii) he himself swims badly [corrected to 'well' after 13.04.30]?

29, 19	[IJ 13.02.27]=	ii		29, 30	[IH 13.02.28]=	i			30, 27	[IJ 13.03.22]=	ii		

30, 76	[IJ 13.04.04]	ii		30, 86	[13.04.17 IH]=	ii		30, 114	[IJ 13.04.30]=	ii		

(33)	30, 82	[IJ 13.04.04]	7		30, 93	[13.04.17 IH]=	6		30, 120	[IJ 13.04.30]=	7		

Meaning: does one understand that the French swimmer does NOT think that (i) the German swimmers swim well? (ii) he himself swims badly [corrected to 'well' after 13.04.30]?

30, 82	[IJ 13.04.04]	i et ii	deux possiblites	30, 93	[13.04.17 IH]=	i		30, 120	[IJ 13.04.30]=	ii		

Meaning: do we infer that the German dwarf LIKES (i) people who support him [= the dwarf] ? (ii) people who support the French giant?

fn. 24, (i)a.	17, 66	[JL 13.05.08]=	6	i	17, 76	[JL 13.05.14]=	6	ii (i possible)
b.			6	i			6	i/ii (almost equal readings)

c.			4	i			3	i (ii possible)

Meaning: do we infer that the German dwarf LIKES (i) people who support him [= the dwarf] ? (ii) people who support the French giant?

(40)a.	17, 65	[JL 13.05.08]=	7	i (ii possible)	17, 75	[JL 13.05.14]=	7	i (ii possible in all these examples, but is strongest in a.)
b.			7	i (ii possible)			7	i
c.			5	i (ii possible)			4	i

Meaning: do we infer that the German dwarf does NOT like (i) people who support him [= the dwarf] ? (ii) people who support the French giant?

(41)a.	17, 64	[JL 13.05.08]=	7	i (ii possible)	17, 69	[JL 13.05.14]=	7	i (ii possible)	17, 141	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii
b.			7	i (ii possible)			7	i (ii possible)			7	i (ii possible)
c.			5	i (ii possible)			5	i (ii possible)			5	i (ii possible)

Meaning: do we infer that the German dwarf does NOT like (i) people who support him [= the dwarf] ? (ii) people who support the French giant? (abbreviated replies for the semantic questions)

(42)a.	17, 72	[JL 13.05.14]=	7	i	17, 98	[JL 13.05.15]=	7	i (ii possible)	17, 142	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii . Also, in a. ii is stronger than in b. or c.
b.			7	i			7	i (ii possible)			7	i (ii possible)
c.			4	i			4	i (ii possible)			7	i (ii possible)

(43)a.	28, 59	[IJ 13.02.05]=	7		28, 80	[IH 13.02.07]=	5	31, 1	[IH 13.05.27]=	6
b.			4				3			5
c.			1				1			2

Meaning: What does one understand concerning the dwarf? One understands: (i) the dwarf likes the giant; (ii) the dwarf likes himself [= the dwarf].

a.	28, 59	[IJ 13.02.05]=	ii		28, 80	[IH 13.02.07]=	ii		31, 1	[IH 13.05.27]=	ii
b.			ii				ii				ii
c.			ii				ii				ii

(44)a.	28, 61	[IJ 13.02.05]=	7		28, 81	[IH 13.02.07]=	5	31, 2	[IH 13.05.27]=	6
b.			4				3			5
c.			1				1			2

Meaning: What does one understand concerning the dwarf? One understands: (i) the dwarf does NOT like the giant; (ii) the dwarf does NOT like himself [= the dwarf].

a.	28, 61	[IJ 13.02.05]=	ii		28, 81	[IH 13.02.07]=	ii		31, 2	[IH 13.05.27]=	ii
b.			ii				ii				ii
c.			ii				ii				ii

(45)a.	28, 63	[IJ 13.02.05]=	7		28, 82	[IH 13.02.07]=	5	31, 3	[IH 13.05.27]=	6
b.			4				3			5
c.			1				1			2

Meaning: What does one understand concerning the dwarf? One understands: (i) the dwarf does NOT like the giant; (ii) the dwarf does NOT like himself [= the dwarf].

a.	28, 63	[IJ 13.02.05]=	ii		28, 82	[IH 13.02.07]=	i		31, 3	[IH 13.05.27]=	ii
b.			ii				i				ii
c.			ii				i				ii

(49)

Meaning [same question for all positions]: do we infer that the dwarf does NOT like: (i) himself [= the dwarf]? (ii) the giant?

1a.	17, 182	[JL 13.05.18]=	6	i	By email	[JL 13.06.19e]=	6	i
1b.			3	i			3	i

2a.	17, 183	[JL 13.05.18]=	6	i	By email	[JL 13.06.19e]=	5	i
2b.			4	i			3	i

3a.	17, 184	[JL 13.05.18]=	7	i	By email	[JL 13.06.19e]=	6	i
3b.			3	i			3	i

4a.	17, 185	[JL 13.05.18]=	6	i	By email	[JL 13.06.19e]=	6	i
4b.			4	i			3	i

(53)-(54)

Vertical - Heads up

a.	30, 67	[IJ 13.03.27]=	7		30, 71	[IJ 13.04.04]	6	30, 99	[13.04.17 IH]=	6	30, 124	[IJ 13.04.30]=	6	31, 13	[IH 13.05.27]=	6	31, 30	[IH 13.06.04]=	6
b.			7				7			6			7			6			6
c.			1				1			4			1			3			3

Meaning: Does one understand that the dwarf does NOT like (i) the giant? (ii) himself?

a.	30, 67	[IJ 13.03.27]=	ii	30, 71	[IJ 13.04.04]	ii	30, 99	[13.04.17 IH]=	ii	30, 124	[IJ 13.04.30]=	ii	31, 13	[IH 13.05.27]=	ii	31, 30	[IH 13.06.04]=	ii
b.			ii			ii			ii			ii			ii			ii
c.						ii			ii			ii			ii			ii

Vertical - Heads down

a.	30, 68	[IJ 13.03.27]=	7	30, 72	[IJ 13.04.04]	6	30, 100	[13.04.17 IH]=	6	30, 125	[IJ 13.04.30]=	6	31, 14	[IH 13.05.27]=	6	31, 31	[IH 13.06.04]=	6
b.			7			7			6			7			6			6
c.			1			1			6			1			3			3

Meaning: Does one understand that the dwarf does NOT like (i) the giant? (ii) himself?

	V	D	J	V	D	J	V	D	J	V	D	J	V	D	J	V	D	J
a.	30, 68	[IJ 13.03.27]=	ii	30, 72	[IJ 13.04.04]	ii	30, 100	[13.04.17 IH]=	ii	30, 125	[IJ 13.04.30]=	ii	31, 14	[IH 13.05.27]=	ii	31, 31	[IH 13.06.04]=	ii
b.			ii			ii			ii			ii			ii			ii
c.						ii			ii			ii			ii			ii

Diagonal - Heads up

a.	30,	[IJ	7	30,	[IJ	6	30,	[13.04.17	6	30,	[IJ	7	31,	[IH		31,	[IH	6

	63	13.03.27]=		70	13.04.04]		98	IH]=		123	13.04.30]=		12	13.05.27]=	6	29	13.06.04]=	
b.			7			7			6			7			6			6
c.			1			1			4			1			3			3

Meaning: Does one understand that the dwarf does NOT like (i) the giant? (ii) himself?

a.	30, 63	[IJ 13.03.27]=	ii	30, 70	[IJ 13.04.04]	ii	30, 98	[13.04.17 IH]=	ii	30, 123	[IJ 13.04.30]=	ii	31, 12	[IH 13.05.27]=	ii	31, 29	[IH 13.06.04]=	ii
b.			ii			ii			ii			ii			ii			ii
c.						ii			ii			ii			ii			ii

Diagonal - Heads down

a.	30, 69	[IJ 13.03.27]=	7	30, 73	[IJ 13.04.04]	6	30, 101	[13.04.17 IH]=	6	30, 126	[IJ 13.04.30]=	6	31, 15	[IH 13.05.27]=	6	31, 32	[IH 13.06.04]=	6
b.			7			7			6			7			6			6
c.			1			1			6			1			3			3

Meaning: Does one understand that the dwarf does NOT like (i) the giant? (ii) himself?

a.	30, 69	[IJ 13.03.27]=	ii	30, 73	[IJ 13.04.04]	ii	30, 101	[13.04.17 IH]=	ii	30, 126	[IJ 13.04.30]=	ii	31, 15	[IH 13.05.27]=	ii	31, 32	[IH 13.06.04]=	ii
b.			ii			ii			ii			ii			ii			ii
c.						ii			ii			ii			ii			ii

(61) a.	14, 224	[JL 12.10.21-2]=	7	17, 19	[JL 13.05.07]=	7
b.			5			6

Meaning [added 13.05.07]: Does one infer that (i) the German swimmers like people who support them [= the German swimmers]? (ii) the German swimmers like people who support the French swimmers?

a .	17, 19	[JL 13.05.07]=	i
b			i (ii possible)

(62) Meaning: do we infer that (i) the German swimmer doesn't like people who support him? (ii) the German swimmer doesn't like people who support the 11 French swimmers?

a.	17, 24	[JL 13.05.07]=	7	i
b.			7	i/ii

Meaning: do we infer that (i) the German swimmer doesn't like people who support him? (ii) the German swimmer doesn't like people who support the 11 French swimmers?

(63)a.	14, 242	[JL 12.10.22]=	7	i	17, 11	[JL 13.05.06]=	6	i	17, 20	[JL 13.05.07]=	6	i
b.			7	i			6	i			6	i

Meaning: do we infer that the German swimmers do NOT like (i) people who support their own team? (ii) people who support the French team?

(64)a.	17, 38	[JL 13.05.07-2]=	7	i	17, 59	[JL 13.05.08]=	7	i (ii possible)	17, 67	[JL 13.05.14]=	7	i (ii possible)	17, 139	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii
b.			7	ii			6	ii			6	ii			6	ii (i possible)
c.			7	ii			7	ii			7	ii			7	ii
a'.			7	i (ii possible)			7	i			7	i			7	i (ii possible)
b'.			7	ii			7	ii			7	ii			6	ii
c'.			7	ii			7	ii			7	ii			7	ii

Meaning: do we infer that the German dwarf does NOT like (i) people who support him [= the dwarf] ? (ii) people who support the French giant?

(65)a.	17, 64	[JL 13.05.08]=	7	i (ii possible)	17, 69	[JL 13.05.14]=	7	i (ii possible)	17, 141	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii
b.			7	i (ii possible)			7	i (ii possible)			7	i (ii possible)
c.			5	i (ii possible)			5	i (ii possible)			5	i (ii possible)

Meaning: do we infer that the German swimmers like (i) people who support their [= the Germans'] own team? (ii) people who support the French team?

(66)a.	17, 39	[JL 13.05.07-2]=	7	i	17, 60	[JL 13.05.08]=	7	i (ii possible)	17, 68	[JL 13.05.14]=	7	i (ii possible)	17, 140	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii
b.			7	ii			6	ii			6	ii			6	ii (i possible)
c.			7	ii			7	ii			7	ii			7	ii
a.			7	i			7	i			7	i			7	i (ii possible)
b.			7	ii			7	ii			7	ii			6	ii
c.			7	ii			7	ii			7	ii			7	ii

Meaning: do we infer that the German dwarf LIKES (i) people who support him [= the dwarf] ? (ii) people who support the French giant?

(67)a.	17, 65	[JL 13.05.08]=	7	i (ii possible)	17, 75	[JL 13.05.14]=	7	i (ii possible in all these examples, but is strongest in a.)
b.			7	i (ii possible)			7	i
c.			5	i (ii possible)			4	i

Meaning:
a-b: do we infer that the German dwarf does NOT like (i) people who support him [= the dwarf] ? (ii) people who support the French giant?
a', b', c': do we infer that the German dwarf does NOT like (i) people who support his [= the dwarf's] team ? (ii) people who support the French giant's team?
(Abbreviated answers)

(68)a.	17, 74	[JL 13.05.14]=		i (ii possible)[47]	17, 99	[JL 13.05.15]=	7	i (ii possible) [ii stronger in a than b or a'.]	17, 143	[JL 13.05.17]=	7	i (ii possible) i.e. i>ii
b.			7	i			7	i (ii possible)			7	i (ii possible)
a'.			7	i			7	i (ii possible)			7	i (ii possible)
b'.			7	ii			6	ii			6	ii
c'.			7	ii			7	ii			7	ii

(69)a.	27, 50	[IJ 13.01.17]=	7	27, 54	[IJ 13.01.22]=	7	28, 2	[IH 13.01.24]=	6
b.			7			7			6
c.			6			7			2

[47]The informant made several remarks, including the following: 'High IX locus seems to have a greater effect here, making meaning ii possible; I believe this effect should also apply in earlier examples, but it was not noted.' This might suggest that feature mismatch does marginally help in bringing out the strict reading.

Meaning: Does one understand that the French know (i) the people who like the German team? (ii) the people who like the French team?

a.	27, 50	[IJ 13.01.17]=	ii	27, 54	[IJ 13.01.22]=	ii	28, 2	[IH 13.01.24]=	i) 6 ii)2
b.			ii			ii			i) 6 ii) 2
c.			i			i			i)6 ii)2

(70)a.	27, 48	[IJ 13.01.17]=	7	27, 53	[IJ 13.01.22]=	7	28,1	[IH 13.01.24]=	6
b.			7			7			7
c.			7			7			3

Meaning: Does one understand that the French do NOT know (i) the people who like the German team? (ii) the people who like the French team?[48]

a.	27, 48	[IJ 13.01.17]=	i	27, 53	[IJ 13.01.22]=	ii	28, 1	[IH 13.01.24]=	i) 7 ii) 1
b.			i			ii			i) 6 ii)1
c.			i			i			i)6 ii)1

(71)a.	27, 52	[IJ 13.01.17]=	7	27, 55	[IJ 13.01.22]=	7	28, 3	[IH 13.01.24]=	7	
b.			7			7			5	
c.			7			7			5	

Meaning: one understands that the French do NOT know (i) the people who liek the German team? (ii) the people who like the French team?

a.	27, 52	[IJ 13.01.17]=	i		27, 55	[IJ 13.01.22]=	ii		28, 3	[IH 13.01.24]=	i)7 ii)2
b.			i				ii				i)7 ii)2
c.			i				i				i) 7 ii)2

(79)a.	14, 188	[JL 12.10.20]=	7	17, 41	[JL 13.05.07-2]=	7
b.			7			7

Meaning: Does each of the swimmers say: (i) I will blow away the other swimmers (ii) We will blow away the other swimmers

a.	14, 188	[JL 12.10.20]=	i/ii (likely ii)	17, 41	[JL 13.05.07-2]=	i/ii
b.			ii			ii

(80)a.	14, 190	[JL 12.10.20]=	7	17, 42	[JL 13.05.07-2]=	7
b.			7			7

Meaning: Does each of the swimmers say (1st trial) / think (2nd trial): (i) I will blow away the other swimmers (ii) We will blow away the other swimmers

a.	14, 190	[JL 12.10.20]=	i/ii (likely ii)	17, 42	[JL 13.05.07-2]=	i/ii
b.			ii			ii

(81)a.	30, 23	[IH 13.03.06-2]=	6	30, 28	[IJ 13.03.22]=	7	30, 77	[IJ 13.04.04]	7	30, 92	[13.04.17 IH]=	5	30, 119	[IJ 13.04.30]=	7
b.			6			7			7			5			7
c.			6			7			7			5			7

Meaning: Does one understand that the 4 French swimmers think: (i) "We are going to win" (or: "The French swimmers are going to win"), (ii) "I am going win"?

a.	30, 23	[IH 13.03.06-2]=	i	30, 28	[IJ 13.03.22]=	i	30, 77	[IJ 13.04.04]	i	30, 92	[13.04.17 IH]=	i		30, 119	[IJ 13.04.30]=	i
b.			i			i			i			i				i
c.			ii			ii			ii			ii				ii

Meaning: Does one understand that the German swimmer[49]: (i) "They [= the French swimmers] are going to win", (ii) "I am going to win"?

a.	30, 23	[IH 13.03.06-2]=	i	30, 28	[IJ 13.03.22]=	ii	30, 77	[IJ 13.04.04]	ii	30, 92	[13.04.17 IH]=	i	30, 11 9	[IJ 13.04.30]=	ii
b.			i			ii			ii			i			ii
c.			i			ii			ii			ii			ii

[48] Here and in a few other cases, LSF informant IH provided numerical ratings for the availability of each reading.
[49] The word 'think' was missing here.

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