Gestural Grammar[*]

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Abstract. We argue that some properties of sign language grammar have counterparts in non-signers' intuitions about gestures, including ones that are probably very uncommon. Thus despite the intrinsic limitations of gestures compared to full-fledged sign languages, they might access some of the same rules. While gesture research often focuses on *co-speech gestures*, we focus instead on *pro-speech* gestures, which fully replace spoken words and thus often make an at-issue semantic contribution, like signs. We argue that *gestural loci* can emulate several properties of sign language loci (= positions in signing space that realize discourse referents): there can be an arbitrary number of them, with a distinction between speaker-, addressee- and third person-denoting loci. They may be free or bound, and they may be used to realize 'donkey' anaphora. Some gestural verbs include loci in their realization, and for this reason they resemble some 'agreement verbs' found in sign language (Schlenker and Chemla 2018). As in sign language, gestural loci can have rich iconic uses, with high loci used for tall individuals. Turning to plurality, we argue that repetition-based gestural nouns replicate several properties of repetition-based plurals in ASL (Schlenker and Lamberton, to appear): unpunctuated repetitions provide vague information about quantities, punctuated repetitions are often semantically precise, and rich iconic information can be provided in both cases depending on the arrangement of the repetitions, an observation that extends to some mass terms. We further suggest that gestural verbs can give rise to repetition-based pluractional readings, as their sign language counterparts (Kuhn 2015, Kuhn and Aristodemo 2017). Following Strickland et al. 2015, we further argue that a distinction between telic and atelic sign language verbs, involving the existence of sharp boundaries, can be replicated with gestural verbs. Finally, turning to attitude and action reports, we suggest (following in part Lillo-Martin 2012) that Role Shift, which serves to adopt another agent's perspective in sign language, has gestural counterparts. (An Appendix discusses possible gestural counterparts of 'Locative Shift', a sign language operation in which one may co-opt a location-denoting locus to refer to an individual found at that location.)

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1 Introduction

1.1 Goals

We argue in this piece that some non-trivial rules that constrain the use of *signs* (in particular in ASL [American Sign Language]) have analogues in some *gestures* in spoken language. Thus there is in a sense a 'gestural grammar' which, despite severe limitations, shares some properties with sign language grammar.

While most gestural work focuses on *co-speech* gestures studied by way of corpora, we base our analysis on *pro-speech* gestures, which fully replace words (rather than accompanying them). Pro-speech gestures fulfill the grammatical and semantic role of full-fledged words; for this reason, they often lead to ungrammaticality if they are omitted.[1] The reason pro-speech gestures are a good point of comparison for signs is that, just like signs, they usually make at-issue contributions. By contrast, co-speech gestures are 'parasitic' on the words they co-occur with, and they were argued to *not* to make at-issue contributions, possibly this reason (Ebert and Ebert 2014, Schlenker 2018a,b).[2] While we will co-speech gestures to introduce discourse referents in gestural space, our focus will be on pro-speech gestures.

To make things concrete, consider the example in (1).

(1) Whenever I can hire IX-hand-a **[a mathematician]** or IX-hand-b **[a sociologist]**, I pick IX-a.
Meaning: whenever I can hire a mathematician or a sociologist, I pick the former.

The first disjunct *a mathematician* is pronounced with an open hand on the right (glossed as *IX-hand-a*, and preceding the co-occurring expression, which is boldfaced) while the second disjunction *a sociologist* co-occurs with an open hand on the left (glossed as *IX-hand-b*). We will argue that these are gestural counterparts of 'loci', positions in signing space that instantiate discourse referents or variables (Lillo-Martin and Klima 1990). As a result, when the sentence-final object of *pick* is replaced with a pointing gesture towards the right (glossed as *IX-a*), we obtain a sentence which is acceptable, and has a 'donkey' reading on which the gestural 'pronoun' is dependent on the (non-c-commanding) existential quantifier. It is worth noting that in this case *him* or *her* could be ambiguous between the two antecedents, whereas the pointing gesture isn't: it is clear that the gesture is not just a code for a word.

Pro-speech gestures of this type are arguably very uncommon, and their properties can be teased apart only by establishing which are intuitively acceptable and which are deviant. It is thus essential to extend to gestural work the method routinely used to collect data on spoken and signed languages, based on acceptability judgments on constructed examples. We will start from a case, involving person markers in gestural verbs, in which this method was validated with experimental means. We will then extend it to new areas involving loci (= positions in signing/gestural space corresponding to discourse referents), plurality, pluractionality, telicity, and context shift, thus offering a diverse sample of grammatical rules that constrain pro-speech gestures. Our data will be based on the introspective judgments of three (non-signing) linguists; we will focus on cases in which there is significant agreement among our informants, and we will leave a (necessary) extension using experimental means for future research.

In the present context, we will follow standard usage in formal studies of sign language (as summarized for instance in Sandler and Lillo-Martin 2006) and treat the phenomena discussed below (loci, plurals, pluractionals, telicity, context shift) as being 'grammatical'. One reason for this terminology is that these phenomena share detailed formal properties with counterparts that are uncontroversially considered as grammatical in spoken language. But it should be kept in mind that

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[1] We write 'often lead to ungrammaticality' rather than 'always lead to ungrammaticality' because a pro-speech gesture may replace a modifier, and since modifiers can usually be omitted, this would be the case of the corresponding pro-speech gesture as well.

[2] For similarities between signs and *co*-speech gestures, see for instance Perniss et al. 2015.

sign language phenomena typically have an iconic component[3] that their spoken language counterparts lack, a point that has been discussed in detail in recent studies (e.g. Schlenker 2017a, to appear a). In addition, there is a debate within sign language linguistics to determine which rules should count as 'grammatical' and which should be seen as 'gestural' in nature (see for instance Liddell 2003 for a statement of the 'gestural' position). The reader who disagrees with our terminological choices need not be distracted by it: our goal is to show, irrespective of the terminology, that signs and pro-speech gestures share detailed formal properties in areas that have not been precisely described up to this point.

1.2 Why study gestural grammar?

While there has been considerable work on the interaction between language and gestures, only recently have there been attempts to study the formal semantics of gestures, as well as aspects of their formal grammar (Lascarides and Stone 2009, Giorgolo 2010, Ebert and Ebert 2014, Schlenker 2018a, Schlenker and Chemla 2018). This research direction has intrinsic interest because gestures offer a rich source of new data for linguistics and allied fields, but it is also essential to a proper comparison between spoken and signed languages.

There is no doubt that sign languages are full-fledged languages with the same general grammatical and semantic properties as spoken languages (with some modality-specific specificities [e.g. Sandler and Lillo-Martin 2006]). But some researchers have raised the possibility that, along certain dimensions at least, sign languages might be expressively *richer* than spoken languages because they have the same logical spine but richer iconic resources (e.g. Schlenker, to appear a). Other researchers have countered that the role of iconicity in this comparison cannot be properly assessed unless co-speech gestures are taken into account; in the words of Goldin-Meadow and Brentari (to appear), "sign should not be compared with speech – it should be compared with speech-plus-gesture". Gestures are thus essential to a comparison between sign and speech.

But which gestures should the comparison focus on? It has been argued that *even* when co-speech gestures are re-integrated in the comparison, there remain systematic differences between the two modalities because the contributions made by co-speech gestures are usually not at-issue, whereas iconic modulations in sign languages often can be (Ebert and Ebert 2014, Schlenker 2018a,b). By contrast, some gestures ('pro-speech gestures') that fully replace words (rather than accompanying them) make at-issue contributions, and for this reason they will play a prominent role in the present comparison between gestural and sign language grammar (Schlenker 2018b; see also Slama-Cazacu 1976, Clark 1996, Fricke 2008, Ladewig 2011). But being gestures, they lack the conventional character, semantic richness, and sophisticated grammatical rules of sign languages; thus we can at best hope to uncover a 'proto-grammar' for gestures.

Still, gestures in general and pro-speech gestures in particular might be important to understand the origins of sign languages. It is noteworthy that homesigners, who grow up without access to sign language, do end up developing gestural languages that share some properties of sign languages (e.g. Abner et al. 2015, Goldin-Meadow 2003), although they are also expressively and communicatively far less rich (hence the importance, emphasized in much research, of providing deaf children will full access to sign language, e.g. Mellon et al. 2015). It is thus natural to ask whether pro-speech gestures might display some grammatical-like properties.

On the syntactic side, Goldin-Meadow et al. 2008 showed that hearing speakers asked to use gestures to silently represent complex actions preferentially adopted an SOV order (subject - object - verb, or actor - patient - action), irrespective of the syntax of their native language. Furthermore, they did so both in communicative tasks (gesturing an entire action for an audience) and in non-communicative tasks (involving the arrangement of transparencies representing an event and its participants), which suggests that the preference is cognitive in nature.

[3] Following Schlenker, to appear a, we treat as iconic those sign language rules of interpretation that produce information by preserving some geometric properties of signs. For instance, the verb *GROW* can be realized more or less quickly to indicate that the growth process was more or less quick, hence an iconic component, to the effect, roughly, that *the faster the realization of the sign, the fast the growth process*. (Note that if a lexical sign happens to resemble its denotation, but no interpretive rule makes reference to the preservation of some geometric properties, it does not count as 'iconic' in this sense, although it may result from 'fossilized' iconicity, so to speak.)

In this piece, we attempt to investigate the acceptability of pro-speech gestures using a different method: we embed them in full-fledged spoken sentences, so that the grammatical spine remains that of English, with gestures 'imported' to fulfill certain syntactic and semantic functions.

We do not claim that pro-speech gestures are common – quite the opposite. It is all the more striking that they must some rules that seem to have counterparts in sign language – which might suggest that the two cases share a common cognitive/linguistic origin.

1.3 Goals and limitations

We will thus argue that several non-trivial properties of sign language grammar can be found in non-signers' intuitions about pro-speech gestures (on similarities between signs and *co*-speech gestures, see for instance Perniss et al. 2015). Indirectly, then, they know some properties of sign language grammar (although they usually don't know that they know them, as these properties have nothing to do with common and often incorrect representations of sign language in non-signers). These results should be seen in the context of a broader comparison between sign language and gestures, and in particular of the finding that there are clear connections between the iconicity of signs and of gestures (Ortega et al. to appear).

There are also important limitations to our enterprise. As we explain below, we base our discussion on the judgments of three informants who are native speakers of American English. We consulted them by way of a survey with videos of a native speaker of American English. Sprouse and Almeida, 2012, 2013, Sprouse, Schütze and Almeida, 2013 have argued for the general validity of introspective methods in standard linguistic judgments. Tieu et al. 2017, to appear have largely confirmed with experimental means early semantic judgments on *co*-speech gestures that appeared in the literature (Schlenker 2018a). Tieu et al. 2018 have done the same for semantic judgments on *pro*-speech gestures. Closer to our topic, we will review experimental results from Schlenker and Chemla 2018 that confirm introspective judgments on the acceptability of some pro-speech gestures.

Still, it is fair to note that introspective methods are less well established for gestures than for speech, and our own survey suggests that there is more variation across informants than one might expect for standard speech data. While we will concentrate on areas of agreement among informants, this theoretical study will have to be followed by detailed experimental work in the future: as in all informant work, concentrating on areas of agreement among subjects comes with the risk that noisy data give rise, *post hoc,* to apparent data stability; systematic methods must be used at a later stage to come for firmer conclusions. But as is the case in linguistics generally, we believe that this experimental stage is most fruitful if preceded by the kind of detailed theoretical and analytical work we seek to develop in this piece.

1.4 Organization

The rest of this article is organized as follows. We provide necessary background pertaining to gestural typology, elicitation methods and transcription conventions in Section 2. An initial case pertaining to the interaction of ellipsis and loci in gestural verbs is summarized in Section 3; it has the advantage of being simultaneously based both on introspective judgments and on experimental results that largely validate them. We then turn to cases involving several nominal as well as temporal and modal loci (Section 4), and focus on their uses in donkey anaphora (Section 5) and on their interaction with iconic conditions (Section 6). We then turn to expressions of plurality (Section 7), pluractionality (Section 8) and telicity (Section 9). We end the paper with possible gestural counterparts of sign language Role Shift (Section 10), before drawing some conclusions (Section 11). (An Appendix discuss less table data pertaining to 'Locative Shift', and Supplementary Materials contain the raw results of our gestural survey[4].)

[4] To facilitate cross-reference, video numbers are provided in each gestural example in the text as well as in the Supplementary Materials.

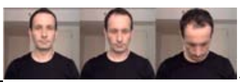
2 Background: typology, methods and transcriptions

2.1 Gesture typologies

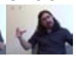
McNeill 2005 (chapter 2) distinguishes between four types of gestures: *iconic*, *metaphoric*, *deictic* and *beat*, defined as follows.
(i) "*Iconic:* such gestures present images of concrete entities and/or actions. They are gestures in which the form of the gesture and/or its manner of execution embodies picturable aspects of semantic content."
(ii) "*Metaphoric:* Gestures can also present *images of the abstract*."
(iii) "*Deictic:* Although the prototypical deictic gesture is the hand with an extended index finger, almost any extensible body part or held object can be used for pointing."
(iv) "*Beats*"*:* they take "the form of the hand beating time".
Some authors, such as Giorgolo 2010 (pp. 4-5), have a subcategory of 'emblems', which 'are "typically culture-specific gestures, associated with a fixed meaning" – for instance the 'thumb up' gesture used in Western culture. We will primarily focus on iconic and 'deictic' gestures, although we will argue that some of the latter have anaphoric uses in addition to their deictic ones.

Schlenker 2018b proposes a pragmatic typology in which different types of gestures make different types of semantic/pragmatic contributions depending in part on whether (i) they are syntactically eliminable and (ii) they have a separate time slot. This typology is represented in (2). The main claim is that co-speech gestures and co-sign facial expressions, which *co-occur* with the words they modify, trigger (weak) presuppositions of a special sort, called 'cosuppositions'; post-speech gestures and post-sign facial expressions, which *follow* the words they modify, trigger supplements, i.e. the same kind of contribution as appositive relative clauses; while pro-speech gestures, which fully *replace* some words, are very free in their semantic contributions and can in particular be at-issue (the same claim is made about iconic modulations of words).[5] Co-speech/sign gestures and facial expressions *co-occur* with the words they modify; post-speech/sign *follow* the words they modify; iconic modulations are modifications of the words; and pro-speech gestures are gestures that fully replace some words (see Section 2.3 for transcription conventions). Some pro- and post-speech gestures are more natural if accompanied with an onomatopoeia, which might be because silent words are uncommon in spoken language, and/or because the onomatopoeia makes the iconic representation more complete.[6] We do not usually encode these, and the reader should try to pick all-purpose onomatopoeias that minimally affect the semantic contribution of the relevant gestures.

[5] Schlenker 2018b seeks to derive parts of the typology from pragmatic considerations; we need not be concerned with this derivation here.
[6] One should not infer that pro- and post-speech gestures are necessarily accompanied with onomatopoeia. This is not the case in (i), which involves a gesture representing a silent action.

(i) In two minutes, our Chair will DOZE-OFF_. (Schlenker 2018b)

(2) **Typology of iconic enrichments** (from Schlenker 2018b)

	External enrichments (= syntactically eliminable)		**Internal enrichments (= syntactically ineliminable)**	
	No separate time slot: **Co-speech/co-sign gestures**	Separate time slot: **Post-speech/post-sign gestures**	No separate time slot: **Iconic modulations**	Separate time slot: **Pro-speech/pro-sign gestures**
Speech	John  **punished** his son.	John punished his son – .	The talk was loooooong.	Your brother, I am going to .
Sign	IX-arc-b NEVER  **[SPEND MONEY]**	IX-arc-b NEVER SPEND MONEY]$_b$ – .	POSS-1 GROUP GROW_  	[currently unclear]
Meaning	**cosuppositions** (= presuppositions of a special sort)	**supplements**	**at-issue or not**, depending on the case	**at-issue**, with an additional non-at-issue component in some cases

Finally, Schlenker, to appear b, argues that a rich typology of linguistic inferences can be reproduced within pro- and post-speech gestures, and the main results are extended with experimental means in Tieu et al. 2018. Specifically, the proposal is that pro-gestures can trigger scalar implicatures and associated phenomena (Blind Implicatures), presuppositions and associated phenomena (so-called 'anti-presuppositions' due to *Maximize Presupposition*), homogeneity inferences that are characteristic of definite plurals, as well as some expressive inferences that are characteristic of some pejorative terms. And as mentioned before, post-speech gestures trigger inferences that are very close to the supplements triggered by appositive relative clauses. By contrast with these earlier works, our focus in the present paper will be on grammatical properties of pro-speech gestures, although inferential judgments will sometimes be helpful to establish them.

2.2 Elicitation methods

Sign language data are usually cited from earlier publications and were elicited by way of the Playback Method, described for instance in Schlenker et al. 2013. When quantitative acceptability judgments appear at the beginning of sign language sentences, they are on a 7-point scale, with 7 = best (references of the form (ASL, 7, 204) are to the videos on which the sentences were recorded).

Gestural data were obtained in two steps. In an initial phase, examples were constructed using the author's judgments and those of linguists that were informally consulted (native speakers of American English who are not signers)[7]. In a second phase, judgments were systematically checked by (i) creating videos of all examples, produced by a native speaker of American English; (ii) asking 3 colleagues for systematic judgments: all three are native signers of American English, none of them is a signer,[8] two have conducted research on gestures before, one of them hasn't. We focus on areas of agreements among informants, but the full survey and results can be found in the Supplementary Materials.

2.3 Transcription conventions and methods

We turn to out transcription conventions and methods.

2.3.1 Sign language transcription conventions

In the following, sign language sentences are glossed in capital letters, as is standard. Expressions of the form *WORD–i*, *WORD*$_i$ and *[…EXPRESSION…]*$_i$ indicate that the relevant expression is associated with the locus (= position in signing space) *i*. A suffixed locus, as in *WORD–i,* indicates that the association is effected by modulating the sign in such a way that it points towards locus *i* (this is different from the addition of a pointing sign *IX-i* to a word); a subscripted locus, as in *WORD*$_i$ or *[…EXPRESSION…]*$_i$, indicates that the relevant expression is signed in position *i*. Locus names are assigned from right to left from the signer's perspective; thus when loci *a, b, c* are mentioned, *a* appears on the signer's right, *c* on the left, and *b* somewhere in between. *IX* (for

[7] Some related French data were discussed with French-speaking colleagues but are not reported here.
[8] One of them, Informant 2, had one week of instruction in French Sign Language (LSF).

‘index’) is a pointing sign towards a locus, while *POSS* is possessive; they are glossed as *IX-i* and *POSS-i* if they point towards (or 'index') locus *i*; the numbers *1* and *2* correspond to the position of the signer and addressee respectively. *IX-i* is a standard way of realizing a pronoun corresponding to locus *i*, but it can also serve to *establish* rather than to *retrieve* one. Agreement verbs include loci in their realization – for instance the verb *a-ASK-1* starts out from the locus *a* and targets the first person locus *1;* it means that the third person individual denoted by *a* asks something to the signer. When an expression indexes a default locus, it is usually written without a letter index (e.g. *IX* rather than *IX-a* - but note that the distinction between a default and a non-default locus may not be easy to make). *IX-arc-i* refers to a plural pronoun indexing locus *i,* as it involves an arc motion towards *i* rather than a simple pointing sign.

The suffix *-rep* is used for unpunctuated repetitions, and in such cases *-rep3, -rep4*, *-rep≥4*, *-rep5*…indicate that there are 3, 4, at least 4, 5, … iterations. When relevant, we add a subscript indicating the shape of the repetition, e.g. *-rep3*$_{horizontal}$ for a horizontal repetition (whether in a straight line or as horizontal arc), *-rep3*$_{triangle}$ for a triangular-shaped repetition. The suffix *-cont* is used for continuous repetitions, and subscripts may be used as well to indicate the shape of the movement, such as *-cont*$_{horizontal}$ or *-cont*$_{triangle}$. Punctuated repetitions of an expression *WORD* are encoded as *[WORD WORD WORD]* if they involve three iterations of that expression; *[WORD WORD WORD]*$_{horizontal}$ and *[WORD WORD WORD]*$_{triangle}$ provide information about the shape of the repetition.

Unless otherwise noted, non-manuals are not transcribed, unless they appeared in the original publications from which the sentences are cited. If so, ^ above a word or expression indicates that it was realized with raised eyebrows. Further conventions are introduced below as they become relevant.

Acceptability scores (on a 7-point scale, with 7 =best) on sign language data appear as subscripts at the beginning of examples.

2.3.2 Spoken language transcription conventions

Glossing conventions for gestures were chosen to be reminiscent of sign language: here too, we used capital letters to gloss elements that are produced manually. This choice should definitely not suggest that signs are gestures or conversely.[9]

For legibility, we use a non-standard font to transcribe gestures. A gesture that co-occurs with a spoken word (= a co-speech gesture) is written in capital letters or as a picture (or both) *preceding* the expression it modifies (in some cases, we have added a link to a video to illustrate some gestures). The modified spoken expression will be boldfaced, and enclosed in square brackets if it contains several words.

Examples (from Schlenker 2018b)

John SLAP **punished** his enemy.

John SLAP_ **punished** his enemy.

John  **punished** his enemy.

A gesture that follows a spoken word (= a post-speech gesture) is written in capital letters or as a picture *following* the expression it modifies, and preceded by a dash: – .

Examples (from Schlenker 2018b)

John punished his enemy – SLAP.

John punished his enemy – SLAP_.

John punished his enemy – .

A gesture that replaces a spoken word (i.e. a 'pro-speech gesture') is written in capital letters, if

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

necessary with an onomatopoeic sound following it (with an 'underscore' connection _ between the sound and the gesture, as for words modified by co-speech gestures).

Examples (from Schlenker 2018b)

My enemy, I will SLAP _<phhh>.

My enemy, I will SLAP__<phhh>.

My enemy, I will _<phhh>.

As in sign language, pointing gestures are alphabetized from right to left from the speaker's perspective.[10] *IX-a* encodes pointing with a finger towards position *a,* while *IX-hand-a* encodes pointing with an open hand, palm up, towards position *a*. A gestural verb involving slapping was glossed as *SLAP-2* if it was realized towards the addressee, and as *SLAP-a* if it was realized towards a third person position – which we'll also call 'locus' for terminological simplicity. Refining the notation, we will write *SLAP(-2)* if we think that this form is both a second person and a neutral form, usable in all persons. We will use the notation *IX-a* to refer to pointing towards gestural locus *a*.

Acceptability scores (on a 7-point scale, with 7 =best) on English gestural data appear as subscripts at the beginning of examples. 'Translations' of gestures are justified by inferential judgments. When different informants have different inferential judgments, we write '2/3 informants' to mean '2 informants out of 3' (since some informants may offer several readings, the total may sum to more than 3). All raw data (acceptability as well as inferential judgments) can be found in the Supplementary Materials.

3 Initial case: gestural agreement

Investigating gestures by way of acceptability judgments is not a fully accepted method yet, and thus we start with a brief summary of an initial case study in which introspective judgments were confirmed with experimental means.

3.1 Agreement verbs: signs vs. gestures

Sign languages typically use positions in signing place, called 'loci', to realize discourse referents (e.g. Sandler and Lillo-Martin 2006, Schlenker 2017a). Loci that denote elements of the discourse situation (including the signer and addressee) must correspond to their real position. Loci that correspond to other elements can be introduced in relatively arbitrary positions of the horizontal plane. One common way to realize pronouns is to 'index', i.e. point towards, the relevant loci.

In ASL, some verbs, 'agreement verbs' (= 'directional verbs'), include loci in their realization. These have been argued to display the behavior of agreement markers (Lillo-Martin and Meier 2011), although alternative analyses have been offered as well (e.g. Liddell 2003). Schlenker and Chemla 2018 argue that agreement verbs have gestural counterparts. They further argue that the two constructions interact in similar ways with ellipsis and focus-sensitive constructions involving *only*. To introduce these findings, let us start by considering the ASL paradigm in (3), constructed around the agreement verb *1-GIVE-a* or *1-GIVE-2*.

(3) a. $^{5.5}$ IX-2 POSS-2 YOUNG BROTHER ONLY BROTHER MONEY IX-1 1-GIVE-a.
'Of your younger brother and yourself, I would give money only to your brother.'
b. ^{7} POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT.
'Your younger brother, I would give money to. You, I wouldn't.'
c. $^{4.7}$ POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. **IX-2** IX-1 NOT 1-GIVE**-a**.
d. ^{7} POSS-2 YOUNG BROTHER MONEY IX-1 1-GIVE-a. IX-2 IX-1 NOT 1-GIVE-2.

[10] We make no claim about the preferential *temporal* order in which loci are introduced; alphabetization just refers to the geometric position of loci with respect to the dominant vs. non-dominant side, not to their temporal order or appearance.

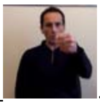
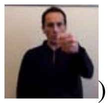
'Your younger brother, I would give money to. You, I wouldn't give money to.'
(ASL, 34, 1558; 4 judgments)

Here the verb *GIVE* is realized by way of a movement from the first person locus *1* to the third person locus *a* (hence: *1-GIVE-a)* or to the second person locus *2* (*1-GIVE-2*). (3)c,d are controls without ellipsis: they establish, unsurprisingly, that a second person object must trigger second person object agreement. But (3)b shows that under ellipsis things are different: on the assumption that the missing verb is copied from the antecedent clause, its object agreement marker can be disregarded in the elided clause, since otherwise the copied verb *1-GIVE-a* would take a second person object argument. (3)a suggests that the same effect might hold in the 'focus dimension' under *only:* what gets negated is that the signer would give money to the addressee, which is not expected if the third person object agreement marker is interpreted. Note that the judgment is somewhat degraded, although this is not the case of related examples (with a locus on the antecedent) that are discussed by Schlenker and Chemla.

Related effects are well known in connection with *phi*-features of spoken language pronouns. This is illustrated in(4), where both the third person features and the feminine features of *her* are ignored under ellipsis and in the 'focus dimension' under *only*.

(4) [Uttered by a male speaker] In my study group,
a. Mary did her homework, and I did too.
=> available bound variable reading in the second clause
b. Only Mary did her homework
=> available bound variable reading, entailing that *I didn't do my homework*.
c. Mary did her homework, and I did her homework too.
=> no bound variable reading in the second clause
(Schlenker and Chemla 2018)

Now the crucial observation is that the ASL data can to some extent be replicated with gestural verbs in English. Things are somewhat complicated by the fact that something like the second person version seems to do double duty as a neutral form, and hence it is glossed as *(-2)* in parentheses. Still, using a third person form with a second person object yields deviance, as shown by the boldfaced examples in (5).[11]

(5) a. Your brother, I am going to SLAP-a_ (/ SLAP(-2)_),
and then you, I am going to **??PUNCH-a_** / PUNCH(-2)_.
b. Your brother, I am going to PUNCH-a_ (/ PUNCH(-2)_),
and then you, I am going to **??SHOOT-a_**/ SHOOT(-2)_.
(from Schlenker and Chemla 2018)

Crucially, when the gestural predicate occurs (with a bound variable) under ellipsis-like constructions, third person locus specifications can be ignored, both in VP-ellipsis in the strict sense, as in (6)b, and in the 'stripping' construction in (6)a; similar remarks carry over to the construction with *only* in (7).

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

[11] With apologies to the readers, some of our examples refer to objectionable situations.

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

3.2 Experimental confirmation

How real are such effects in naive subjects? Schlenker and Chemla's 2018 experiment makes two points: (i) the target of a gestural verb can mark a distinction between third and second person; (ii) this person marking can be disregarded under ellipsis. Three conditions were devised, and are depicted in (8): a 'match' condition in which a gestural verb with a second person object targets a second person position, as in (9)a; a 'mismatch' condition in which the same gestural verb (incorrectly) targets a third person position, as in (9)b; and an ellipsis condition in which the antecedent verb also targets a third person position, as in (9)c. Test videos were made with the sentences in (9)-(11).[12]

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

		First part of the sentence		Second part of the sentence		Examples		
		Statement	Gesture	Statement	Gesture	SHOOT	PUNCH	SEND-KISSES
Gesture	Match	3rd	3rd	2nd	2nd	(9)a	(10)a	(11)a
Gesture	Mismatch	3rd	3rd	2nd	3rd	(9)b	(10)b	(11)b
Ellipsis	Mismatch	3rd	3rd	2nd	Ellipsis	(9)c	(10)c	(11)c

(9) SHOOT

a. Your brother, I am gonna PUNCH-a, then you, I am gonna SHOOT-2.

b. Your brother, I am gonna PUNCH-a, then you, I am gonna SHOOT-a.

c. Your brother, I am gonna SHOOT-a, then you, too.

(10) PUNCH

a. Your brother, I am gonna SLAP-a, then you, I am gonna PUNCH-2.

b. Your brother, I am gonna SLAP-a, then you, I am gonna PUNCH-a.

c. Your brother, I am gonna PUNCH-a, then you, too.

(11) SEND-KISSES

a. Your brother, I am gonna PUNCH-a, then you, I am gonna SEND-KISSES-2.

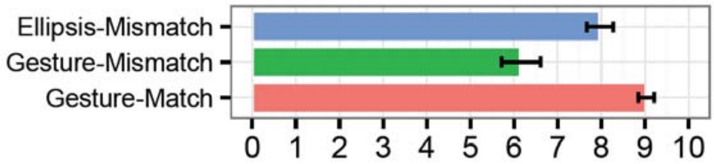
b. Your brother, I am gonna PUNCH-a, then you, I am gonna SEND-KISSES-a.

c. Your brother, I am gonna SEND-KISSES-a, then you, too.

The prediction was the 'match' condition would be acceptable, that the 'mismatch' condition would be degraded, and that the 'ellipsis' condition would be ameliorated relative to the 'mismatch' condition because the mismatched features could be ignored under ellipsis. Aggregate results of acceptability judgments given by subjects recruited on Mechanical Turk are displayed (without additional control conditions) in (12).

[12] We replace Schlenker and Chemla's *PUNCH-3* with *PUNCH-a*: they only considered second and third person loci whereas we will discuss a variety of third person loci (*a*, *b*, *c* …), and thus in our notation *PUNCH-a* is the correct transcription.

(12) Mean acceptability responses, averaged over in all conditions. Error bars represent standard error to the mean after averaging across participants (for details, see Schlenker and Chemla 2018)



The main results validate the findings originally obtained on the basis of introspective judgments. First, the mismatch condition with overt gestures was judged significantly lower than the match conditions with overt gestures. Second, under ellipsis the condition with a mismatched antecedent was ameliorated relative to the overt mismatch condition. This suggests that third person agreement marker can to some extent be ignored in the course of ellipsis resolution.

3.3 Theoretical directions

There are three broad directions that one could explore to explain the gestural and sign language data (see Schlenker and Chemla 2018 and also Schlenker 2016a).

(i) Person-based analyses: One possibility is that (i) the gestural verbs in (6) and (7) have a third person object marker which can be disregarded, and that (ii) person features can be disregarded in ellipsis resolution and under *only* if they result from agreement. The latter assumption is often made for phi-features more generally, for instance to account for the data in (4).

This analysis is insufficient to account for sign language data because there can be an unbounded number of third person loci: it seems that bound loci rather than person *per se* can be disregarded in the course of ellipsis resolution. As we will see below, this conclusion extends to gestural loci.

(ii) Variable-based analyses: An alternative is to take the loci to instantiate variables, and to allow for binding, as is represented in the gestural case in (13) for the sentence in (9)c: the locus variable *a* gets bound in the first part of the sentence, and the entire VP gets copied in the second part.

(13) Analysis of (9)c
Your brother, λa I am going to SHOOT-a, and then
you too ~~λa I am going to SHOOT-a~~.

(iii) Agreement-based views: For the sign language case, Kuhn 2015a, followed by Schlenker 2016a, argue that treating loci as variables is not enough, and that in some cases one needs a rule that allows some loci to be inherited by way of agreement. On such an analysis, the locus *a* in (9)c is taken to be disregarded by ellipsis resolution, as in (14).

(14) Analysis of (9)c
Your brother, λx^a I am going to SHOOT-~~a~~ x^a , and then
you too ~~λx I am going to SHOOT-x~~.

Without getting into details, we should mention that Schlenker and Chemla 2018 argue that the (complicated) ASL data that Kuhn 2015a used to motivate his conclusion can be replicated in the gestural case.[13]

4 Simple loci

One striking observation in sign language is that there is no clear upper limit on the number of loci that can be simultaneously used besides limitations of performance; in this respect, loci sharply differ from

[13] A fourth possibility, briefly mentioned by Schlenker and Chemla 2018, is that certain inconspicuous aspects of gestures and possibly signs, having to do with orientation, can be disregarded under ellipsis. This theoretical direction has not been fully explored yet.

rich discourse referent systems found in spoken language (see for instance Schlenker 2017a). Importantly, pronouns realized by way of locus indexing are constrained by some principles of Binding Theory, with some versions of reflexive and non-reflexive pronouns (e.g. Koulidobrova 2011, Sandler and Lillo-Martin 2006) and Strong Crossover effects (Schlenker and Mathur 2013).

We will now see that several properties of sign language loci can be replicated with pro-speech pointing in gestures (see for instance Cormier et al. 2013 for a comparison between sign language pronouns and *co*-speech pointing).

4.1 Nominal loci

Schlenker and Chemla 2018 only tested the existence of a single third person locus, and only did so by way of gestural agreement verbs. We will now go further and show that there can be several third person loci, and that they can be indexed by way of pro-speech pointing (see for instance Kendon 2004 for a general discussion of pointing in gestures, including the diversity of pointing methods that can be used[14]).

The method we use here and below is the following: we use co-speech gestures to introduce three loci corresponding to John, Mary and Sam, and we do so by way of open hands placed in the relevant position. These loci are then retrieved by way of pro-speech pointing. It was noted in Schlenker and Chemla 2018 that acceptability of pro-speech gestures is a bit ameliorated when they are clause-final, and we follow suit in testing clause-final positions whenever this is possible.

(15) Yesterday I had a long conversation with IX-hand-a **[John]**, then with IX-hand-b **[Mary]**, then with IX-hand-c **[Sam]**. You know who the company's gonna promote?
a. $^{6.7}$ IX-a. b. $^{6.3}$ IX-b. c. $^{6.7}$ IX-c. d. ^{6} IX-1. e. ^{6} IX-2.
= John = Mary = Sam = me = you (Video 3845)

The acceptability of all pointing patterns in (15) is high (between 6 and 7 on a 7-point scale). And depending on which locus is indexed by way of pro-speech pointing, we obtain five different meanings for the answer: three pointing patterns correspond to the three introduced loci, and two additional ones are obtained by pointing towards the speaker or addressee. It is worth noting that pointing gestures don't just go proxy for pronouns: if John and Sam are males, answering *him* in this context would be intolerably ambiguous, as it would be entirely unclear whether John or Sam is being intended. Gestural pointing lifts the ambiguity.

Importantly, it appears to be difficult to establish an arbitrary locus for the addressee, which mirrors the observation that sign language loci denoting speech act participants (and more broadly deictic elements) preferably correspond to their real position. An attempt is displayed in (16)

(16) Tomorrow the boss will have a conversation with IX-hand-a **[you]** and with IX-hand-b **[John]**. And you know who the company will promote?
a. $^{4.3}$ IX-a. b. $^{5.3}$ IX-b. c. $^{3.3}$ IX-2.
= you = John = you (Video 3853)

Here an open hand *IX-hand-a* co-occurs with *you* (on the right) at the beginning of the sentence, while another open hand *IX-hand-b* co-occurs with *John*. This is precisely the device used in (15) to establish loci, but now the result is degraded when *you* is indexed, be it in position *a*, as in (16), or in the addressee's position *2*, as in (16)c (the sentence is more acceptable if the final gestural pointing refers to John, as in (16)b).[15]

[14] Kendon 2008 writes in particular: "Gestures understood as pointing are commonly done with the hands, but they may also be done with the head, by certain movements of the eyes, by protruding the lips (...), by a movement of the elbow, in some circumstances even with the foot (...)."
(For an experimental study of the informational contribution of co-speech pointing relative to its linguistic context, see for instance So et al. 2009, 2013.)

[15] Example (3) in the Supplementary Materials (Video 3861) seeks to assess what happens when an arbitrary locus is established to refer to a non-speech act participant present in the context. Specifically, a head sign (combined with eyegaze) indicates that the speaker intends the expression *this guy* to refer to someone on this *left*, but

Sign language loci can be bound by quantifiers (e.g. Sandler and Lillo-Martin 2006, Schlenker et al. 2013). Does the same hold for gestural loci? For standard binding (under c-command), the only clear case we have involves existential quantifiers, as in (17); we will see in Section 5 that several other cases can be devised with donkey pronouns (hence without c-command).

(17) Whenever there is a Board meeting,
IX-hand-a IX-hand-a **[at least one manager]** asks IX-hand-b **[the CEO]** to promote
a. [5.3] IX-a b. [4] IX-b c. [4] IX-2 d. [4] IX-1.
= him = himself [= the CEO] = you = me (Video 3869)

Ratings suggest that *IX-a* can be dependent on the existential quantifier *IX-hand-a* ***[at least one manager]***, and inferential questions (displayed in the Supplementary Materials) suggest that the pointing gesture yields the intended reading. Other options are degraded. For *IX-2* and *IX-1*, this might simply be because the loci *a* and *b* that were established before are idle.[16] For *IX-b* this might be because of a violation of Condition B, as is found without gestures in: **I asked the CEO$_i$ to promote him$_i$*; but investigating this possibility would require a more sophisticated study.[17]

Binding by *every*- and *none*-type quantifiers is, for our informants, more degraded. But this might be due to the realization we picked: in the case of (19), two informants explicitly mentioned that the example would improve if the locus-establishing open hand *IX-hand-a* just co-occurred with *manager* rather than with *no manager*; we leave this question for future research.

(18) Whenever there is a Board meeting, IX-hand-a **[every manager]** asks IX-hand-b **[the CEO]** to promote
a. [4] IX-a b. [4] IX-b c. [3.7] IX-2 d. [3.7] IX-1.
= him = himself [= the CEO] = you = me (Video 3867)

(19) Whenever there is a Board meeting, IX-hand-a **[no manager]** ever asks IX-hand-b **[the CEO]** to promote
a. [3.2] IX-a b. [2.8] IX-b c. [2.8] IX-2 d. [2.8] IX-1
= him = himself [= the CEO] = you = me (Video 3871)

If pointing gestures can be bound under existential quantifiers, one might expect that they can give rise to bound readings under ellipsis. The existence of such bound readings is attested in the literature on sign language (for ASL and LSF, see for instance numerous examples in Schlenker 2014). In our limited data, the preferred reading seems to be a strict one:

(20) [5.7] Whenever there is a Board meeting, the IX-hand-a **[first manager]** always asks the CEO promote IX-a, and the IX-hand-b **[second manager]** does too!
Preferred reading: strict, i.e. the second manager always asks the CEO to promote the first manager (3/3 informants; 1/3 informant: 'with difficulty', a bound variable reading is available) (Video 3899)

Still, it is important to determine whether *with the right context* a bound variable reading emerges. This seems to be the case for some informants but not others, as shown by the example in (21) and the individual results in (22): Informants 2 and 3 allow for a bound reading in this scenario.

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simultaneously, a mismatched open hand on the *right* co-occurs with *this guy* to indicate locus assignment. Thus the sentence tests whether a locus on the right can refer to a salient person on the left. The result is deviant, but more work is needed to determine this is because of the particular realization we chose, or because of a sign language-like prohibition against using arbitrary loci to refer to entities that are present in the context.

In this connection, an anonymous reviewer finds that "that pointing to a location when referring to the addressee seems possible in the case the addressee is virtually located in different places", as in (i). This should be tested, and could indirectly bear on the availability of Locative Shift for second person pronouns, as discussed in the Appendix.

(i) I have the choice to visit IX-hand-a [you in France], IX-hand-b [you in England], or IX-hand-c [John in Croatia]. You know who I am going to visit? IX-a.

[16] This remark was explicitly made by an informant with respect to a related video [Video 3867].
[17] Amir Anvari has been independently working on the issue of Condition B violations with pro-speech pointing.

(21) [4.8] Whenever there is a Board meeting, the IX-hand-a **[first]** manager and the IX-hand-b **[second]** manager both look after their own interests. So the IX-hand-a **[first manager]** always asks the CEO promote IX-a, and the IX-hand-b **[second manager]** does too!
2/3 informants: strict reading 2/3 informants: bound reading (Video 3897)

(22) Acceptability and inferential results for (21)

Video 3897	Acceptability	Reading
Informant 1	2.5	strict
Informant 2	6	bound
Informant 3	6	strict or, with some effort, bound

4.2 Agreement verbs revisited

Having seen that several third person gestural loci can be introduced in the same sentence, we should go back to the agreement data discussed in Section 3, and extend them to display the use of several third person loci. In (23)c, we replicate the observation that bound third person loci can be ignored under ellipsis resolution, but now in an example that involves several person loci; overt locus mismatch as in (23)b is less acceptable.

(23) When I was a kid, I often got into fights with IX-hand-a [your brother], but/and[18] also with IX-hand-b **[your sister]**. One morning,
a. [6.3] your brother, I tried to PUNCH-a, and then your sister, I tried to SLAP-b.
b. [4.5] your brother, I tried to PUNCH-a, and then your sister, I tried to SLAP-a.
c. [5.7] your brother, I tried to PUNCH-a, and then your sister too!
=> the speaker tried to slap the addressee's sister (Video 3905)

As a result, the findings of Section 3 cannot be interpreted in terms of a simple distinction between third and second person. Rather, it appears that loci (rather than just standard person markers) can be ignored in the course of ellipsis resolution (as mentioned in Section 3.3 in connection with sign language, there are several ways to explain this phenomenon).

As an extension (but without considering ellipsis), one could ask whether cases of gestural agreement be found beyond the object case. A case of subject agreement is found in (24): deviance is obtained if the gestural verbs *TAKE-OFF-plane* (display a plane take-off) and *TAKE-OFF-ROTATING* (displaying a helicopter take-off) originate from positions that do not correspond to those introduced with *one plane* and *one helicopter* respectively.[19]

(24) The company has IX-hand-a **[one plane]** and IX-hand-b **[one helicopter]**. When the plane
a. [6.3] a-TAKE-OFF-plane, the noise is unbearable, but when the helicopter b-TAKE-OFF-ROTATING,
b. [3.8] b-TAKE-OFF-plane, the noise is unbearable, but when the helicopter a-TAKE-OFF-ROTATING,
less so. (Video 3917)

In sum, the existence of loci, the person distinctions they display, and their behavior under ellipsis are reminiscent of sign language loci.

4.3 Temporal and modal loci

Schlenker 2013 argues that ASL loci can have temporal and modal uses, as is illustrated in (25) (it is uncontroversial that ASL loci can have locative uses as well, a point to which we return in Section 0).

[18] *But* was used in a. and b., *and* was used in c.
[19] When testing these examples, it could be important to take into account the possibility of 'neutral' uses of gestures, in a central position or towards the speaker's dominant side. For a right-handed speaker, if *IX-hand-a* ***[one plane]*** appears on the right, using *b-TAKE-OFF-plane* to describe that same plane should be quite odd. But moving instead from the non-dominant to the dominant side might conceivably be more acceptable due to a neutral, non-located use of the gesture, produced close to the speaker's dominant side.

(25) a. *Context*: Every week I play in a lottery.

^{7} IX-1 [SOMETIMES WIN]$_a$. IX-1 [SOMETIMES LOSE]$_b$. $\overline{\text{IX-a}}^{\wedge}$ IX-1 HAPPY.
'Sometimes I win. Sometimes I lose. Then [= when I win] I am happy.' (ASL, 7, 204)

b. a. *Context*: The speaker is playing in a lottery.

$^{6.8}$ NOW IX-1 [POSSIBLE RICH]$_a$. [POSSIBLE SAME POOR]$_b$. $\overline{\text{IX-a}}^{\wedge}$ IX-1 LUCKY.
'Now I might be rich. I might also still be poor. Then [= if I am rich] I am lucky.' (ASL, 7, 196)
(Schlenker 2013)

Can such uses be replicated with gestural loci? While we make no claim about the availability of these readings with *index* pointing (of the sort that was used above for nominal reference), full open hand pointing (palm up) is accepted by our informants in the temporal case, as in (26), and to a lesser extent in the modal case, as in (27).

(26) $^{5.7}$ Every week John plays the lottery. Sometimes he IX-hand-a **wins**, and sometimes he IX-hand-b **loses**. And you know when I am nice to him? IX-hand-a.
=> the speaker is nice to John when John wins (Video 3921)

(27) ^{5} John might IX-hand-a **win**, and he might IX-hand-b **lose**. And you know in what case I'll be nice to him? IX-hand-a.
=> the speakerwill be nice to John in case John wins (Video 3925)

Temporal and modal uses of gestural loci should be explored in future research. If index pointing is worse in this case than full hand pointing, it would have to be explained why, in particular in connection with the diverse modes of pointing discussed in Kendon 2004.

5 Dynamic loci

5.1 Initial cases

5.1.1 Symmetric cases with sign language and with gestural loci

Schlenker 2011b argues that loci can be the overt realization of dynamic discourse referents, as in the theories of 'donkey anaphora' developed in dynamic semantics (e.g. Kamp 1981, Heim 1982). The argument was based on examples such as (28): each indefinite introduces a locus within the *WHEN*-clause, but affects the value of pronouns found in the main clause. Either indexing is relatively acceptable (with a preference for anaphoric links that follow linear order), as long as the two pronouns index different loci. This is expected on standard theories of loci-*qua*-indices because using the same locus in the subject and object position would yield an odd coreferential reading, which entails that a Frenchman wonders who he lives with.

(28) WHEN [FRENCH MAN]$_a$ a,b-MEET [FRENCH MAN]$_b$,
'When a Frenchman meets a Frenchman,'
a. IX-a WONDER WHO IX-b LIVE WITH.
'the former wonders who the latter lives with.'
b. ? IX-b WONDER WHO IX-a LIVE WITH.
'the latter wonders who the former lives with.'
c. # IX-a WONDER WHO IX-a LIVE WITH.
'the former wonders who the former lives with.'
d. # IX-b WONDER WHO IX-b LIVE WITH.
'the latter wonders who the latter lives with.'
(ASL, i P1040945; Schlenker 2011b)

Because the indefinites do not c-command the pronouns, standard binding cannot apply in these configurations. Dynamic binding offers one possible analysis (e.g. Kamp 1981, Heim 1982). E-type theories (e.g. Heim 1990, Elbourne 2005) offer another, according to which the pronouns realize concealed definite descriptions. But the examples were picked in order to make such an analysis difficult. The reason is this: depending on the E-type theory under consideration, *IX-a* would have to be paraphrased as *the person* (Elbourne 2005), or *the person that meets a person* (Heim 1990), and *IX-b* would then be analyzed as *the person,* or *the person that a person meets* (these are called 'bishop examples' in the literature because the most famous cases involved a bishop meeting a bishop). Elbourne's theory has the advantage of elegance: for him, *he* is represented as *the ~~bishop~~*, with ellipsis of *bishop*. But in the case at hand, ensuring that the two descriptions *he* and *him* (i.e. *the ~~bishop~~* and *the ~~bishop~~*) denote different individuals is non-trivia, as we will see when we discuss the theoretical consequences.

Can similar data be replicated with gestural loci? Basic cases of donkey anaphora are easy to construct, as in (29), which was already discussed in simplified form in (1).

(29) Whenever I can hire IX-hand-a **[a mathematician]** or IX-hand-b **[a sociologist]**, I pick
a. [6.7] IX-a. (= the mathematician)
b. [6.7] IX-b. (= the sociologist)
(Video 3927)

Cases with symmetric antecedents can be created as well, as shown in (30). As in sign language, using different loci in subject position (co-occurring with *he*) and in object position (as a pro-speech gesture) yields a disjoint reference reading. Using the same locus yields twice yields a locally coreferential reading, which is degraded, probably for plausibility reasons, and also possibly due to a Condition B effect. Be that as it may, the two patterns of indexing yield entirely different readings. (Note that our main clause has two conjuncts because an informant noted that a main clause with only *IX-hand-a* ***he*** *blesses IX-b* introduces what seems to be an unjustified asymmetry between the two bishop-denoted loci; the second conjunct was intended to restore the symmetry.)

(30) Whenever IX-hand-a **[a bishop]** meets IX-hand-b **[a bishop]**,
a. [6] IX-hand-a **he** blesses IX-b, and then IX-hand-b **he** blesses IX-a.
=> the first bishop blesses the second bishop[20]
b. [4.5] IX-hand-a **he** blesses IX-a, and then IX-hand-b **he** blesses IX-b.
=> the first bishop blesses the first bishop
(Video 3933)

Finally, Elbourne 2005 noticed that when the two symmetric indefinite antecedents are conjoined in subject position, as in (31)b (which contrasts with the original 'bishop' example in (31)a), the result is degraded. He took this to be a positive result for his theory: with certain auxiliary assumptions, Elbourne could explain that the symmetric antecedents play entirely similar semantic roles as well, which makes it impossible for the pronoun-as-description to pick only one singular bishop (the idea was that in the subject-object case in (31)a, by contrast, the antecedent bishops play not just syntactically but also semantically distinguished roles).

(31) a. If a bishop meets a bishop, he greets him.
b. #If a bishop and a bishop meet, he greets him.

Schlenker 2011b argues that this observation does not extend to ASL (and LSF) examples, as illustrated in (32).

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[20] Although there is, in our judgment, doubt at all that the sentence entails that the second bishop blesses the first bishop, we fail to report the inference because our survey contained an infelicity in the statement of the relevant question: "Who does the other bishop bless? (i) himself (ii) the other bishop". Without context, 'the other bishop' is ambiguous in this case; Informant 3 commented on this and stated that they understood the expression to refer to the first bishop (this is the only possibility that makes pragmatic sense given that option (i) is: *himself*).

(32) WHEN SOMEONE$_a$ AND SOMEONE$_b$ LIVE TOGETHER, IX-a LOVE IX-b.
‘When someone and someone live together, the former loves the latter.’
(ASL, i P1040966; Schlenker 2011b)

Interestingly, pro- and co-speech pointing yields judgments that are closer to the sign language than to the spoken data.[21] Thus in (33), we modify (30) so as to have conjoined antecedents. Unsurprisingly, without pointing, the examples in (33)a,b are very degraded. Importantly, a sharp amelioration is observed with pro-speech pointing as in (33)d, and also with co-speech pointing as in (33)c (the latter case is better – possibly because co-speech pointing is more standard than pro-speech pointing, and possibly also because the model's realization of the pro-speech pointing didn't include onomatopoeias, hence some completely silent 'words').

Notation: capitalized *HE* and *HIM* serve to encode phonological emphasis.

(33) Whenever IX-hand-a **[a bishop]** and IX-hand-b **[a bishop]** meet,
a. [1] he blesses him, and then he blesses him.
b. [2.2] HE blesses HIM, and then HE blesses HIM.
c. [7] IX-hand-a **HE** blesses IX-hand-b **HIM**, and then IX-hand-b **HE** blesses IX-hand-a **HIM**.
d. [5.7] IX-hand-a **HE** blesses IX-b, and then IX-hand-b **HE** blesses IX-a.
(Video 3937)

In sum, a contrast that was found between English and ASL can be replicated internal to English, using English-plus-gesture as a way to replicate a version of the ASL facts.

5.1.2 *Theoretical consequences*

In Schlenker 2011b, 2017a, the sign language data summarized above were used to suggest that (i) dynamic approaches predict the correct patterns of indexing in the case of donkey sentences, while (ii) E-type approaches in general, and Elbourne’s analysis in particular, are faced with a dilemma: either they are refuted by the sign language data, or they must be brought so close to dynamic semantics that they might end up becoming a variant of it. As we will see, the structure of the argument straightforwardly extends to our gestural data.

Schematically, we displayed above some examples similar to (34)a, but with sign language or gestural loci that realize a structure akin to (34)b: each antecedent is associated with a distinct locus, and each pointing index also retrieves a distinct locus; if instead two indexes retrieve the same locus, a coreferential reading is obtained.

(34) a. If a bishop meets a bishop, he blesses him.
b. If [a bishop]$_x$ meets [a bishop]$_y$, he$_x$ blesses him$_y$.
c. If [a bishop] meets [a bishop], he ~~bishop~~ blesses him ~~bishop~~.
c’. If [a bishop] meets [a bishop], he ~~bishop #1~~ blesses him ~~bishop #2~~.

The *dynamic analysis* can straightforwardly account for the data by positing that each indefinite introduces a separate variable. This allows each pronoun to depend on a different quantifier if *he$_x$* and *him$_y$* carry different variables (we could also have *he$_y$/him$_x$,* but not *he$_x$/him$_x$* or *he$_y$/him$_y$*: the pronouns must carry different variables to refer to different bishops, or else the sentence would be understood as involving self-blessings[22]).

Since the *E-type analysis* does not allow for coindexing without c-command, it cannot adopt the same solution. But in Elbourne's influential theory, it can still establish a formal link between the pronouns and their antecedents: it is the formal link provided by ellipsis resolution. On this view, if an indefinite and a pointing sign/gesture share a locus, the elided NP realized by the pronoun is obtained by copying it from the antecedent indefinite. But in symmetric examples such as (34)a, analyzed as in

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[21] Special thanks to Salvador Mascarenhas (p.c.) for discussion of these and related points.
[22] In addition, a reflexive pronoun would be needed to express the 'self-blessing' reading (because of Condition B of Binding Theory).

(34)c, all we get in this way are two identical descriptions *the bishop* and *the bishop*, and further measures are needed to ensure that they can denote different individuals.

To address this problem, Elbourne starts by positing that the *if*-clause quantifies over extremely fine-grained situations – so fine-grained, in fact, that a situation <x, y, meet> in which x meets y is different from a situation <y, x, meet> in which y meets x (this is the sense in which the subject and object bishop antecedents are not just syntactically but also semantically distinct). Still, this is not quite enough: in order to obtain the right meaning, the pronouns must still be endowed with some additional material – perhaps provided by the context – to pick out different bishops in a given situation of the form <bishop_1, bishop_2, meet>. Even with the device of very fine-grained situations, the analysis in (34)c is insufficient because it does not specify *which* bishop each pronoun refers to; in (34)c', the pronouns are enriched with the (stipulated) symbols *#1* vs. *#2*, which are intended to pick out the 'first' or the 'second' bishop in <bishop_1, bishop_2, meet>.

But the question is how these index-like objects end up in the Logical Form. This presents a dilemma for Elbourne's theory. If the symbols *#1* and *#2* are inherited by the mechanism of ellipsis resolution itself, we will end up with something very close to a dynamic analysis: the antecedents carry a formal index, and the pronouns recover the very index carried by their antecedent, as is illustrated in (35).

(35) If [a bishop]#1 meets [a bishop]#2, he ~~bishop #1~~ blesses him ~~bishop #2~~.

On the other hand, if *#1* and *#2* are provided by a mechanism – possibly a contextual one – which is independent from Noun Phrase ellipsis resolution, we lose the desired connection between interpretation and pointing: we make the incorrect prediction that pointing signs or gestures corresponding to *he* and *him* can index the same locus while inheriting *#1* and *#2* respectively (since these are now provided by the context, not by pointing itself). This is of course undesirable.

The argument was initially developed with sign language data, but it is striking that it can now be developed just as well with gestural data.

5.2 Refinements

Schlenker 2011b discusses various more sophisticated examples, involving generalized quantifiers as well as antecedents under negation; both cases have interesting theoretical consequences for dynamic semantics. The first can be replicated with gestural pointing, while it's not yet clear that the second can be.[23]

5.2.1 Dynamic anaphora to generalized quantifiers

❑ *Sign language vs. gestural data*

Schlenker 2011b argues that with generalized quantifiers, ASL and LSF loci give rise to readings that resemble those obtained in spoken language, with the difference that the anaphoric links are overt. On the intended reading of (36), $they_i$ refers to the maximal set of linguists that meet psychologists, and similarly $they_k$ denotes the maximal set of psychologists that some linguists meet. Similar readings carry over to ASL and LSF, as illustrated for ASL in (37). It is easy to see that similar facts hold of the pro-speech pointing gesture *IX-b* in (38), where it is preferably interpreted to refer to the psychologists present rather than to psychologists in general.

(36) When [more than 10 linguists]$_i$ meet [fewer than 4 psychologists]$_k$, they$_i$ (each) criticize them$_k$.

(37) IF LESS [THREE FRENCH PERSON HERE]$_a$ AND LESS [FIVE AMERICAN PERSON HERE]$_b$, IX-arc-a WILL GREET-b IX-arc-b.
'If less than three Frenchmen were here and less than five Americans were here, they [= the Frenchmen] would greet them [= the Americans].' (ASL, 2, 117; Schlenker 2011b)

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[23] We leave for future research an investigation of singular donkey pronouns with split antecedents, also discussed in Schlenker 2011b.

(38) [5.7] Whenever IX-hand-a **[more than 10 linguists]** meet IX-hand-b **[fewer than 4 psychologists]**, IX-hand-a **they** criticize IX-b.
=> the linguists present criticize the psychologists present [3/3 informants] (possible but less preferred [1/3 informant]: the linguists present criticize psychologists in general) (Video 3941)

❑ *Theoretical consequences*

These findings help address an important theoretical question for dynamic semantics: are discourse referents introduced by (i) all quantifiers (van den Berg 1996, Brasoveanu 2006, Nouwen 2003) or (ii) only existential ones (such as *a man*, *two men*, etc; e.g. Kamp and Reyle 1993)? Kamp and Reyle (1993) postulated two different mechanisms of anaphora resolution for donkey anaphora: for existential quantifiers, they adopted a dynamic approach allowing for coindexing without c-command. But for other quantifiers, they adopted a different mechanism, inspired by E-type theories, where the dependent pronouns went proxy for definite descriptions. The sign language and gestural data discussed in this section suggest that no differential treatment is called for: loci appear to establish the same kind of formal and interpretive relation in the two cases, which argues for the homogeneous accounts developed by van den Berg, Brasoveanu and Nouwen, among others (for details in the context of sign language data, see Schlenker 2011b).

5.2.2 Dynamic anaphora across negation

❑ *Sign language vs. gestural data*

Schlenker 2011b further argues that dynamic binding can occur across negation. The existence of such examples in English, as in (39), is not controversial, but their analysis is: the question is whether there is a formal anaphoric link between the donkey pronoun *it* and its antecedent *an umbrella,* despite the presence of the intervening negations. This question is of theoretical interest because early dynamic theories, such as Kamp 1981 and Heim 1982, predicted that negation should 'break' dynamic anaphoric links. Schlenker 2011b argues that ASL examples make such a link visible, as in (40) and (41).

(39) It is not true that John doesn't have an umbrella. I have just seen it: it is red.

(40) IX-1 NOT DOUBT SOMEONE$_a$ WILL GO MARS. IX-a WILL FAMOUS
'I don't doubt that someone will go to Mars. He wil be famous.' (ASL, i P1040982; Schlenker 2011b)

(41) IX-1 DOUBT [NO DEMOCRAT PERSON IX-open-hand$_a$]$_a$ WILL MATCH SUPPORT HEALTH CARE BILL WITH [REPUBLICAN PERSON]$_b$. IX-1 THINK IX-a WILL a-GIVE-b A-LOT MONEY.
'I don't think no Democrat will cosponsor the healthcare bill with a Republican. I think he [= the Democrat] will give him [= the Republican] a lot of money.' (ASL, 2, 229; Schlenker 2011b).

Schlenker 2011b further argues that anaphora to a *none*-type quantifier is possible if the negative quantifier is itself under a negative operator, so that it ends up having existential force, as in (42) – or for that matter in (41) if one considers anaphora to *no Democrat*.

(42) IX-1 DOUBT NO ONE$_a$ WILL GO MARS. IX-a WILL FAMOUS.
'I don't think no one will go to Mars. He [= the person who goes to Mars] will be famous.' (ASL, i, P1040980; Schlenker 2011b)

Our attempt to replicate the sign language data with gestures starts with a paradigm that should be degraded: in (43), pro-speech pointing attempts to establish donkey anaphora to quantifiers that fail to have existence implications; on any theory, this should be degraded, and it is.

(43) IX-hand-a **[No Democrat]** will strike a deal with IX-hand-b **[a Republican]**, but we'll have to give a lot of money to
a. [4] IX-a.
= the Democrats in general
b. [3.7] IX-b.
= the Republicans in general [3/3 informants], or: the Republican or Republicans who strike a deal with

Democrats [1/3 informant]
(Video 3943)

The question is whether this example gets significantly ameliorated upon the addition of a negation at the beginning, as in (44). There is in fact an amelioration, but it is less striking than one might wish. Still, it is worth noting that the inferential judgments change as well: for lack of a 'donkey' reading, pertaining to the Democrats and Republicans *that performed the relevant action*, our informants primarily obtained in (43) readings involving the Democrats or Republicans *in general*. Things are different in (44), which has the hallmarks of a 'donkey' reading pertaining to the Democrats or Republicans who performed the relevant action.

(44) It is not true that IX-hand-a **[no Democrat]** will strike a deal with IX-hand-b **[a Republican]**, but we'll have to give a lot of money to
a. ^{5} IX-a.
= the Democrat or Democrats who strike a deal with Republicans [3/3 informants], or (less preferred) the Democrats in general [1/3 informant]
b. $^{4.7}$ IX-b.
= the Republican or Republicans who strike a deal with Democrats [3/3 informants], or (less preferred) the Republicans in general [1/3 informant]
(Video 3947)

In English, a donkey pronoun can take as an antecedent a *none*-type quantifier found in a separate disjunct, as in (45). Schlenker 2011b argues that this fact carries over to overt indexing in sign language, as in (46). As things stand, we have no evidence at all that this holds of gestural loci, as the judgments in (47) are rather degraded; in addition, inferential judgments are mixed.

(45) Either there is no bathroom in this house or it is well hidden. (attributed to B. Partee; see also Geach 1962 and Evans 1977)

(46) EITHER NO [DEMOCRAT IX-open-hand$_a$]$_a$ WILL MATCH SUPPORT HEALTH CARE BILL WITH [REPUBLICAN PERSON]$_b$ OR IX-a WILL a-GIVE-b A-LOT MONEY.
'Either no Democrat will cosponsor the healthcare bill with a Republican, or he [=the Democrat] will give him [=the Republican] a lot of money.' (ASL, 2, 230; Schlenker 2011b)

(47) Either IX-hand-a **[no Democrat]** will strike a deal with IX-hand-b **[a Republican]**, or we'll have to give a lot of money to
a. $^{3.7}$ IX-a.
= the Democrats in general [2/3 informants], or the Democrat or Democrats who strike a deal with Republicans [2/3 informants]
b. $^{3.3}$ IX-b.
= the Republicans in general [2/3 informants], or the Republican or Republicans who strike a deal with Democrats [2/3 informants]
(Video 3949)

❑ *Theoretical consequences*

Our gestural data weakly replicate sign language data that suggested that negation need not 'break' anaphoric dependencies, and that even negative quantifiers such as *No NP* can introduce discourse referents. Such facts are theoretically important because they might argue for relatively unconstrained theories of the establishment and retrieval of discourse referents, as argued in recent dynamic semantics and related works (see for instance Brasoveanu 2010 and Schlenker 2011b). The general idea is that coindexing is more liberally established than one might have thought, including across negation: it is thus possible to coindex *it* and *an umbrella* in (48).

(48) #John doesn't have [an umbrella]$_i$. It$_i$ is red.

But a semantic condition is responsible for 'filtering out' undesirable anaphoric possibilities. In (48), one can take the problem to be that the index *i* denotes the maximal set of umbrellas that John has, but this set is asserted by the first sentence to be empty, hence a presupposition failure triggered by the pronoun it_i.

It is striking that not just sign language data but also gestural data might help bolster this conclusion. But it is also clear that much more work is needed: extant sign language data on this topic (from Schlenker 2011b) are from two language (ASL and LSF) and two informants; and gestural data are less than striking, as mentioned above.

Last, but not least, there is no theoretical reason why the case with disjunction in (47) should behave differently from that of negation in (44), but in our data (47) is rather degraded. On liberal theories of coindexing, where the deviance of (48) is due to a presupposition failure rather than to a lack of coindexing, the effect of double negation can be reproduced with disjunction, as illustrated in (49)a.

(49) a. Either John doesn't have an umbrella, or it is broken.
b. Either John doesn't have an umbrella, or his umbrella is broken.

The reason this result is expected is that theories of presupposition projection typically assume that a presupposition found in the second disjunct can be satisfied by the negation of the first disjunct (Beaver 2001, Schlenker 2008, 2009). This explains why the existence presupposition of *his umbrella* in (49)b is satisfied, and similarly in (49)a the maximal set of umbrellas that John owns can be presupposed to be non-empty. But on such liberal views of coindexing, (47)a,b would be expected to be relatively acceptable, contrary to our data. A more thorough investigation should be conducted, possibly with experimental means.

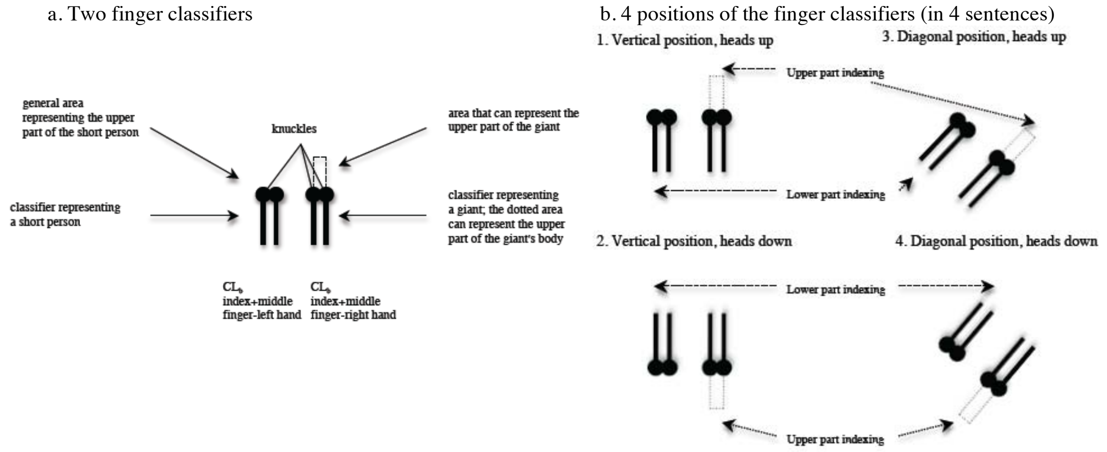
6 Iconic Loci

6.1 Iconic loci in sign language

Schlenker et al. 2013 argue, following Liddell 2003 and Kegl 2004, that loci may simultaneously function as variables and as simplified pictures of their denotations: pointing signs can target high loci when the denoted individuals are tall (or powerful or important); and different agreement verbs target different parts of a 'structured locus' depending on their meaning (for Liddell, this was part of an argument that there are gestural elements in loci). Crucially, these examples display 'iconicity in action': if one talks about individuals that rotated in various positions, the targeted position gets rotated as well. In addition, Schlenker 2014 argues that the iconic specifications of loci behave like *phi*-features in that they can be ignored in the course of ellipsis resolution and in the 'focus dimension' under *only*, as in the English examples in (4) above.

The argument for 'iconicity in action' in Schlenker 2014 was based on ASL and LSF paradigms involving a short and a tall person training to be astronauts by being rotated in various positions (here we follow the summary from Schlenker 2017a). It will help to start from the diagram in (50)a, which displays two finger classifiers, one representing a tall astronaut (on the right) and the other representing a short astronaut (on the left). Four sentences were constructed in which the classifiers were rotated in four different ways, as seen in (50)b.

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



The initial goal was to show that (i) in 'standing' position, 'tall person' indexing could be higher than 'short person' indexing; but in addition, 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.

These points were tested by the discourse in (51), which makes reference to a tall and to a short individual, and explains that they were rotated as shown in (50), with CL_a and CL_b finger classifiers representing a tall and a short person respectively.

(51) 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 [various positions shown]. They were in position __ [1 position shown].

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, 179, 180, and 181)

Let us focus for the moment on the boxed part of (51)a. In the 'vertical position, heads up' depicted in (50)b1, the reflexive *SELF-a_upper_part* targeted a position *above* the knuckles because the classifier CL_a denoted a tall person. But as different cases of rotation were considered, the finger classifiers rotated accordingly, and the 'upper part' of the locus indexed by *SELF-a_upper_part* did as well, as depicted in (50)b2, b3, b4.

In addition, the second (elided) sentence of (51)a was designed to test whether ASL ellipsis makes it possible to disregard height specifications, just as phi-features could be disregarded in the English example in (4). Analogously, in (51)a the antecedent VP includes a reflexive pronoun indexing the upper part of a locus, which is adequate to refer to a tall but not to a short person. Despite this apparent mismatch, the elided sentence is acceptable – unlike the overt counterpart in (51)b, which includes a reflexive *SELF* referring to a short person but with high specifications. Thus in ASL height specifications can be ignored by the mechanism that computes ellipsis resolution, just as is the case for gender features in (4) above. Whether one should conclude from this that height specifications *are* grammatical features is another matter, and Schlenker 2014 was cautious in this connection.

6.2 *Iconic loci in gestures*

Schlenker and Chemla 2018 argue (but without experimental data on this particular point) that loci in gestural verbs can display height differences. Thus in (52), one can use a high gestural locus to talk about a tall person.

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

Schlenker and Chemla 2018 further suggest that these specifications can be ignored under ellipsis, as shown in (53).

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

Consider for instance the case in which the sentence involves a high locus with the gestural verb *PUNCH(-2)^{high}*, unmarked for person. If the missing VP of (53)b were copied from the first sentence, we would obtain something like: *you, I will ~~PUNCH(-2)^{high}~~ as well,* where ~~*PUNCH(-2)^{high}*~~ is the elided gestural verb. But its high locus specification should yield deviance, since the addressee is short, not tall.[24]

But do these examples display 'iconicity in action'? To test this, we investigate cases comparable to (50)-(51), where rotated loci conveyed gradient information about the positions of the relevant individuals. In (54)a, high object agreement is acceptable for the person in upright position, and low object agreement is acceptable for the person in upside down position. If we try to apply high agreement for the person in upside down position, the result is deviant, as in (54)b. Finally, the 'high' specifications can be disregarded in the course of ellipsis resolution, as in (54)c.[25]

(54) When I was a kid, I often got into fights with your siblings. Once, in a space museum, they were both mock-training to become astronauts:
IX-hand-a **[your brother]** was 2-FINGERS-ROTATING$_a$ **rotating** into all sorts of weird positions, and IX-hand-b **[your sister]** was 2-FINGERS-ROTATING$_b$ **[doing the same thing]**.

I waited until your brother was very high, like 2-FINGERS-UP$_a$ **this**, and your sister was very low, like 2-FINGERS-DOWN$_b$ **this**. And then,
a. $^{6.3}$ your brother, I tried to PUNCH-a^{high}, and your sister, I tried to SLAP-b^{low}.
b. $^{3.5}$ your brother, I tried to PUNCH-a^{high}, and your sister, I tried to SLAP-b^{high}.
c. $^{5.7}$ your brother, I tried to PUNCH-a^{high}, and your sister too!
(Video 3961)

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[24] Schlenker and Chemla 2018 make similar remarks about the disappearance of height specifications in the 'focus dimension' under *only*.

[25] Informant 3 commented on the realization of the fingers, writing: 'It's a little strange with the fingers together' (see the Supplementary Materials). Note that it's not the position of the fingers but their shape that the informant objected to. There might be a sign language influence in the finger shape that we adopted, and this should be corrected in the future (the fact that Informant 3 is a (non-signing) linguist with prior knowledge of some sign language research seems to have helped them disregard this gestural infelicity).

These results only bear on the availability of high and low indexing with gestural verbs. A question for the future is whether they can be replicated with gestural pointing towards high and low position; our current results are hard to interpret in this connection.[26]

6.3 Theoretical conclusions

We conclude that gestural loci, just like sign language loci, can simultaneously behave as logical variables and as simplified pictures of their denotations. At this point, our conclusion only applies to loci that are part of gestural agreement verbs; loci that are accessed by full pointing gestures require more work.

Remarkably, iconic specifications on bound variables share the behavior of the phi-features in (4) in that they can be disregarded in the course of ellipsis resolution (and under *only*). While this could be explained by positing that such iconic specifications are grammatical features, a weaker conclusion is called for, as it has not been shown that *only* grammatical features can be disregarded in such environments (see Schlenker 2014 for a discussion of this theoretical issue in the context of sign language data).

7 Plurality

7.1 Three types of repetitions in ASL[27]

Schlenker and Lamberton, to appear argue that three types of repetitions can be found in ASL (they follow in part Pfau and Steinbach 2006, Coppola et al. 2013, Abner et al. 2015; see also Koulidobrova 2018). *Punctuated repetitions* are made of the discrete iteration of the same nominal sign in different parts of signing space. They are typically interpreted as providing precise information about the number of elements involved, one for each iteration.[28] *Unpunctuated repetitions* involve iterations with shorter and less distinct breaks between them, which makes the iterations less distinct and sometimes harder to count (similar devices were investigated in homesigners by Coppola et al. 2013 and Abner et al. 2015[29]). They provide vague information about the quantity of denoted objects, but larger number of repetitions and quicker repetitions indicate larger quantities. Finally, *continuous repetitions* can be applied to some (but definitely not all) mass terms, in which case they indicate that an entire area or space was filled with the relevant substance; if several continuous repetitions are involved, they serve to refer to several such areas. In all three cases, the arrangement of the iterations can provide iconic information about the arrangement of the objects or substances.

To illustrate, let us consider the paradigm in (55), which contrasts a horizontal and a triangular arrangement of the repetitions, both punctuated and unpunctuated; pictures have been added to help the reader visualize the two shapes in key conditions. The horizontal version involves the repetition of the sign in a left-to-right row in front of the signer, with the shape: … ; the triangular version involves repetition in the shape of a vertical triangle signed from left to right, with the two bases on the left and

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[26] A paradigm somewhat similar to (54), but with *hit* $IX\text{-}a^{high}$ replacing $PUNCH\text{-}a^{high}$, was explored in (22) in the Supplementary Materials (Video 3979+3989). We obtained the same comparative results as in (54)a,b,c: (a) high pointing for an individual situation high was acceptable; (b) low pointing was degraded; but (c) the latter effect was obviated under ellipsis. But all scores were lowered, with (a) = 4, (b) = 1.3, (c) = 3.7. Informant 1 commented about (a) that "it's not clear why the pointing gestures were necessary at all". It's hard to conclude at this point, and more work is needed on this issue.

[27] This section is a summary of some aspects of Schlenker and Lamberton, to appear.

[28] This condition does not apply when a numeral co-occurs with a punctuated repetition. Number is then given by the numeral, while the unpunctuated nature of the repetition indicates that the objects were spread out.

[29] Coppola et al. 2013 describe punctuated repetitions in homesigners as "series of discrete movements, each referring to an entity or action in the vignette. Each movement was clearly articulated and easily segmentable from the rest of the movements." By contrast, unpunctuated repetitions "were movements produced in rapid succession with no clear break between them. Although the pauses between these iterations were much smaller than those separating the components of Punctuated Movements, they were identifiable and could be easily counted. These movements could be produced in a single space, but more often were produced in multiple spatial locations."

right, and the tip above in the middle, with the shape: ∴ There are clear truth-conditional differences between the two cases, and the iconic contribution is interpreted within the scope of the conditional, which suggests that it can be at-issue.[30]

(55) *Context:* The speaker will be renting the addressee's apartment; he knows it contains trophies, but he hasn't seen them.
POSS-2 APT IF HAVE ________, IX-1 ADD 20 DOLLARS.
'If your apartment has ____, I will add $20.'

a. ^{7} [TROPHY TROPHY TROPHY]$_{\text{horizontal}}$
____ = three trophies forming a line
=> if there at least three trophies in a horizontal line, $20 will be added. Precise condition about numbers: no hesitation for the 'exactly 3' condition

b. ^{7} [TROPHY TROPHY TROPHY]$_{\text{triangle}}$
____ = three trophies forming a line
=> if there at least three trophies forming a triangle, $20 will be added. Precise condition about numbers: no hesitation for the 'exactly 3' condition

c. ^{7} TROPHY-rep3$_{\text{horizontal}}$

____ = several trophies forming a line
=> if there at least three or four trophies in a horizontal line, $20 will be added. Vague condition about numbers: explicit uncertainty for the 'exactly 3' condition (2/4 judgments)

d. $^{6.7}$ TROPHY-rep3$_{\text{triangle}}$

____ = several trophies forming a triangle
=> if there are at least 3 trophies forming a triangle, $20 will be added. Explicit uncertainty if there is a large number of trophies in a row (4/4 judgments)

e. $^{6.7}$ TROPHY-rep≥4$_{\text{horizontal}}$
____ = quite a few trophies forming a line
=> if there at least three or four or five trophies in a horizontal line, $20 will be added. Vague condition about numbers: explicit uncertainty for the 'exactly 3' (2/4 judgments) and 'exactly 4' (1/4 judgments) conditions

f. $^{6.5}$ TROPHY-rep≥4$_{\text{triangle}}$

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[30] Schlenker and Lamberton, to appear checked in their last judgment task that these sentences do not trigger any inference to the effect that *if* there are trophies, they should be arranged in a particular way. This was to ascertain that there is no 'projection' outside of the conditional of the inference pertaining to the arrangement of the relevant objects. This test matters because if the iconic conditions behaved like co-speech gestures as analyzed in Schlenker 2015, 2018a, one would expect an inference to the effect that *if there are trophies, they are arranged in a linear/triangular fashion.*

____ = quite a few trophies forming a triangle
=> if there are at least three or four or five trophies forming a triangle, $20 will be added. Vague condition about numbers: explicity uncertainty for the 'exactly 3' (2/2 judgments) and 'exactly 4' (1/4 judgment) conditions. Explicit uncertainty if there is a large number of trophies in a row (3/4 judgments).
(ASL, 32, 0096, 4 judgments; Schlenker and Lamberton, to appear, which makes available a lightly anonymized video: www.goo.gl/Ui53Yf)

Schlenker and Lamberton further argue that some mass terms, such as *SALT* and *PEE*, can be repeated continuously and can then provide information about the distribution of the relevant substance. In addition, they show that "iconic uses can give rise to punctuated and unpunctuated repetitions, in which case one obtains readings that involve clusters: disparate and clearly distinguishable clusters in the case of punctuated repetitions, and a group of them in the case of unpunctuated repetitions, as can be seen in (56)a,b."

(56) HERE HAVE
'Here there
a. [6.7] [PEE PEE PEE]$_{horizontal}$.
are three (?) areas of pee.'
=> there are (at least three?) separate areas of pee
b. [7] PEE-rep$_{horizontal}$.
are areas of pee.'
=> there are (at least three?) areas of pee, possibly closer to each other than in a.
c. [7] PEE-cont$_{horizontal}$.
is a large area of pee.'
=> there is pee in a large area
(ASL, 33, 0526; 3 judgments)

7.2 Repetition-based plurality with gestures

Schlenker and Lamberton, to appear, further suggest that similar data can be found with pro-speech gestures (see Feldstein 2015 for an earlier attempt to study plurals in gesturers). Here we base our discussion on the present survey, not available to Schlenker and Lamberton; we will see that part, but only part, of the basic data are replicated for our informants. As always, this may be due to suboptimal realizations of the videos, hence more systematic work will be needed in the future.

Following Schlenker and Lamberton, to appear, we considered the paradigm in (57), with multiple choice inferential questions that can be found in the Supplementary Materials. Unless otherwise noted, the informants did not give conflicting inferential answers, but some were unclear on some inferences or added a question mark to it; in either case, we put a question mark next to the inference.

Notation: CROSS represents the gesture , repeated in several parts of gestural space, in a punctuated fashion for *CROSS CROSS CROSS*, in an unpunctuated fashion for *CROSS-rep3* (the specifications *horizontal* and *triangle* refer to the same types of shapes as in (55)).

(57) *Context:* The addressee is taking part in a treasure hunt in churches. The speaker provides an indication about the location of the treasure.
a. [6.7] If you enter a room and you see [CROSS CROSS CROSS]$_{horizontal}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
exactly three crosses (precise)
arranged horizontally

b. [6.3] If you enter a room and you see [CROSS CROSS CROSS]$_{triangle}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
exactly three crosses (precise)
arranged as a triangle

c. [5] If you enter a room and you see CROSS-rep3$_{horizontal}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
? three crosses or more (imprecise)
arranged horizontally

d. [4.3] If you enter a room and you see CROSS-rep3$_{triangle}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
? exactly three crosses (precise) [1/3 informant], or: three crosses or more (imprecise) [1/3 informant]
? arranged as a triangle

e. [6] If you enter a room and you see CROSS-rep6$_{horizontal}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
three crosses or more (imprecise)
arranged horizontally

f. [4.3] If you enter a room and you see CROSS-rep6$_{triangle}$, you have reached the prize.
=> when he reaches the prize, the speaker will see
? three crosses or more (imprecise)
? arranged as a triangle
(video 4001)

In (57), the horizontal version involves repetition of the gesture for a cross in a row in front of the signer, with the shape … , while the triangular version has the shape ∴ . The inferential results are very similar to those described for ASL: punctuated repetitions give rise to precise readings, unpunctuated repetitions give rise to imprecise readings, a horizontal arrangement of the repetitions iterations yields indicates that the denoted objects are horizontally arranged, while a triangular arrangement suggests (less clearly) that the objects form a triangle. Importantly, however, only the punctuated version of the triangular arrangement in (57)b is acceptable (score: 6.3), whereas the unpunctuated versions in (57)d,f are degraded (scores: both 4.3).[31]

Schlenker and Lamberton, to appear also suggest that some gestures can be used with a mass meaning, with iconic effects reminiscent of some ASL iconic mass terms. We tested an inintial example in (58), where *FLAT-HAND* stands for a flat hand (palm down) in the horizontal plane, making a small circular/trembling motion, and used to refer to areas of a disgusting substance. In (58)a, two continuous iterations are produced, more or less in the same area. In (58)b, three iterations are produced in different parts of gestural space, with no clear breaks between them (which makes them unpunctuated-like). In (58)c, three punctuated iterations are produced in different parts of space, with clear breaks (and space) between them.

Notation: :-(***[GESTURES]*** indicates that the relevant gesture co-occur with a disgusted facial expression.

(58) There was a leak coming from the upstairs neighbor's bathroom, so when I got home, I saw
a. [7] :-([FLAT-HAND-cont2]
=> the speaker a big puddle / liquid everywhere
b. [5.8] :-([FLAT-HAND-rep3]
=> the speaker saw 3 or several puddles of water
c. [6] :-([FLAT-HAND FLAT-HAND FLAT-HAND]
(Video 4005)

[31] We note for completeness that Schlenker, to appear b, argues that repetition-based gestural plurals share crucial semantic properties of standard English plurals when combined with anaphora. Specifically, they give rise to (vague) universal readings in positive environments, as in: *Ann found her presents* (implying that she found all or almost all). But in negative environments, they give rise to existential readings: *Ann didn't find her presents* doesn't mean that she didn't find all, but rather than she didn't find any. These results in the gestural domain are confirmed with experimental means by Tieu et al. 2018.

Inferential judgments were not multiple-choice and are thus presented in full in (59), and summarized in (58). Different realizations clearly come with different iconic implications concerning the number of puddles and their arrangement, in a way which is reminiscent of the ASL data in (56): a continuous repetition suggests that the substance formed a connected whole, whereas discontinous repetitions come with the opposite implication.

(59) Inferential judgments for (58)

Video 4005	a.	b.	c.
Informant 1	a big puddle of water	three possibly overlapping puddles of water	three distinct puddles of water
Informant 2	A big puddle of water	3 (or more) puddles of water	Exactly 3 puddles of water
Informant 3	Some sort of disgusting liquid everywhere.	Either one big puddle or, more likely, a few separate puddles	Three (or more?) separate puddles

7.3 Interaction with anaphora

Schlenker and Lamberton, to appear, argue that iconic plurals interact in interesting ways with anaphora. Specifically, the *edges* of an iconic plural representation can sometimes introduce a discourse referent for further anaphoric uptake, but this is more difficult for non-edges. A simplified paradigm is given in (60). In (60)a, the unpunctuated repetitions of *TROPHY* appear in horizontal shape (= …), and the possessive indexes the middle of the row. The result is degraded, and the dominant (although not the sole) reading is that all trophies have a funny inscription. In (60)b, unpunctuated repetitions of *TROPHY* appear in a triangular shape (= ∴), and the top tip of the triangle is indexed by the possessive. The sentence is acceptable and the possessive denotes the top trophy. In the complete paradigm, one can see that when the left-most or the right-most iteration of *TROPHY* is indexed, the sentence is acceptable and the possessive refers to the left-most or right-most trophy, as the case may be.

(60) YESTERDAY IX-1 VISIT POSS-2 APT. IX-1 SEE TROPHY-rep-_ . POSS_ CARVE WORDS FUNNY.
'Yesterday, I visited your apartment. I saw several trophies, arranged in a _____. The inscription of …… was funny.'

POSS_ targets the intermediate *TROPHY*
a. $^{5.2}$ TROPHY-rep-3$_{\text{horizontal}}$
_____ = row; …… = all trophies / the intermediate trophy
=> all the trophies are funny (3/4 judgments) or the intermediate trophy is funny (4/4 judgments)
b. $^{6.2}$ TROPHY-rep-3$_{\text{triangle}}$
_____ = triangle; …… = the top trophy
=> the top trophy was funny
(ASL, 32, 0084c, d; 4 judgments; Schlenker and Lamberton, to appear)

No such contrasts are found with simple examples involving punctuated repetitions: in (61), the intermediate iteration is indexed by the possessive, the sentence acceptable, and the possessive refers to the middle trophy.

(61) HERE HAVE [TROPHY TROPHY TROPHY]$_{\text{horizontal}}$.
^{7} POSS-middle SHAPE STRANGE.
=> the intermediate trophy has a weird shape
'Here there are at least three trophies in a row. The intermediate one has a weird shape.'
(ASL, 33, 0596c 3 judgments)

Schlenker and Lamberton, to appear, leave it open whether this Edge effect can be replicated with gestural plurals. Our data do not allow us to decide in favor of the Edge effect in gestures, because all cases of anaphora with unpunctuated repetitions are degraded, and do not yield contrasts. On the other hand, with punctuated repetitions, anaphora is acceptable, and does not yield an Edge effect (nor is one found in ASL, since each unpunctuated iteration can support anaphora). Since sentences (62)e-h are rather degraded, we do not attempt to summarize the inferential judgments, which can be found in the Supplementary Materials.

(62) *Context:* The speaker is taking part in a treasure hunt, and he has been told to look for a cross.

At last, I entered a room and I saw

a. $^{6.7}$ [CROSS CROSS CROSS]$_{\text{horizontal}}$. So you know I what I did? I took IX-middle
=> the speaker saw: exactly three crosses, arranged horizontally
=> the speaker took the middle cross
b. $^{6.7}$ ____ IX-right
=> the speaker saw: exactly three crosses, arranged horizontally
=> the speaker took the right-most cross

c. $^{6.3}$ [CROSS CROSS CROSS]$_{\text{triangle}}$. So you know I what I did? I took IX-middle
=> the speaker saw: exactly three crosses, arranged as a triangle
=> the speaker took the middle cross

d. $^{6.3}$ ____ IX-right
=> the speaker saw: exactly three crosses, arranged as a triangle
=> the speaker took the right-most cross

e. ^{4} CROSS-rep3$_{\text{horizontal}}$. So you know I what I did? I took IX-middle
f. ^{4} ____ IX-right
g. $^{3.7}$ CROSS-rep3$_{\text{triangle}}$. So you know I what I did? I took IX-middle
h. $^{3.7}$ ____ IX-right
(video 4007)

7.4 Theoretical consequences

Schlenker and Lamberton, to appear, propose that the traditional semantics for plurals must be tweaked to make provisions for iconic conditions, as in (63) (stated for *TROPHY*, as above; this is just their initial proposal, which is refined later in their paper). The rule in (63)(i), combined with the definition in (64), yields a standard requirement: a plural should denote a plural object, defined as a mereological sum (punctuated and unpunctuated repetitions alike are treated as plurals, but the iconic conditions they introduce are taken to be responsible for the semantic differences between them). Mass terms have whatever meaning is lexically specified. The condition in (63)(ii) adds to this a specifically iconic constraint, according to which the denoted group or substance must resemble the repetition that represents it – and of course the details of this requirement will depend on a more precise iconic semantics. Finally, the condition in (63)(iii) specifies that a repetition-based plural introducing a variable *X* does not just make *X* available for further anaphoric uptake. It can also make available further discourse referents $x_1, \ldots, x_n$ on iconic grounds, as we saw in Section 7.3.

(63) **Semantics of punctuated, unpunctuated and continuous repetitions** (initial attempt in Schlenker and Lamberton, to appear)
For $N\text{-}iter_X = N\text{-}rep_X$ or $[N\ N\ N]_X$ or $N\text{-}cont_X$, if P is a propositional expression,
$[[\text{N-iter}_X\ \text{P}]]^{c,s}$ = true iff for some group d,
(i) if *N* is count, $*[[\text{N}]]^{c,\, s[X\to d]}(d)$ = true; and if *N* is mass, $[[\text{N}]]^{c,\, s[X\to d]}(d)$ = true, and
(ii) ***N-iter* iconically represents d given c,** and
(iii) $[[\text{P}]]^{c,\, s[X\to d,\, x_1\to d_1, \ldots, x_n\to d_n]}$ = true, where $x_1, \ldots, x_n$ are discourse referents made available by the iconic semantics of *N-iter,* and $x_1, \ldots, x_n$ respectively denote $d_1, \ldots, d_n$ (which are parts of d).

(64) Link's sum closure operator: if X is a set, *X is the smallest set such that:
(i) $X \subseteq *X$
(ii) for all x, x', if $x \in X$ and $x' \in X$, then $x+x' \in X$, where x+x' is the mereological sum of x and x'

At this point, we can conclude (i) that the iconic component of the definition is also necessary for gestural pluralities, and (ii) that the discourse referent creation component (in (63)c) is necessary for *punctuated* gestural repetitions. Whether it is necessary for unpunctuated repetitions is currently unclear.

8 Pluractionality

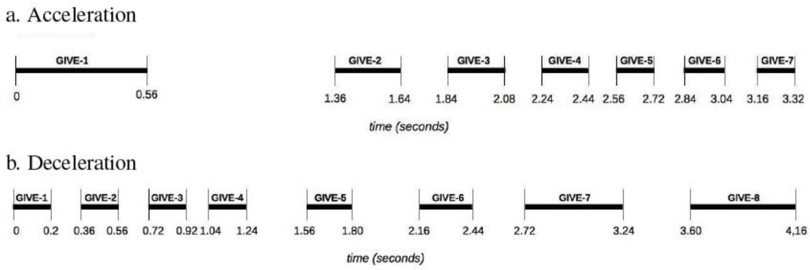
8.1 Iconic pluractionals in signs and in gestures

Kuhn 2015b and Kuhn and Aristodemo 2017 argue that repetition-based pluractionals in LSF can have an iconic component, and that it may contribute at-issue information. As an example, the difference in realization between the 'accelerating' and the 'decelerating' versions of LSF *GIVE* transcribed in (65)a and (65)b are represented by way of the diagrams in (66)a and (66)b respectively, which display the time-course of the sign iterations. The translations immediately show that the rate of repetitions of the signs are interpreted: accelerating repetitions refer to accelerating repetitions of the event, and similarity for decelerating repetitions. Kuhn 2015b and Kuhn and Aristodemo 2017 make specific proposals about the form of the iconic rule of interpretation at work here.

(65) a. MIRKO CHILD BOOK GIVE-rep-accelerating.
'Mirko gave the child a book at an accelerating pace.' (Kuhn and Aristodemo 2017)

b. MIRKO CHILD BOOK GIVE-rep-deceleration.
'Mirko gave the child a book at decelerating pace.' (Kuhn and Aristodemo 2017)

(66) Time-course diagrams of accelerating and decelerating *GIVE-rep* (Kuhn and Aristodemo 2017)



We believe that repetitions of gestural verbs give rise to the same type of iconic inferences as sign language pluractionals. We investigated the paradigm in (67), where SLAP co-occurs with the onomatopoeia *pf*.
Notation: SLAP is a slapping gesture produced in neutral position (in front of the speaker). SLAP, SLAP, SLAP encodes three repetitions with clear pauses, SLAP-repn encodes n repetitions without clear pauses; accelerating and decelerating indicate that the repetitions are produced at an accelerating and decelerating speed respectively.

(67) My opponent, I am going to
a. $^{5.7}$ SLAP, SLAP, SLAP.
=> the speaker will slap his opponent
exactly three times
slowly [3/3 informants] / in a very deliberate fashion [1/3 informant]
b. $^{5.3}$ SLAP-rep3.
=> the speaker will slap his opponent
two/three times [2/3 informants] / exactly three times [1/3 informant] / three times or more [1/3 informant]
fast
c. $^{5.7}$ SLAP-rep5?[32].
=> the speaker will slap his opponent

[32] The iterations are hard to count, and the first onomatopoeia *paf* was produced with slight pause, which probably explains the inference drawn by one of the informants (= ' once, followed by several quick slaps').

three times or more [1/3 informant] / six times or more [2/3 informants]
fast [2/3 informants] / once, followed by several quick slaps [1/3 informants]
d. 5.7 SLAP-rep-accelerating.
=> the speaker will slap his opponent
six times or more
in an accelerating fashion
e. 5.7 SLAP-rep-decelerating.
=> the speaker will slap his opponent
six times or more
in a decelarating fashion
(video 4013)

First, with clearly separated unpunctuated repetitions, as in (67)a, we obtain a reading on which there were exactly as many slapping actions as there are slapping gestures. Second, focusing now on unpunctuated repetitions (as in Kuhn and Aristodemo's discussion), these appear to provide vague quantitative information about the number of denoted actions: the (approximately) five unpunctuated iterations in (67)c are associated with larger numbers of slappings than the three iterations in (67)b, but in both cases thresholds give rise to disagreement among informants. Finally, accelerating or decelerating repetitions as in (67)d,e yield inferences that are close to those reported by Aristodemo and Kuhn.

We conclude that gestural pluractionals might come close to the iconic properties described for sign language pluractionals by Kuhn and Aristodemo 2017. While more work will be needed on this topic (particularly on the distinction between punctuated and unpunctuated repetitions, both in sign language and in gestures), there appear to be strong initial similarities between iconic pluractionals in sign language and in gestures.

8.2 Theoretical consequences

Kuhn and Aristodemo 2017 analyze one-handed repetitions in LSF by way of the lexical entry in (68), which takes a verbal denotation *V* (analyzed as a set of events), and in essence returns the set of plural events e that satisfy that verbal condition *while* being in relevant respects similar to the form the verbal form. This iconic condition is stated by way of a conjunct *Iconic*$^{\Phi}$*(e)*, which specifies that the plural event e has a temporal distribution that is similar to that of the repetition (the relevant notion of similarity is explicated more precisely in the full theory).

(68) $[[\text{-rep}]] = \lambda V\ \lambda e\ [V(e)\ \&\ \exists e', e'' \leq e\ [\tau(e') \neq \tau(e'')]\ \&\ \text{Iconic}^{\Phi}(e)]$
'/-rep/ takes a verb denotation V and gives the set of V-ing events that have at least two subparts with different runtimes and that have the temporal distribution shown.'

It is clear that this general analysis could also be applied to the repetition-based gestural verbs discussed in this section.[33]

In addition, while the implementation is different, Kuhn and Aristodemo's theory shares a crucial property with the (later) analysis of ASL iconic plurals discussed in Schlenker and Lamberton, appear: in both cases, a standard logical condition is enriched with an iconic condition that specifies that a plural object or event should resemble aspects of a form. This general interaction between logical and iconic conditions appears to characterize signs and gestures alike.

9 Telicity[34]

Semanticists traditionally classify event descriptions as *telic* if they hold of events that have a natural endpoint determined by that description, and they call them *atelic* otherwise. *John spotted Mary* and

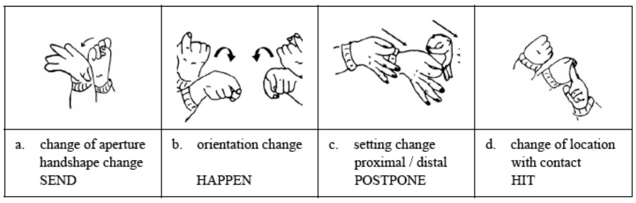
[33] It is worth noting that Kuhn and Aristodemo discuss two types of repetitions in LSF. Besides the one-handed repetition *-rep*, discussed here, they analyze a two-handed alternating repetition *-alt*, which comes with further constraints: the plural events that satisfy the condition must have subevents with different thematic arguments. It would be interesting to investigate in future research whether the distinction between *-rep* and *-alt* has counterparts in pro-speech gestures.
[34] This section borrows from a summary in Schlenker 2016b.

John understood have such a natural endpoint – the point at which John spotted Mary and came to an understanding, respectively; *John knew Mary* and *John reflected* lack such a natural endpoint and are thus atelic. Standardly (e.g. Rothstein 2004), a temporal modifier of the form *in α time* can modify telic VPs, whereas *for α time* modifies atelic VPs (e.g. *John reflected for a second* vs. *John understood in a second*). In an influential piece, Wilbur 2003 argued that *the distinction between telic and atelic predicates is often realized overtly in ASL.* In Wilbur and Malaia's (2008) words, the observation was that

> ASL lexical verbs could be analyzed as telic or atelic based on their form: telic verbs appeared to have a sharper ending movement to a stop, presumably reflecting the semantic end-state of the affected argument (...). These end-states were observed to be overtly marked in ASL by several mechanisms: (1) change of handshape aperture (open/closed or closed/open); (2) change of handshape orientation; and (3) abrupt stop at a location in space or contact with a body part. (...) The observation that semantic verb classes are characterized by certain movement profiles was formulated as the Event Visibility Hypothesis (EVH) for sign languages: "In the predicate system, the semantics of the event structure is visible in the phonological form of the predicate sign" (Wilbur, 2008: 229).

Wilbur 2008 posited that in ASL and other sign languages, telicity is overtly marked by the presence of an affix dubbed *EndState*, and which "means that an event has a final state". Its phonological form is "a rapid deceleration of the movement to a complete stop", which can come in several varieties, as illustrated in (69).

(69) Examples of movement sin signs denoting telic events (from Wilbur 2008, figure 3)



Schlenker, to appear a, proposes instead that Wilbur's finding should be recast within a theory of iconic meaning. The point is that sign language telic verbs can be modulated in such a way that the entire development of the sign rather than just its endpoints provide information about the precise development of the denoted action.

Be that as it may, Strickland et al. 2015 revisit Wilbur's Hypothesis of Event Visibility, but in non-signers. They show that non-signers that have not been exposed to sign language still 'know' Wilbur's generalization about the overt marking of telic endpoints in sign language: when asked to choose among a telic or atelic meaning (e.g. 'decide' vs. 'think') for a sign language verb they have never seen, they are overwhelmingly accurate in choosing the telic meaning in case endpoints are marked. Furthermore, this result holds even when *neither* meaning offered to them is the actual meaning of the sign, which rules out the possibility that subjects use other iconic properties to zero in on the correct meaning.

We believe that related facts can be found with pro-speech gestures. We tested three pairs of gestural verbs (each time a telic and an atelic form according to Wilbur's generalization), and only focus on the clearest pair, illustrated in (70)-(71). *CIRCLE-cont* represents a parachute slowly rotating down, with the right hand, palm down, moving downwards without sharp gestural boundaries. *CIRCLE-sharp* is realized in a similar way, but the left hand is added to represent the ground, and there is a sharp boundary when the right hand hits the left hand, representing landing. The contrasts are clear, and expected if Wilbur's generalization applies to gestural verbs: *CIRCLE-cont*, having no sharp boundaries, is treated as atelic and is thus acceptable with *for* in (70)a but not with *in* in (71)b. *CIRCLE-cont*, which has a sharp boundary, is treated as telic and is unacceptable with *for* (in (70)b) but acceptable with *in* (in (71)b).

(70) When skydiving tomorrow, you will
a. [6] CIRCLE-cont
b. [1.8] CIRCLE-sharp
for five minutes.

(Video 4033. Anonymized video: https://www.dropbox.com/s/6mf5xmg63y9c17p/IMG%204033-doubly_anon.mp4?dl=0)

(71) When skydiving tomorrow, you will
a. [2] CIRCLE-cont
b. [5.3] CIRCLE-sharp
in five minutes.
(Video 4039. Anonymized video: https://www.dropbox.com/s/x3gqmqxu2j2giku/IMG%204039-doubly_anon.mp4?dl=0)

On the assumption that the telic/atelic distinction is logical in nature (as standardly assumed, e.g. Rothstein 2004), it is of course unsurprising that different gestural verbs should pattern differently depending on their intuitive meaning. But what is interesting is the potential validity of Wilbur's generalization for the *realization* of the telic/atelic distinction in at least some gestural verbs. It is plausible that our informants never saw the precise gestures we used above, and yet they were immediately able to classify them as telic or atelic, exactly as in Strickland et al.'s 2015 work, but now with gestures rather than signs.

10 Role Shift

As summarized in Quer 2013, Role Shift across sign languages is morpho-syntactically characterized by non-manual markers such as the following: (i) 'temporary interruption of eye contact with the actual interlocutor and direction change of eye gaze towards the reported interlocutor'; (ii) 'slight shift of the upper body in the direction of the locus associated with the author of the reported utterance'; (iii) 'change in head position'; (iv) 'facial expression associated to the reported agent.' Role Shift comes in two varieties (e.g. Schlenker, 2017b,c): Attitude Role Shift serves to report thoughts or words, with a quotational component; Action Role Shift describes an action in a particularly vivid way, with an iconic component.

Some analysts (Quer 2005, 2013, Schlenker 2017b,c) take Role Shift to be an overt manifestation of 'context shift', a grammatical operation that shifts of the context of evaluation of some or all indexicals, (e.g. Schlenker 2011a). Schlenker 2017b,c argues that Role Shift is context shift *augmented* with special iconic constraints. Others take Role Shift to incorporate a gestural, demonstrative component - with the idea that it signals that the words or actions were in relevant respects 'like' the words used by the signer (Davidson 2015). In fact, Lillo-Martin 2012 noted that "what role shift conveys is very similar to what is conveyed with the colloquial English use of like, as in, “He’s like, I can’t believe you did that!”", and in some cases this construction may involve pro-speech gestures, as in Davidson's example in (72) (Davidson 2015; see also Quinto-Pozos and Parrill 2015 for a comparison between signers' and speakers' strategies to encode viewpoint in narratives, and Streeck 2002 for a discussion of the gestural enactment usage of *like*).

(72) Bob was like [gobbling gesture].

Without taking a stance on the theoretical debate, we can ask whether some pro-speech gestures can be realized under Role Shift. Attitude and Action Role Shift are arguably both exemplified in **Error! Reference source not found.**, which was maximally acceptable for each of our informants (7 on a 7-point scale).

Notation: RS_i indicates that the speaker shifts his body to adopt the position of a fictional character found in gestural locus i (here we will have i = a or i = b). The gesture that follows RS_i is realized from this shifted position.

(73) [7] I was standing next to IX-hand-a **[little Robin]** and IX-hand-b **[little Francis]**, and I was a holding a really yummy chocolate bar. And I asked: Who wants it? And so of course
(i) IX-hand-a **[little Robin]** goes: RS_a IX-1. And IX-hand-b **[little Francis]** goes: RS_b IX-1.
Next thing I know,

(ii) IX-hand-a **[little Robin]** turns to IX-hand-b **[Francis]** and $\boxed{\text{RS}_a \text{ SLAP-b}}$. And so IX-hand-b **[Francis]** RS_b PUNCH-a.

(Video 4053. Anonymized video: https://www.dropbox.com/s/tjcmqmd34hr9w2d/IMG%204053-doubly_anon.mp4?dl=0).

Error! Reference source not found.(i) displays an example reminiscent of Attitude Role Shift, here involving direct quotation. The first person pointing gestures are interpreted as quoted material: one understands that Robin and Francis each replied with a first person gesture (if the gesture were repeated, we understand that they used repeated gestures in their answers); and facial expressions that accompany this gesture will equally be attributed to the relevant child.

By contrast, in **Error! Reference source not found.**(ii) we are dealing with a construction reminiscent of Action Role Shift: the gesture is not quoted, but rather is used to refer to an action. Thus no speech report is involved here, but rather an action report.

It is worth adding that these gestural examples do not by themselves decide theoretical debates about sign language Role Shift. These hinge on far more subtle constructions than are discussed here. In fact, without a more thorough investigation of the data, it will be hard to argue that we genuinely have a gestural counterpart of Role Shift, rather than a different construction which is vaguely reminiscent of it. Detailed formal work will be needed to come to some clarity on this issue.

11 Conclusions

Our observations suggest the following conclusions, which ought to be further tested with experimental means in the future.

(i) There are non-trivial rules governing the use of pro-speech gestures, in particular when it comes to the syntax/semantics interface. Investigating these rules could thus offer a rich field of new data for formal linguistics.

(ii) Gestural rules share non-trivial properties with rules that (a) are instantiated in sign language, and (b) in several cases, are categorized as being 'grammatical' in the formal linguistics of sign language. More detailed empirical and theoretical work will be needed to assess the extent of the similarities, including in areas we did not discuss here, such as Binding Theory.

(iii) It should go without saying that the existence of gestural rules reminiscent of sign language grammar in no way implies that sign languages are mere gestural systems. Pro-speech gestures on their own are isolated iconic elements, which we studied by embedding them in full-fledged spoken language sentences. By contrast, sign languages notoriously have sophisticated formal properties and rich expressive possibilities, just like spoken languages but independently from them (in fact, along some dimensions, the simultaneous presence of rich logical *and* iconic means in sign languages might give them an expressive advantage).

(iv) Since home signs and emerging sign languages are historically connected to pro-speech gestures, our results might bear on home sign and sign language development and typology. Work on the pro-speech gestures used in different cultures would be helpful in this connection.

(v) Finally, it is likely that most of the pro-speech gestures discussed in this piece are very uncommon in standard use. If so, and if speakers still have relatively clear intuitions about their grammar and meaning, an acquisition-theoretic question emerges: how can the relevant rules be acquired on the basis of highly limited (possibly 'zero-shot') experience?[35]

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[35] One question we attempted to test in our survey but do not report here (because the results are too inconsistent and complex) pertains to the interaction of eyebrow raising (as a potential focus-marking device) and pro-speech gestures. See the Supplementary Materials for the data we obtained, and Dohen 2005 and Dohen and Loevenbruck 2009 for the use of eyebrow raising marking focus when used as co-speech facial expressions.

Appendix.
Locative Shift in Signs and in Gestures

This Appendix is devoted to a puzzling property of sign language: in some cases, a location-denoted locus can be co-opted to refer to an individual found at that location. We summarize the main findings and ask whether they extend to gestural loci. As we will see, judgments are variable across informants, and an experimental investigation might be called for.

❑ *Basic Locative Shift in sign language*

In ASL (and LSF), one may sometimes re-use a locus initially associated with a spatial location to denote an individual found at that location (Padden 1988, Van Hoek 1992, Emmorey 2002, Emmorey and Falgier 2004, Schlenker 2013, Schlenker to appear c). This phenomenon, sometimes called 'Locative Shift', is illustrated in (74). In (74)a(i), locus *b*, associated with *JOHN,* appears as the object agreement marker of *HELP*, whereas in (74)a(ii) loci *a* and *c,* associated with *FRENCH CITY* and *AMERICAN CITY* respectively, are used to refer to John-in-the-French-city and John-in-the-American-city. The latter sentence exemplifies Locative Shift, which in this case is preferred (in other examples, there is optionality). The operation is constrained, however: indexical loci (here illustrated with a second person locus) usually do not like to undergo Locative Shift, as illustrated in (74)b(ii).

(74) a. JOHN IX-b WORK [IX-a FRENCH CITY]$_a$ SAME WORK [IX-c AMERICA CITY]$_c$.
‘John does business in a French city and he does business in an American city.

(i) No Locative Shift
$^{4.2}$ IX-a IX-1 1-HELP-b. IX-c IX-1 NOT 1-HELP-b.

(ii) Locative Shift
^{6} JOHN IX-b WORK [IX-a FRENCH CITY]$_a$ SAME WORK [IX-c AMERICA CITY]$_c$.
IX-a IX-1 1-HELP-a. IX-c IX-1 NOT 1-HELP-c.
There [= in the French city] I help him. There [= in the American city] I don’t help him.’

b. IX-2 WORK [IX-a FRENCH CITY]$_a$ SAME IX-2 WORK [IX-c AMERICA CITY]$_c$.
‘You do business in a French city and you do business in an American city.

(i) No Locative Shift
$^{6.3}$ IX-a IX-1 1-HELP-2. IX-c IX-1 NOT 1-HELP-2.
There [= in the French city] I help you. There [= in the American city] I don’t help you.'

(ii) Locative Shift
$^{2.3}$ IX-a IX-1 1-HELP-a. IX-c IX-1 NOT 1-HELP-c.
(ASL, 8, 1; 3 judgments; Schlenker 2011c)

❑ *Basic Locative Shift in gestures*

A basic case of Locative Shift with pro-speech gestures is illustrated in (75)c: instead of pointing towards the gestural locus introduced with *John*, the speaker points towards the gestural locus introduced with *New York*, but to refer to John-in-New York, so to speak.

(75) Since IX-hand-a **John** can't seem to work/get along with IX-hand-2 **you**, I'll/I am going to have him transferred to IX-hand-c **New York**. And later, if I need to downsize, you know who I'll fire?[36]
a. $^{6.3}$ IX-2. (= the addressee)
b. $^{4.7}$ IX-a. (= John)
c. $^{4.3}$ IX-c. (= John)
(Video 3991)

[36] The model interchangeably used 'work with' and 'get along with' in different sentences; similar for 'I'll' vs. 'I am going to'.

(76) Acceptability ratings for (75)

Video 3991	a.	b.	c.
Informant 1	5	2	5
Informant 2	7	6	1
Informant 3	7	6	7

Averages obscure some of the patterns in this case: Informant 1 obligatorily applies Locative Shift, Informant 2 prohibits it, Informant 3 allows it, as seen by the scores in (76).

When it is denied that John will be in New York, pointing towards the gestural locus associated with New York to refer to John entirely fails (for all informants), as seen in (77).

(77) Since IX-hand-a **John** can't seem to work with IX-hand-2 **you**, I won't have him transferred to IX-hand-c **New York**. And if later I need/I later[37] need to downsize, you know who I'll fire?
a. $^{6.3}$ IX-2. (= the addressee)
b. $^{6.3}$ IX-a. (= John)
c. ^{1} IX-c.
(Video 3993)

Do we replicate in gestures the sign language finding that second person loci resist Locative Shift? The lower score in (78)c suggests that this is indeed the case, but due to the complexity of the ratings in the baseline in (76), we must discuss individual judgments, provided in (79).

(78) Since IX-hand-2 **you** can't seem to work with IX-hand-a **John**, I'll have you transferred to IX-hand-c **New York**. And if later I need to downsize, you know who I'll fire?
a. $^{6.5}$ IX-2. (= the addressee)
b. $^{6.3}$ IX-a. (= John)
c. $^{3.8}$ IX-c. (= the addressee (?))
(Video 3987)

(79) Acceptability ratings for (78)

Video 3997	a.	b.	c.
Informant 1	5.5	5	4.5
Informant 2	7	7	1
Informant 3	7	7	6

Let us look at the individual scores for (78)c. Informant 1, who obligatorily applied Locative Shift in (76), allows for the non-locative-shifted option in (78)a, and slightly disprefers applying Locative Shift to it (score: 4.5). Informant 2 prohibited Locative Shift in (76) and continues to prohibit it in this case (score: 1). From the perspective of the sign language prohibition against locative-shifted indexical pronouns, it is surprising that Informant 3 accepts Locative Shift (score: 6). Still, their pattern of preference is reversed: Informant 3 preferred to apply Locative Shift to third person pointing in (76) (scores: 7 with Locative Shift, 6 without), whereas with second person pointing, Informant 3 prefers not to apply Locative Shift (scores: 6 with Locative Shift, 7 without).

We conclude that (i) Locative Shift has a counterpart with gestural loci, but (ii) it's not clear whether gestural Locative Shift can apply to indexical pronouns or, as argued for ASL, is preferably avoided in such cases. Experimental work would be helpful in this area.

❑ *Theoretical consequences*

There are two facts to be explained with respect to the sign language data. First, (i) why can location-denoting loci be co-opted to denote individuals found at these locations? Second, (ii) why is this operation degraded when the speaker or addressee (and possibly other deictic elements) are denoted? The first question applies to our gestural data, the second question might or might not.

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[37] The model interchangeably used *if later I need* and *if I later need* depending on the sentence.

The question in (i) was answered in Schlenker, to appear c, by way of the hypothesis in (80). In a nutshell, it states that a locus *a* denoting an individual s(a) and a locus *b* denoting a location (or more generally a situation) s(b) can be combined to form a complex expression a^b which (i) denotes the stage of individual s(a) found in situation s(b), and (ii) is spelled out as *b*. They key in this analysis is that locative-shifted loci have more fine-grained meanings than standard loci and denote *individuals at situations* rather than just individuals or just situations.

(80) **Hypothesis about Locative Shift** (Schlenker, to appear c)
a. Syntax
If a locus *a* denotes an individual s(a) and a locus *b* denotes a spatial, temporal or modal situation s(b), then under some pragmatic conditions, the locus *b* can also spell out the complex expression a^b.
b. Semantics
Evaluated under an assignment s, a^b denotes the stage of individual s(a) found in situation s(b).

Turning to the question in (ii), its answer might lie in the observation, made in connection with (16)a, that there is a strong preference in sign language and gestures alike to refer to elements that are present in the context by pointing at them (but see Schlenker, to appear c for further discussion). This same principle might explain why one cannot easily introduce/retrieve an arbitrary locus to refer to the addressee in (16). And it would lead us to expect that in gestures as well Locative Shift cannot target indexical pronouns.

Supplementary Materials

The survey on which this article is based can be downloaded at the following URL:

https://drive.google.com/file/d/1Ib6W9oA33b_07a9Rxp2Kh5XdeU9bXlGU/view?usp=sharing

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