

Logical Visibility and Iconicity in Sign Language Semantics: Theoretical Perspectives

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Abstract. We argue that sign languages have a crucial role to play in the foundations of semantics, for two reasons. First, in some cases *sign languages provide overt evidence on crucial aspects of the Logical Form of sentences*, ones that must be inferred indirectly in spoken language (= 'Logical Visibility'). Examples involve loci, which might sometimes be the overt realization of logical variables; and Role Shift, which may be the overt realization of context shift. Second, along one dimension *sign languages are strictly more expressive than spoken languages* because iconic phenomena can be found at their logical core (= 'Iconicity'). Thus loci may have a depictive component, and Role Shift has iconic effects as well. From this perspective, spoken language semantics is along some dimensions a 'simplified' version of sign language semantics, one from which the iconic component has been mostly lost. While one may conclude that the full extent of Universal Semantics can only be studied in sign languages, an alternative is that spoken languages have comparable expressive mechanisms, but only when co-speech gestures are taken into account – hence the need for a precise semantics for gestures as well.

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This piece is intended as a handbook article, summarizing results that are presented at greater length in Schlenker, to appear c.

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1 Introduction

We argue that sign languages have a crucial role to play in the foundations of semantics, for two reasons. First, in some cases *sign languages provide overt evidence on crucial aspects of the Logical Form of sentences*, ones that must be inferred indirectly in spoken language (= 'Logical Visibility'). Second, along one dimension *sign languages are strictly more expressive than spoken languages* because iconic phenomena can be found at their logical core (= 'Iconicity'). From this perspective, spoken language semantics is along some dimensions a 'simplified' version of sign language semantics, one from which the iconic component has been mostly lost. While one may conclude that the full extent of Universal Semantics can only be studied in sign languages, an alternative is that spoken languages have comparable expressive resources, but only when co-speech gestures are taken into account – hence the need for a precise semantics for gestures as well.

We state our hypothesis of Logical Visibility in (1) (see Lillo-Martin and Klima 1990 and Wilbur (2003, 2008), among others).

(1) Hypothesis 1: Logical Visibility²

Sign languages can make overt some mechanisms which (i) have been posited in the analysis of the Logical Form of spoken language sentences, but (ii) are not morphologically realized in spoken languages.

Examples will involve in particular (i) covert variables that have been posited to disambiguate relations of binding in spoken language, and are realized as loci in sign languages; and (ii) covert operations of context shift, which have been argued to be useful to analyze the behavior of indexicals in some spoken languages, and are realized as Role Shift in sign languages.³

We state our hypothesis about Iconicity in (2) (see Schlenker, to appear c, for reference to iconic views in Liddell 2003, Kegl 2004, Cuxac 1999, Cuxac and Salandre 2007, Taub 2001).

(2) Hypothesis 2: Iconicity

Sign languages make use of expressions that simultaneously have a logical/grammatical function and an iconic semantics, defined as a semantics in which some geometric properties of signs must be preserved by the interpretation function.

Examples will primarily involve sign language loci, which can simultaneously fulfill the role of variables *and* display pictorial/diagrammatic properties. Here too, we will not claim that iconic effects don't exist in spoken language, but we will suggest that the richness of iconicity in sign language and its seamless integration to the logical engine of the language raise particular challenges.

2 Logical Visibility I: Visible Variables

We start our discussion of Logical Visibility with sign language loci, which were analyzed by several researchers (starting with Lillo-Martin and Klima 1990) as the overt manifestation of logical variables. We lay out this hypothesis in Section 2.1, illustrate it in the case of individual-referring loci in Section 2.2, trace some of its consequences for debates about the existence of time and world variables in Section 2.3, and then step back in Section 2.4 to ask how strong the analogy between loci and variables really is. (We leave out 'dynamic variables' from the present discussion; they are discussed at greater length in Schlenker 2011b, to appear c).

² We use the term 'logical' loosely, to refer to primitive distinctions that play a key role in a semantic analysis. Some of our examples are logical categories in the strict sense (e.g. logical variables), but others are not (e.g. the representation of aspectual classes). We avoid the term 'LF visibility' because it might be associated with a different idea, namely that a particular level of representation posited in some generative approaches, called 'LF', might be more transparently visible in some languages than in others. It has sometimes been claimed, for instance, that the 'LF position of quantifiers' is relatively transparently represented in Hungarian (e.g. Brody and Szabolcsi 2003); this syntactic claim is of course an unrelated claim to the hypothesis discussed here.

³ We state the hypothesis existentially, as being about *some* mechanisms that are covert in spoken language but overt in sign language. This is in fact a well-worn type of argument in semantic typology. For instance, Szabolcsi 2000 (following Kiss 1991) argues that Hungarian 'wears its LF on its sleeve' because the scope of quantifiers is disambiguated by their surface position.

2.1 Variable Visibility

Sentences such as (3)a and (4)a can be read in three ways, depending on whether the embedded pronoun is understood to depend on the subject, on the object, or to be deictic.

- (3) a. Sarkozy_i told Obama_k that he_{i/k/m} would be re-elected.
 b. Sarkozy λ_i Obama λ_k t_i told t_k that he_{i/k/m} would be re-elected.
- (4) a. [A representative]_i told [a senator]_k that he_{i/k/m} would be re-elected.
 b. [a representative]_i λ_i [a senator]_k λ_k t_i told t_k that he_{i/k/m} be re-elected

These ambiguities have been analyzed in great detail in frameworks that posit that pronouns have the semantics of variables, which may be bound by a quantifier, or left free – in which case they receive their value from an assignment function provided by the context. For instance, in the textbook analysis of Heim and Kratzer 1998, one way to represent the ambiguity of (3)a is through the representation in (3)b, where a *bona fide* Logical Form would be obtained by choosing the index *i*, *k* or *m* for the pronoun *he* (since the subject and object are referring expressions, there are several alternative ways to represent the ambiguity). (4)b summarizes three possible Logical Forms of (4)a within the same framework, depending on whether *he* is given the index *i*, *k* or *m*.

Sometimes these representations can get quite complex, for instance to capture the fact that plural pronouns may be simultaneously bound by several quantifiers, as in (the relevant reading of) (5)a, represented as in (5)b.

- (5) a. [A representative]_i told [a senator]_k that they_{i,k} would (both) be re-elected.
 b. [a representative]_i λ_i [a senator]_k λ_k t_i told t_k that they_{i+k} would be re-elected

In this case, it is essential on the relevant reading that *they* should be simultaneously dependent on *a representative* and on *a senator*, hence the 'sum' index *i+k* that appears on *they* in (5)b.

In this section, we survey recent results that suggest that sign language displays an overt version of something close to the indices of (3)-(5), and that this fact can be used to revisit some foundational questions in semantics. However, it will prove useful to distinguish between two versions of this hypothesis of 'Variable Visibility'. According to the Weak Version, it is possible to associate to both a pronoun and to its antecedent a symbol (namely a locus) that marks their dependency, and to associate to different deictic pronouns different symbols if they denote different objects. According to the Strong Version, the symbols in question – loci – really do display the behavior of variables – which as we will see below is a strictly stronger (and possibly overly strong) claim.

(6) Variable Visibility

a. Weak Version

In sign language, a given locus in signing space can be associated both to a pronoun and to its antecedent to mark their dependency. Furthermore, deictic pronouns that refer to different objects may be associated to different loci.

b. Strong Version

In sign language, some uses of loci display the behavior of logical variables, both in their bound and in their free uses.

2.2 Loci as variables⁴

As mentioned, Lillo-Martin and Klima 1990 argued that logical variables or 'indices', which are usually covert in spoken languages, can be overtly realized in sign language by positions in signing space or 'loci'. In case a pronoun is used deictically or indexically, its locus usually corresponds to the actual position of its denotation, be it the speaker, the addressee, or some third person (e.g. Meier, 2012). If the pronoun is used anaphorically, the antecedent typically establishes a locus, which is then 'indexed' (= pointed at) by the pronoun. In (7)a (ASL), the sign names *Bush* and *Obama* establish loci by being signed in different positions; in (7)b, the antecedent noun phrases are accompanied with pointing signs that establish the relevant loci. In quantificational examples, indexing disambiguates

⁴ This section borrows from Schlenker et al. 2013 and Schlenker 2014.

among readings, as in (8) (LSF).

- (7) a. IX-1 KNOW BUSH_a IX-1 KNOW OBAMA_b. IX-b SMART BUT IX-a NOT SMART.
 'I know Bush and I know Obama. He [= Obama] is smart but he [= Bush] is not smart.'
 b. IX-1 KNOW PAST PRESIDENT IX-a IX-1 KNOW NOW PRESIDENT IX-b. IX-b SMART BUT IX-a NOT SMART.
 'I know the former President and I know the current President. He [= the current President] is smart but he [=the former President] is not smart.'
 (ASL; 4, 179; Schlenker 2011b)
- (8) DEPUTY_b SENATOR_a CL_b-CL_a IX-b a-TELL-b IX-a / IX-b WIN ELECTION
 'An MP_b told a senator_a that he_a / he_b (= the deputy) would win the election.' (LSF; 4, 233)

A crucial property of sign language anaphora is that loci can be created 'on the fly' in many different positions of signing space, and that there is no clear upper bound on the number of loci that can simultaneously be used, besides limitations of performance (since signers need to be able to distinguish loci from each other, and to keep their position and denotation in memory). Now there are spoken languages in which third person reference can be disambiguated by grammatical means, for instance by way of a distinction between proximate and obviative marking (in Algonquian, see Hockett 1966) or in switch-reference systems (e.g. Finer 1985). But these only make it possible to distinguish among a small number of third person elements – typically two or three (for instance, 'proximate', 'obviative', and sometimes 'double obviative' in obviative systems). By contrast, there seems to be an unlimited number of potential distinctions in sign language, and in this case the signed modality – and specifically the fact that loci can be realized as points in space – seems to play a crucial role in Variable Visibility.

As is well-known, when a pronoun denotes a plurality it may be realized by an 'arc' pointing sign, which thus indexes a semi-circular area; and there are also dual and even trial pronouns when the pronoun denotes two or three individuals. Strikingly, these pronouns can simultaneously index several loci in cases corresponding to the 'split antecedents' discussed in (5). Thus in (9), the dual pronouns *THE-TWO-a,b* is realized as a horizontal 2 that goes back and forth between the two loci; and it can be checked that this is no accident: if the position of the loci is modified, the movement that realizes *THE-TWO* changes accordingly.

- (9) IX-1 HAVE TWO TICKET. IF 1-GIVE JOHN_a BILL_b, THE-TWO-a,b HAPPY.
 'I have two tickets. If I give them to John and Bill, they will be happy.' (ASL; 2, 180)

More complex cases can easily be constructed, with trial or plural pronouns indexing more than two loci.

Because there appears to be an arbitrary number of possible loci, it was suggested that these do not spell out morpho-syntactic features, but rather are the overt realization of formal indices (Lillo-Martin and Klima 1990, Sandler and Lillo-Martin 2006; we revisit this point in Section 2.4). Importantly, there are some striking similarities between sign language pronouns and their spoken counterparts, which makes it desirable to offer a unified theory.⁵

The first similarity is that sign language pronouns obey at least some of the syntactic constraints on binding studied in spoken language syntax. For instance, versions of the following rules have been described for ASL (Lillo-Martin 1991, Sandler and Lillo-Martin 2006, Koulidobrova 2011, Schlenker and Mathur 2013): Condition A, which mandates that a reflexive pronoun such as *himself* corefer with a local antecedent (e.g. *He_i admires himself_i*); Condition B, which prohibits a non-reflexive pronoun from overlapping in reference with a local antecedent (hence the deviance of *#He_i admires him_i*, understood with coreference); and Strong Crossover, which prohibits a quantificational expression from moving to the left of a coindexed pronoun that c-commands its base position (hence the deviance of *#[Which man]_i does he_i think I will hire t_i*, where *t_i* is the base position of the interrogative expression, and *he_i* is coindexed with it).

The second similarity is that, in simple cases at least, the same ambiguity between strict and bound variable readings is found in both modalities (see Lillo-Martin and Sandler 2006; further cases

⁵ While pointing can have a variety of uses in sign language (Sandler and Lillo-Martin 2006, Schlenker 2011a), we will restrict our attention to pronominal uses.

will be discussed below); this is illustrated in (10), which has the same two readings as in English: the third person mentioned can be understood to like his mother, or the speaker's mother.⁶

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

2.3 *Individual, time and world variables*⁷

We turn to the debate concerning the existence of an abstract anaphoric mechanism that applies in similar fashion to the nominal, temporal and modal domains. In a nutshell, we suggest that ASL loci have all three uses, and thus provide an argument in favor of the existence of such an abstract system. In what follows, temporal and modal uses of loci have roughly the same meaning as the English word *then*, which has both temporal and modal uses; the crucial difference is that in ASL the very same word can have nominal, temporal and modal uses (and locative uses as well, as we will see shortly); and that it arguably 'wears its indices on its sleeves' because of the variable-like uses of loci.

The point is by no means trivial. In the tradition of modal and tense logic, it was thought that expressions are only *implicitly* evaluated with respect to times and possible worlds: language was thought to be endowed with variables denoting individuals, but not with variables denoting times or possible worlds. By contrast, several researchers argued after Partee 1973 and Stone 1997 that natural language has time- and world-denoting variables – albeit ones that manifest themselves as affixes (tense, mood) rather than as full-fledged pronominal forms. Here we make the simple suggestion that ASL pronouns in their various forms can have nominal, temporal, modal and also locative uses.

The full argument has three steps:

1. As we discussed above, nominal anaphora in sign language usually involves (i) the establishment of positions in signing space, called 'loci', for antecedents; (ii) pointing towards these loci to express anaphora. Both properties are also found in the temporal and modal domains.
2. This observation doesn't just hold of the singular index; temporal uses of dual, trial and plural pronouns can be found as well. The phenomenon is thus general and it is not plausible to posit that it is an accident that all these morphologically distinct pronouns simultaneously have nominal, temporal and modal uses: indexing *per se* seems to have all these uses.
3. Temporal and modal anaphora in ASL can give rise to patterns of inference that are characteristic of so-called 'donkey' pronouns (i.e. pronouns that depend on existential antecedents without being in their syntactic scope).

Here we just illustrate the first step of the argument, and refer the reader to Schlenker 2013a for further details. Let us start with *temporal indexing*: It can be seen in (11) that the same possibilities are open for temporal anaphora as were displayed for nominal anaphora in (7)-(8): antecedents establish loci; pronominal forms retrieve them by way of pointing.⁸

- (11) a. [YESTERDAY RAIN]_a [DAY-BEFORE-YESTERDAY SNOW]_b. $\overset{\wedge}{\text{IX-b}}$ IX-1 HAPPY. $\overset{\wedge}{\text{IX-a}}$
 IX-1 NOT HAPPY.
 'Yesterday it rained and the day before yesterday it snowed. Then [= the day before yesterday] I was happy but then [= yesterday] I wasn't happy.' (ASL, 4, 181)
- b. [WHILE RAIN]_a TEND WARM. [WHILE SNOW]_b TEND COLD. $\overset{\wedge}{\text{IX-b}}$ IX-1 HAPPY. $\overset{\wedge}{\text{IX-a}}$
 IX-1 NOT HAPPY.

⁶ For simplicity, we gloss *IX-a* as *he*, but without context this pronoun could just as well refer to a female. On a theoretical level, we note that in order to provide a formal treatment of (10), we might need to posit a rule of 'locus erasure' – a point we will return to in Section 2.4.

⁷ This section borrows from Schlenker 2013a, b.

⁸ $\overset{\wedge}$ encodes the appearance of raised eyebrows, a modification of the manual sign. The line on which $\overset{\wedge}$ appears encodes the duration of eyebrow raising, which in these cases took place over the pronoun only. Eyebrow raising is regularly found in topic and focus positions in general, and on *if*-clauses in particular; we include it because this non-manual marker appeared in the original transcriptions cited here.

‘When it rains it is warm but when it snows it is cold. Then [= when it snows] I am happy but then [= when it rains] I am not happy.’ (ASL, 4, 182)

c. *Context*: I went skiing during the holidays.

[SOMETIMES RAIN]_a [SOMETIMES SNOW]_b. $\frac{\wedge}{IX-b}$ IX-1 HAPPY. $\frac{\wedge}{IX-a}$ IX-1 NOT HAPPY.

‘Sometimes it rained and sometimes it snowed. Then [= when it snowed] I was happy but then [= when it rained] I wasn’t happy.’ (ASL, 4, 195)
(Schlenker 2013a)

As can be seen, temporal indexicals, *when*-clauses (which are semantically similar to definite descriptions of times), and existential time quantifiers (*sometimes*) can all give rise to patterns of anaphora involving the same pronoun *IX* as in the nominal case (the existential cases involves a case of ‘dynamic binding’ whose nominal counterpart is discussed at greater length in Schlenker 2011b). Importantly, loci appear in the *usual* signing space, which is in front of the signer. Although the words for *tomorrow* and *yesterday* are signed on the ‘time line’, which is on a sagittal plane (*tomorrow* is signed in the front, *yesterday* towards the back), no pointing occurs towards it, at least in this case (but see Emmorey 2002 for discussion).

Let us turn to *modal indexing*. While there are no clear world indexicals or world proper names, modals such as *can* are standardly analyzed as existential quantifiers over possible worlds; and *if*-clauses have occasionally been treated as definite descriptions of possible worlds (e.g. Bittner 2001, Schlenker 2004a, Bhatt and Pancheva 2006). Both cases can give rise to locus indexing in ASL:

(12) a. TOMORROW [POSSIBLE RAIN]_a [POSSIBLE SNOW]_b. $\frac{\wedge}{IX-b}$ IX-1 HAPPY. $\frac{\wedge}{IX-a}$ IX-1 NOT HAPPY.

‘Tomorrow it might rain and it might snow. Then [= if it snows] I’ll be happy. Then [= if it rains] I won’t be happy.’ (ASL, 4, 183)

b. [IF RAIN TOMORROW]_a WILL WARM. [IF SNOW TOMORROW]_b WILL COLD. $\frac{\wedge}{IX-b}$ IX-1 HAPPY. $\frac{\wedge}{IX-a}$ IX-1 NOT HAPPY.

‘If it rains tomorrow it will be warm, but if it snows tomorrow it will be cold. Then [= if it snows] I’ll be happy. Then [= if it rains] I won’t be happy.’ (ASL, 4, 183)
(Schlenker 2013a)

We conclude that explicit anaphoric reference to times and possible worlds is possible in ASL – though our analysis leaves it entirely open whether times and worlds should be primitive types of entities in our ontology, or should be treated as varieties of a more general category of *situations*.

2.4 Variables or features - or both?⁹

We take examples such as (7)-(9), as well as much of the foregoing discussion, to have established the plausibility of the Weak Hypothesis of Variable Visibility in (6)a: a given locus may be associated both with a pronoun and to its antecedent to mark their dependency; furthermore, deictic pronouns that refer to different objects may be associated with different loci. But this does not prove that loci share in all respects the behavior of logical variables, and thus these facts do not suffice to establish the Strong Hypothesis of Variability in (6)b.

This stronger hypothesis was recently challenged by Kuhn (2015), who argues that loci should be seen as features akin to person and gender features, rather than as variables. On a positive level, Kuhn argues that the disambiguating effect of loci in (7)-(9) can be explained if loci are features that pronouns inherit from their antecedents, just as is the case of gender features in spoken languages (and it is uncontroversial that *these* are not variables). On a negative level, Kuhn argues that treating loci as variables predicts that they should obey two constraints that are in fact refuted by

⁹ This section borrows from Schlenker to appear b.

his ASL data.

First, a variable is constrained to depend on the structurally closest operator it is co-indexed with. Thus the boxed variable x_j in (13)a cannot be semantically dependent on the universal quantifier $\forall x_j$ because of the intervening quantifier $\exists x_j$ – by contrast with (13)b, where the intervening quantifier carries a different index. For the same reason, the boxed variable in both formulas cannot be free and refer (deictically, in linguistic parlance) to a fixed individual.

(13) **Variable capture in First-Order Logic**

$\boxed{x_j}$ can be bound by $\forall x_1$ in b. but not in a.

a. $\forall x_1 \exists x_1 \dots P \boxed{x_1} \dots$

b. $\forall x_1 \exists x_2 \dots P \boxed{x_1} \dots$

By the same token, the two occurrences of the variable x_j in (14) must have the same semantic value – in particular, if no quantifier binding x_j appears at the beginning of the formula, both occurrences will be free and will denote a fixed individual.

(14) **Variable re-use in First-Order Logic**

The two occurrences of x_j must denote the same object.

... Px_1 & Qx_1 ...

Kuhn 2015 argues that both predictions are incorrect: first, expected cases of variable capture fail to arise under the quantificational adverb *only*; second, multiple occurrences of the same locus may refer to different individuals. For brevity, we only discuss the second problem here (see Schlenker, to appear NLLT for the first problem). Kuhn shows that in (15) a single locus is assigned to John and Mary, and another locus is assigned to Bill and Suzy. As a result, the boxed occurrences $\boxed{IX-a}$ and $\boxed{IX-b}$ refer to John and Mary respectively, while the underlined pronouns $\underline{IX-a}$ and $\underline{IX-b}$ refer to Mary and Suzy.

(15) 6 EVERY-DAY, JOHN_a TELL MARY_a $\boxed{IX-a}$ LOVE $\underline{IX-a}$. BILL_b NEVER TELL SUZY_b $\boxed{IX-b}$ LOVE $\underline{IX-b}$.

b.

'Every day, John_i tells Mary_j that he_i loves her_j. Bill_k never tells Suzy_l that he_k loves her_l.' (ASL, Kuhn, to appear)

As Kuhn observes, this example is problematic for the variable-based view. The initial association of the proper name *JOHN* with variable a should force a to refer to John; but then how can a also refer in the same clause, and without any intervening binder, to Mary? By contrast, these data are unproblematic for the feature-based analysis of loci: just like two Noun Phrases may bear the same feminine gender features while denoting different individuals, so it is with loci-as-features. (Locus re-use is certainly limited by pragmatic or other constraints – a more standard strategy is to assign one locus per individual. Kuhn's argument is really an existential proof that in *some* cases loci display a behavior which is incompatible with the view that they spell out variables.)

Two directions have been explored to solve these problems.

- Kuhn treats loci as features which are not interpreted (so that neither the problem of variable capture nor the problem of variable re-use can arise in the first place), but are inherited by a mechanisms of morpho-syntactic agreement; this allows him to provide a variable-free treatment of loci, which is developed in great detail in Kuhn 2015 (as Kuhn observes, the fact that loci are not variables does not show that there are no variables in the relevant Logical Forms, just that loci are not them; giving a variable-free treatment of these data is thus a possibility but certainly not a necessity).
- Schlenker to appear b suggests instead that loci may *both* display the behavior of variables and of features – they are thus 'featural variables'. Specifically, *when they are interpreted* their semantics is given by an assignment function, just like that of standard indices. But they may be disregarded in precisely the environments in which person or gender features can be disregarded. Furthermore, in many environments loci constrain the value of covert variables.

3 Logical Visibility II: Beyond Variables

In this section, we turn to further cases – not related to loci – in which sign language makes overt parts of Logical Forms that are usually covert in spoken language. The first case involves context shifting operators, which were argued in semantic research to be active but covert in spoken language (e.g. Schlenker 2003, Anand and Nevins 2004 and Anand 2006). Following Quer 2005, we propose that context shift can be realized overtly in sign language, by way of an operation called 'Role Shift'. We then move to the aspectual domain, and summarize results which suggest that some primitive categories in the representation of aspectual classes are made visible in sign language but are usually covert in spoken language (the 'Event Visibility Hypothesis' of Wilbur 2003).

3.1 *Role Shift as visible context shift*¹⁰

3.1.1 *Basic data*

Two strands of research on context-dependency have come together in recent years. In the semantics of *spoken languages*, considerable attention has been devoted to the phenomenon of context shift, as evidenced by the behavior of indexicals. While these were traditionally thought to depend rigidly on the context of the actual speech act (Kaplan 1989), it turned out that there are languages and constructions in which this is not so: some attitude operators appear to be able to 'shift the context of evaluation' of some or all indexicals (e.g. Schlenker 1999, 2003, 2011d, Anand and Nevins 2004, Anand 2006). In research on *sign languages*, there has been a long-standing interest in Role Shift, an overt operation (often marked by body shift and/or eyegaze shift) by which the signer signals that he adopts the perspective of another individual (e.g. Padden 1986, Lillo-Martin 1995, Sandler and Lillo-Martin 2006). Role Shift comes in two varieties: it may be used to report an individual's *speech or thought* – henceforth 'Attitude Role Shift'. Or it may be used to report in a particularly vivid way an individual's *actions* – henceforth 'Action Role Shift' (a more traditional term in sign language research is 'Constructed Action').

Quer 2005 connected these two strands of research by proposing that *Attitude Role Shift is overt context shift*. His main motivation was that some or all indexicals that appear in its scope acquire a shifted interpretation. For such an argument to be cogent, however, an alternative analysis must be excluded, one according to which the role-shifted clause is simply quoted – for quoted clauses are arguably mentioned rather than used, which obviates the need to *evaluate* their content relative to a shifted context.¹¹ Quer's argument is in two steps (2005, to appear). First, he shows that some indexicals in Attitude Role Shift in Catalan Sign Language (LSC) have a shifted interpretation, i.e. are intuitively evaluated with respect to the context of the reported speech act. Second, he shows that in some of these cases clausal quotation cannot account for the data because *other* indexicals can be evaluated with respect to the context of the actual speech act. This pattern is illustrated in (16), where the first person pronoun *IX-1* is evaluated with respect to the reported context (and thus refers to Joan), while *HERE* is evaluated with respect to the actual context.

(16)

$\overbrace{\text{IX}_a \text{ MADRID}_m \text{ MOMENT JOAN}_i \text{ THINK}}^t \text{ IX-1}_i \text{ STUDY FINISH HERE}_b$ RS-i
 'When he was in Madrid, Joan thought he would finish his study here (in Barcelona).'

(LSC, Quer 2005, to appear)

As emphasized by Quer (to appear), it is also possible to understand *HERE* as being shifted; but the reading with a 'mixing of perspectives' found in (16) is crucial to argue that there is context shift rather than standard quotation.¹²

¹⁰ This section borrows from Schlenker, to appear a.

¹¹ At this point, we assume that quotation must target an entire clause, and we come back below to the possibility of a theory with 'partial quotation', as argued in Maier, to appear.

¹² In the end, Quer (to appear) suggests on the basis of syntactic evidence that Attitude Role Shift in Catalan Sign Language can in some contexts involve quotation, but that in other contexts it involves *bona fide* indirect

3.1.2 Typology: Mixing of Perspectives vs. Shift Together

In order to account for his data, Quer 2005 makes use of a framework developed in Schlenker 2003, in which attitude operators could bind object-language context-variables, with the result that a given embedded clause could include both shifted and shifted indexicals. In Schlenker 2003, the argument for this possibility of a 'mixing of perspectives' came from preliminary Amharic data, as well as data from Russian. Schematically, Schlenker 2003 posited Logical Forms such as those in (17), where an attitude verb binds a context variable c , while a distinguished variable c^* denoting the actual speech act remains available for all indexicals. As a result, when two indexicals $indexical_1$ and $indexical_2$ appear in the scope of an attitude verb, they may be evaluated with respect to different context variables, as is illustrated in (17).

- (17) Mixing of Perspectives in Schlenker 2003
 ... attitude-verb _{c} ... $indexical_1(c)$... $indexical_2(c^*)$...
 ... attitude-verb _{c} ... $indexical_1(c^*)$... $indexical_2(c)$...
 ... attitude-verb _{c} ... $indexical_1(c)$... $indexical_2(c)$...
 ... attitude-verb _{c} ... $indexical_1(c^*)$... $indexical_2(c^*)$...

While agreeing that some attitude verbs are context shifters, Anand and Nevins 2004 and Anand 2006 argued that Mixing of Perspectives is undesirable. Specifically, they showed that in Zazaki, an Indo-Aryan language of Turkey, *if an indexical embedded under an attitude verb receives a shifted reading, so do all other indexicals that are found in the same clause* – a constraint they labeled 'Shift Together':

- (18) Shift Together (Anand & Nevins 2004)
 If an indexical is shifted in the scope of a modal operator, all other indexicals in the same clause must be shifted as well.

... attitude verb ... δ [... shifted $indexical_1$... shifted $indexical_2$...]

For Anand and Nevins 2004 and Anand 2006, a covert context-shifting operator is optionally present under the verb *say* in Zazaki, but crucially it does not bind context variables, and just manipulates an implicit context parameter. When the operator is absent, the embedded clause behaves like an English clause in standard indirect discourse. When the context-shifting operator is present, it shifts the context of evaluation of *all* indexicals within its scope – hence the fact that we cannot 'mix perspectives' within the embedded clause. This is schematically represented in (19):

- (19) Shift Together in Anand and Nevins 2004, Anand 2006
 ... attitude-verb ... $indexical_1$... $indexical_2$... => neither indexical is shifted
 ... attitude-verb Op ... $indexical_1$... $indexical_2$... => both indexicals are shifted

While the initial debate was framed as a choice between two competing theories of context shift, an alternative possibility is that different context-shifting constructions pattern differently in this connection (e.g. with Zazaki going with 'Shift Together', and Russian and Amharic with 'Mix Perspectives') The sign language data that have been explored thus far argue for this ecumenical view: some languages allow for Mixing Perspectives, while others obey Shift Together. Arguing for Mixing of Perspectives, the data from Catalan Sign Language in (16) mirror the Russian data in that two indexicals that appear in the same clause may be evaluated with respect to different contexts. Similarly, German Sign Language allows for Mixing of Perspectives, with a shifted indexical co-existing with an unshifted one in the same clause (Herrmann and Steinbach 2012, Hübl and Steinbach 2012, Quer to appear). Arguing for Shift Together, Schlenker to appear a, 2015 shows that American and French Sign Language replicate the Zazaki pattern: under Role Shift, all indexicals are obligatorily shifted. A case in point is displayed in (20), where the first person pronoun *IX-I* and the adverb *HERE* are both signed under Role Shift, *and both are obligatorily interpreted with a shifted meaning*.

discourse with some shifted indexicals. For present purposes, we are only concerned with cases that can be shown not to involve standard quotation.

(20) *Context*: the speaker is in NYC

RS_a_____

7 IN LA WHO IX-a JOHN_a SAY IX-1 WILL MEET HERE WHO
 Informant JL (on a video on which he signed the sentence [ASL, 6, 316]): 7, *HERE* = LA
 Informant 2 (on a video on which he signed the sentence with *IX-b* replacing *IN* [ASL, 6, 293]): 7, *HERE*
 = preferably LA [6, 294-295].¹³
 'In LA, who did John say he would meet there [in LA]?' (ASL; 6, 293; 6, 316)

In sum, given the available data, it seems that the typology of context-shifting operations in sign language mirrors that found in spoken language: some languages/constructions obey Shift Together, whereas others allow for Mixing of Perspectives. The difference between the two modalities is, of course, that in sign language Role Shift is overtly realized.

3.1.3 Further complexities

While this basic picture of Role Shift as overt context shift is appealingly simple, it abstracts away from important complexities.

First, Role Shift doesn't just occur in attitude reports (= 'Attitude Role Shift'), but it can also be used in action reports, especially to display in a particularly vivid fashion some parts of the action through iconic means (= 'Action Role Shift'). Attitude Role Shift can target an entire clause, as well as any indexicals within it (optionally or obligatorily depending on the language). By contrast, Action Role Shift is more constrained; depending on the author, in ASL it is believed to just target verbs (Davidson, to appear), or possibly larger constituents, but if so only ones that contain no indexicals or first person agreement markers (Schlenker, to appear). Be that as it may, any context-shifting analysis of Role Shift must be extended in non-trivial ways to account for Action Role Shift (for a proposal, see Schlenker, to appear, 2015).

Second, it is not clear that ASL and LSF Role Shift cannot be analyzed in terms of quotation. Indexicals won't help, since the data mentioned above seem to argue that all indexicals are evaluated with respect to the same perspectival point, which is also what one would expect in standard quotation. In spoken languages, a standard strategy to disprove a quotational analysis of a clause under *say* is to establish a grammatical dependency between the embedded clause and the matrix clause – with the assumption that 'grammatical dependencies do not cross quotation marks' (presumably because quoted material is mentioned, not used). Thus quotation is impossible in (21) and (22) because of a grammatical dependency between the quoted clause and the matrix clause, involving a moved interrogative expression ('*wh*-extraction') in (21) and a dependency between a Negative Polarity Item (NPI) and its negative licenser in (22).

(21) *What did John say: 'I understand _'?

(22) *John didn't say: 'I understand any chemistry'.

Now in the data reported in Schlenker to appear, 2015, ASL Role Shift allows for *wh*-extraction out of role-shifted clauses, but so does another construction that is plausibly quotational (because it involves a sign for quotation at the beginning of a non-role-shifted clause). For this reason, the evidence that the role-shifted clause doesn't involve quotation is weak – maybe quotation just does allow for *wh*-extraction in our ASL data, for unknown reasons. Furthermore, another standard test of indirect discourse fails; it involves the licensing of a Negative Polarity Item, *ANY*, by a negative element found in the matrix clause. When the embedded clause is in standard indirect discourse, 'any' can be licensed by a matrix negation both in the English sentence in (23)a, and in an analogous sentence in ASL. When the clause is quoted, as in the English example in (23)b, 'any' cannot be licensed from by a negation in the matrix clause. Crucially, an analogous sentence with Role Shift in ASL displays a pattern similar to (23)b, which suggests that Attitude Role Shift does have a quotational component.

(23) a. John never said he showed Mary any kindness.

b. #John never said: 'I showed Mary any kindness'.

¹³ Informant 2 gave *HERE* = LA with a rating of 5/7; *HERE* = NYC with a rating of 2.5/7.

In addition, in LSF *wh*-extraction out of role-shifted clause fails, just as it fails out of a quoted sentence in the English data in (21)a; this too suggests that Attitude Role Shift has a quotational component. Thus in ASL and LSF, the argument that Role Shift involves context shift rather than quotation depends rather heavily on the existence of Action Role Shift, which couldn't be analyzed in quotational terms (because it is used to report actions rather than thought- or speech-acts). By contrast, in Catalan and German Sign Language the argument against a quotational analysis is fairly strong due to the ability of role-shifted clauses to mix perspectives.


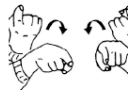


Finally, Schlenker to appear, 2015, following much of the literature, argues that Role Shift comes with a requirement that some elements be interpreted iconically (and suggests that the quotational effects discussed in (ii) above are a special case of iconicity). We come back to this point in Section 5.3.

3.2 Aspect: visible event decomposition

Cases of Visibility are not limited to the domains of reference (as in Section 2) and context-dependency (as in Section 3.1). Wilbur 2003 argued that sign language makes visible the logical structure of verbs – and coined the term 'Event Visibility' to label her main hypothesis. To introduce it, a bit of background is needed. Semanticists traditionally classify event descriptions as *telic* if they apply to events that have a natural endpoint determined by that description, and they call them *atelic* otherwise. *John spotted Mary* and *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* modifies telic VPs while *for α time* modifies atelic VPs (e.g. *John reflected for a second* vs. *John understood in a second*). Now Wilbur's hypothesis is that *the distinction between telic and atelic predicates is often realized overtly in ASL* by: (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." (Wilbur and Malaia 2008).

On a theoretical level, Wilbur 2008 posits 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 (24). Remarkably, then, Wilbur's findings suggest that sign language can articulate overtly some grammatically relevant aspects of event decomposition. In Section 5.2, we will revisit Wilbur's Event Visibility Hypothesis, asking whether it might not follow from a more general property of structural event iconicity.

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

			
a. change of aperture handshape change SEND	b. orientation change HAPPEN	c. setting change proximal / distal POSTPONE	d. change of location with contact HIT

4 Iconicity I: Iconic Variables

4.1 Introduction

In the cases we have discussed up to this point, sign language makes some aspects of the Logical Forms of sentences more transparent than they are in spoken language. In this section, we turn to cases in which sign language has greater expressive power than spoken languages because it makes greater use of iconic resources. There are certainly iconic phenomena in spoken language, for instance in the sentence *The talk was loooooong* (see Okrent 2002): the excessive duration of the vowel gives a vivid idea of the real or experienced duration of the talk (as one might expect, saying that *the talk was shooooooooort* would yield a rather odd effect). But sign language make far more systematic use of iconicity, presumably because their depictive resources are much greater than those of spoken languages. While one might initially seek to separate neatly between a 'grammatical/logical' and an

'iconic' component in sign language, we will see that the two are closely intertwined: iconic phenomena are found *at the core of the logical engine of sign language*. In particular, we will revisit in detail the case of sign language loci, and we will argue that in some cases they are *simultaneously* logical variables and simplified pictures of what they denote.

4.2 *Embedded Loci: Plurals*¹⁴

The simplest instance of an iconic constraint concerns plural ASL and LSF loci, which are usually realized as (semi-)circular areas. These can be embedded within each other, and we hypothesize that this gives rise to cases of *structural iconicity*, whereby topological relations of inclusion and relative complementation in signing space are mapped into mereological analogues in the space of loci denotations.

Our initial focus is on the anaphoric possibilities made available in English by the sentence *Most students came to class*. Recent research has argued that such a sentence makes available two discourse referents for further anaphoric uptake: one corresponding to the maximal set of students, as illustrated in (25)b ('maximal set anaphora'); and one for the entire set of students, as illustrated in (25)c ('restrictor set anaphora').

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

Crucially, however, no discourse referent is made available for the set of students that didn't come to class ('complement set anaphora', as this is the complement of the maximal set within the restrictor set); this is what explains the deviance of (25)a. This anaphoric pattern, whereby *they* in (25)a is read as referring to the students that did *not* come, is at best limited when the initial quantifier is *few*, and nearly impossible with *most*. Nouwen 2003 argues that when available, complement set anaphora involves *inferred* discourse referents: no grammatical mechanism makes available a discourse referent denoting the complement set – here: the set of students who *didn't* come.

On the basis of ASL and LSF data, Schlenker et al. 2013 made two main observations.

Observation I. When a default plural locus is used in ASL, data similar to (25) can be replicated – e.g. complement set anaphora with *most* is quite degraded. This is illustrated in (26), with average judgments (per trial) on a 7-point scale, with a total of 5 trials and 3 informants.

- | | |
|--|-----------------------------------|
| (26) POSS-1 STUDENT FEW a-CAME CLASS. | POSS-1 STUDENT MOST a-CAME CLASS. |
| 3.6 IX-arc-a a-STAY HOME | 2.8 IX-arc-a a-STAY HOME |
| <i>Intended</i> : 'Few/Most of my students came to class. They [the students that didn't come] stayed home.' | |

Observation II. When embedded loci are used, the effect is circumvented: one large locus (written as *ab*, but signed as a single circular locus) denotes the set of all students; a sub-locus (= *a*) denotes the set of students who came; and a complement locus (= *b*) thereby becomes available, denoting the set of students who didn't come, as illustrated in (27).

¹⁴ This section borrows from Schlenker 2013b and Schlenker et al. 2013.

(27) POSS-1 STUDENT IX-arc-ab MOST IX-arc-a a-CAME CLASS.

'Most of my students came to class.'

a. 7 IX-arc-b b-STAY HOME

'They stayed home.'

b. 7 IX-arc-a a-ASK-1 GOOD QUESTION

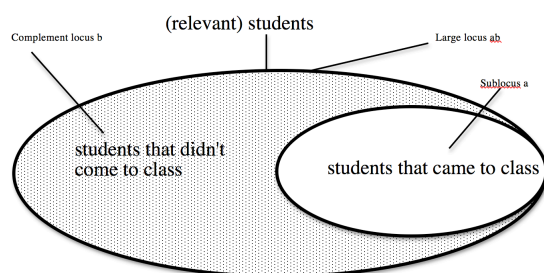
'They asked me good questions.'

c. 7 IX-arc-ab SERIOUS CLASS.

'They are a serious class.'

(ASL; 8, 196)

(28)



Schlenker et al. 2013 account for Observation I and Observation II by assuming that Nouwen is right that in English, *as well as ASL and LSF*, the grammar *fails* to make available a discourse referent for the complement set, i.e. the set of students who didn't come; but that the mapping between plural loci and mereological sums preserves relations of inclusion and complementation, which in (27)a makes available the locus *b*.

The main assumptions are that (a) the set of loci is closed with respect to relative complementation: if *a* is a sublocus of *b*, then $(b-a)$ is a locus as well; and (b) assignment functions are constrained to respect inclusion and relative complementation: if *a* is a sublocus of *b*, the denotation of *a* is a subpart of the denotation of *b*, and $(b-a)$ denotes the expected complement set. These conditions are stated more completely in (29):

(29) Conditions of loci

Let LOC be the set of plural loci that appear in signing space, and let *s* an admissible assignment function that assigns values to loci. We make the assumptions in (a)-(b), where we view plural loci as sets of geometric points, and loci denotations as sets of individuals.

a. Conditions on LOC: for all *a*, *b* ∈ LOC, (i) $a \subseteq b$ or $b \subseteq a$ or $a \cap b = \emptyset$; (ii) if $a \subset b$, $(b-a) \in \text{LOC}$

b. Conditions on *s*: for all *a*, *b* ∈ LOC, (i) $a \subset b$ iff $s(a) \subset s(b)$; (ii) if $a \subset b$, $s(b-a) = s(b)-s(a)$

Since it is unusual to take a symbol to be *part of* another symbol, it should be emphasized that the notation $a \subseteq b$ is to be taken literally, with the locus (and thus symbol) *a* being a subpart of the locus *b* (this can for instance be further analyzed as: the set of points *a* in signing space is a subset of the set of points *b* in signing space). The condition $a \subset b$ iff $s(a) \subset s(b)$ should thus be read as: the locus *a* is a proper subpart of the locus *b* just in case the denotation of *a* is a proper subpart of the denotation of *b*.¹⁵

Let us now see how the conditions on loci in (29) derive our sign language data. In (27)a, where embedded loci are used, we can make the following reasoning:

- Since *a* is a proper sublocus of a large locus *ab*, we can infer by (29)a(ii) that $(ab-a)$ (i.e. *b*) is a locus as well;
- by (29)b(i), we can infer that $s(a) \subset s(ab)$;
- and by (29)b(ii), we can infer that $s(b) = s(ab)-s(a)$.

In this way, complement set anaphora becomes available because ASL can rely on an iconic property which is inapplicable in English. But this does not mean that there is a proper grammatical

¹⁵ If we wanted to state an analogous condition in a more standard system in which the variables are letters rather than loci, we could for instance require that the denotation $s(v)$ of a variable called *v* should be a subpart of the denotation $s(w)$ of a variable called *w* because graphically *v* can be viewed as a subpart of *w*. Because inclusion of one symbol in another is so uncommon with letters, this would of course be a very odd condition to have; but it is a much more natural condition when the variables are loci rather than letters.

(non-iconic) difference between these two languages: as we saw, with default loci the English data are replicated, which suggests that Nouwen's assumption that the grammar does not make available a discourse referent for the complement set applies to ASL just as it does to English. Rather, it is because of iconic conditions on plural loci, not grammar in a narrow sense, that a difference does arise in the case of embedded loci.¹⁶

4.3 High and low loci

In the preceding section, relations of inclusion and relative complementation among loci were shown to be preserved by the interpretation function. We now turn to cases in which the vertical position of loci is meaningful and argues for an iconic analysis as well.

While loci are usually established in a single horizontal plane, in some contexts they may be signed high or low. Our point of departure lies in the inferences that are obtained with high and low loci in such cases. An ASL example without quantifiers, from Schlenker et al. 2013, is given in (30). In brief, high loci are used to refer to a tall, important or powerful individuals, whereas low loci are used to refer to short individuals (similar data were described for LSF in Schlenker et al. 2013). Loci of normal height are often unmarked and thus do not trigger any relevant inference.

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

As can be seen, the relevant inferences are preserved under negation, which provides initial motivation for treating them as presuppositional in nature, a proposal that has been made about the semantic specifications of pronouns, such as gender, in spoken language (Cooper 1983).

Importantly, high and low loci can appear under binding, with results that are expected from the standpoint of a presuppositional analysis. From this perspective, (31)a is acceptable because the bound variable her_i ranges over female individuals; and (31)b is acceptable to the extent that one assumes that the relevant set of directors only comprises females.

- (31) a. [None of these women]_i thinks that I like her_i.
b. [None of these directors]_i thinks that I like her_i.

Similar conditions on bound high and low loci apply in (32) (here too, similar examples were described for LSF):

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

As argued in Schlenker et al. 2013 and Schlenker 2014, it will not do to treat height specifications of loci as contributing information about an *intrinsic* property of their denotations, for instance in terms of being tall or short. This is because in some of their uses they provide information about the spatial position of the upper part of a person's body. This was shown by paradigms in

¹⁶ One additional remark should be made in connection with our discussion of the debate between the analyses of loci as variables vs. as features (in Section 2.4). It is notable that the locus b in (27)a is not inherited by way of agreement, since it is not introduced by anything. From the present perspective, the existence of this locus is inferred by a closure condition on the set of loci, and its interpretation is inferred by an iconic rule. But the latter makes crucial reference to the fact that loci have denotations. It is not trivial to see how this result could be replicated in a variable-free analysis in which loci don't have a denotation to begin with. Presumably, the complement set locus would have to be treated as being deictic (which is the one case in which the variable-free analysis has an analogue of variable denotations). This might force a view in which complement set loci are handled in a diagrammatic-like fashion, with co-speech gestures incorporated in signs – a point to which we return in Section 6.

which individuals appeared in several positions in standing or hanging position, upside down. In the latter case, pointing corresponding a tall individual became low, in accordance with the general claims of Liddell 2003: the locus behaved like a structured representation of its denotation, with a head and a foot – hence when the individual was introduced as hanging upside down, the locus appeared in upside down position as well, and pointing towards the head of the locus implied pointing *downwards*.

A formal analysis was developed for simple cases in Schlenker et al. 2013, based on the idea that height differences among loci should be proportional to the height differences among their denotations. The analysis took as its starting point the presuppositional theory of gender features developed in Cooper 1983, given in (33): a pronoun she_i evaluated under an assignment function s refers to $s(i)$, *unless* the presupposition triggered by the feminine features of she – that its denotation is female – is not satisfied.

(33) *Gender specifications*

Let c be a context of speech, s an assignment function and w a world (with c_w = the world of c).
 $[[she_i]]^{c,s,w} = \#$ iff $s(i) = \#$ or **$s(i)$ is not female** in c_w . If $[[she_i]]^{c,s,w} \neq \#$, $[[she_i]]^{c,s,w} = s(i)$.

Schlenker et al. 2013 extend this presuppositional analysis to high and low loci, but with an iconic condition in the presuppositional part, boldfaced in (34).

(34) *Height specifications*

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

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

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

As was the case in our analysis of plural loci in Section 4.2, loci have the semantics of variables, but their realization – specifically: their height in signing space – affects their meaning. In words, the condition in (34) considers a pronoun $IX-i$ indexing a locus i , and compares its height to that of a neutral locus n . It says that the height difference between the denotations $s(i)$ and $s(n)$ should be proportional to the height difference between the loci i and n , with a multiplicative parameter $\alpha_c > 0$; in particular, this condition imposes that orderings be preserved.¹⁷

While one might be tempted to posit a small number of heights along the vertical plane, Schlenker 2014 argues that a full-fledged semantics is needed: in paradigms involving astronauts training in a variety of positions and thus rotated in 4 positions, the loci seemed to track the position of the astronauts in a non-discrete fashion.

Finally, one could ask how integrated to the grammatical system height specifications are. We mentioned above that their semantics in Schlenker et al. 2013 was modeled after that of gender features, albeit with an iconic twist. Schlenker 2014 cautiously suggests that height specifications resemble gender features in another respect: they can somehow be disregarded under ellipsis. An example is given in (35)a, where the elided VP has a bound reading, unlike its overt counterpart in (35)b. On the (standard) assumption that VP ellipsis is effected by copying part the antecedent VP, this suggests that the feminine features of that antecedent can be ignored by ellipsis resolution, as represented with a barred pronoun in (35)b.

¹⁷ Since bodies are not points, further hypotheses were needed to determine which parts of locus denotations mattered in the relevant ordering; an initial hypothesis is that when it comes to people, their upper bodies matter:

(i) Partial hypothesis (slightly modified from Schlenker et al. 2013)

When evaluating the height of loci denotations,

a. the position of c_a is assessed by considering the real or imagined position of the upper part of the body of c_a in c_w ;

b. if $s(i)$ is a person, the position of $s(i)$ corresponds to the position of the upper part of the body of $s(i)$ in c_w .

- (35) In my study group,
 a. Mary did her homework, and John did too.
 => available bound variable reading in the second clause
 b. Mary $\lambda_i t_i$ did her_i homework, and John $\lambda_i t_i$ did [~~do her_i~~ homework] too
 c. Mary did her homework, and John did her homework too.
 => no bound variable reading in the second clause

Schlenker 2014 discusses analogous ASL and LSF examples in which height specifications can be ignored in a similar fashion, but the interpretation of these results requires some care. The main question is whether the ability of an element to be disregarded under ellipsis is *only* true of featural elements, or targets a broader class. Schlenker 2014 didn't give a final answer, and we will see below that co-speech gestures in spoken language, which certainly don't count as 'features', can almost certainly be disregarded in this way.

In conclusion, the various pronouns we have just discussed display a grammatical behavior as bound variables while also contributing iconic information about the position of their denotations. In this domain, sign language semantics has a more expressive semantics than spoken language, which is devoid of rich iconic mechanisms of pronominal reference.

5 Iconicity II: Beyond Variables

As mentioned at the outset, iconic conditions are pervasive in sign language, and are definitely not limited to the semantics of variable-like constructions. With no claim to exhaustivity, we discuss below three cases that have been important in the recent literature and are also of foundational interest.

5.1 Classifier constructions

Some 'classifier constructions' were shown in Emmorey and Herzig 2003 to give rise to gradient iconicity effects in native signers of ASL. Specifically, they designed an experiment in which the position of a dot in relation to a bar could be indicated in a gradient fashion by way of a small object classifier (F-handshape) positioned relative to a flat object construction (B-handshape); and they showed that subjects could indeed recover gradient information from the relative position of the signs.

While the formal analysis of such constructions is still under study, it is clear that one will need rules that make reference to iconic conditions. This can be achieved by directly incorporating iconic conditions in semantic rules, as we did for high and low loci above, and as was sketched for the case of classifiers in Schlenker 2011a. Alternatively, one could take these expressions to have a demonstrative component that makes reference to *the gesture performed while realizing the sign itself*, a proposal made in Zucchi 2011 and in Davidson to appear. An example from Zucchi 2011 is given in (36)a and paraphrased in (36)b.

- (36) a. CAR CL-vehicle-DRIVE-BY
 b. 'A car drove by *like this*', where the demonstration is produced by the movement of the classifier predicate in signing space (after Zucchi 2011)

Here *CL-vehicle-DRIVE-BY* is a classifier predicate used to describe the movement of vehicles. The movement of the classifier predicate in signing space tracks in a gradient fashion the movement performed by the relevant car in real space. As informally shown in (36)b, Zucchi takes the classifier predicate to have a normal meaning (specifying that a vehicle moved) as well as a demonstrative component, which is self-referential; in effect, the classifier predicate ends up meaning something like: 'moved as demonstrated by this very sign'. We come back in Section 6 to the possibility that sign language semantics should quite generally make reference to a gestural component.

5.2 Event visibility or event iconicity?

In our discussion of loci, we saw that these lead a dual life: on the one hand, they have – in some cases at least – the behavior of logical variables; on the other hand, they can also function as simplified pictures of what they denote. As it turns out, a similar conclusion might hold of Wilbur's cases of 'Event Visibility' discussed in Section 3.2: sign language phonology makes it possible to

make visible key parts of the representation of events, *but also to arrange them in iconic ways* (see Kuhn 2015 and Kuhn and Aristodemo 2015 for a detailed discussion involving pluractional verbs, i.e. verbs that make reference to plurality of events). A case in point can be seen in (37), which includes 5 different realizations of the sign for *UNDERSTAND*, three stages of which appear in (38) (all the signs involve lowered eyebrows, represented as a ~ above the sign).

(37) YESTERDAY MATHEMATICS PROOF IX-1 UNDERSTAND.

'Yesterday I understood a mathematical proof.' (LSF 49, 27; 4 trials)

Realization of *UNDERSTAND*:

a. 7 normal

b. 7 \sim \sim
slow fast

=> difficult beginning, but in the end I understood

c. 5.5 \sim \sim
fast slow

=> easy beginning, then more difficult, but I understood

(38) **Initial, intermedial and final stage in the realization of *UNDERSTAND* in (37)b**



As illustrated in (38), *UNDERSTAND* is realized by the progressive closing of a tripod formed by the thumb, index and middle finger of the dominant hand (right hand for a right-handed signer). But different meanings are obtained depending on how the closure is effected. With a single change of speed, as in (37)b-c, the result is acceptable and semantically interpretable: if the sign starts slow and ends fast, one infers that the corresponding process had a similar time course; and conversely when the sign starts fast and ends slow (with two changes of speed, the results are deviant).¹⁸ Schlenker, to appear c shows that similar iconic modulations can be obtained with the LSF atelic verb *REFLECT*.

In the long term, two theoretical possibilities should be considered. One that is that event iconicity should work *alongside* Wilbur's Event Visibility Hypothesis, which should thus retain a special status, with discrete but covert distinctions of spoken language made visible in sign language. An alternative is that Wilbur's data are a *special case* of event iconicity; on this view, telic and atelic verbs alike have the ability to map in a gradient fashion the development of an event, and it is for this more general reason that telic verbs mark endstates in a designated fashion (we come back to this point in Section 6).

5.3 Iconic effects in Role Shift

We now turn once again to the issue Role Shift. In Section 3.1, we suggested that Role Shift can be analyzed as a visible instance of context shift. But we will now see that this analysis is incomplete, and must be supplemented with a principle that makes reference to iconicity. In brief, we suggest that Role Shift is a visible instance of context shift, but one which comes with a requirement that the expressions under Role Shift should be interpreted *maximally iconically*. The argument is in two steps. First, we suggest that Role Shift under attitude reports (= Attitude Role Shift) has a strong quotational component, at least in ASL and LSF. Second, we suggest that Role Shift in action reports (= Action Role Shift) has an iconic component.

¹⁸ In this example, the facial expressions remain constant, with lowered eyebrows throughout the realization of the sign, encoded as ~ on the relevant parts of the sign; more natural examples are obtained when the facial expressions are also modulated, and in such cases more changes of speed can be produced and interpreted – but in these more complex examples it is difficult to tease apart the relative role of the manual vs. non-manual modulation in the semantic effects obtained.

As was mentioned in Section 3.1.3, Schlenker to appear, 2015 notes that even in his ASL data, which allow for *wh*-extraction out of role-shifted clauses under attitude verbs, some tests suggest that these have a quotational component. First, an ASL version of the test discussed in (22), with *ANY* (which in some environments has a clear NPI behavior) suggests that it *cannot* appear under Role Shift without being quoted. Second, another test of indirect discourse based on licensing of ellipsis from outside the attitude report similarly fails. For simplicity, we will just lay out its logic on an English example:

- (39) *Context*: The speaker has recently had a political conversation with John. The addressee and John have never met each other.
- a. You love Obama. John told me that he doesn't.
 - b. (#) You love Obama. John told me: 'I don't.'

In (39)a, the elided VP in the second sentence is licensed by the first sentence, and one definitely does not infer that John's words involved an elided VP. The facts are different in (39)b, which clearly attributes to John the use of the very words *I don't* – hence a possible deviance if the context does not explain why John might have used a construction with ellipsis. While standard indirect discourse in ASL patterns like English with respect to the licensing of ellipsis, the facts are different under Role Shift; there an elided VP is interpreted exactly as if it were quoted.

Finally, some non-linguistic properties of role-shifted clauses must usually be attributed to the agent rather than to the signer, and in this respect Role Shift differs from standard indirect discourse and resembles quotation. Schlenker 2015 established this generalization (which is unsurprising for the traditional sign language literature) by asking his consultants to sign sentences in which the signer displays a happy face, something encoded with a happy face :-), followed by ----- over the expressions that were accompanied by this facial expression. Importantly, this happy face is not a grammaticalized non-manual expression. The consultant was asked to start the happy face at the beginning of the report, to maximize the chance that it would be seen to reflect the signer's (rather than the agent's) happiness. In standard indirect discourse, this is indeed what was found. In Attitude Role Shift, by contrast, the judgments in (40) suggest that it is more difficult to attribute the happy face to the signer only, *despite* the fact that it starts outside the role-shifted clause, and that the context is heavily biased to suggest that the agent of the reported attitude was anything but happy.

- (40) SEE THAT ARROGANT FRENCH SWIMMER IX-a? YESTERDAY IX-a ANGRY.
- a. RS_a_____
6.2. IX-a SAY IX-1 WILL LEAVE.
He said: 'I will leave.!'
 - b. :-)-----
- RS_a_____
- 4.6 IX-a SAY IX-1 WILL LEAVE.
Rating under the meaning: the SPEAKER is displaying his happiness that the French swimmer said he was leaving
He said: 'I will leave.!'
(ASL, 14, 233)

At this point, one may conclude that despite the possibilities of *wh*-extraction out of Role Shift discussed in connection to (20), role-shifted clauses under attitude verbs just involve quotation (possibly mixed quotation, hence the possibility of *wh*-extraction; see Maier 2014, to appear). But as mentioned above, Schlenker to appear, 2015 argues (i) that Role Shift can also be applied, with specific grammatical constraints, to reports of actions rather than of attitudes ('Action Role Shift' vs. 'Attitude Role Shift'); (ii) that in such cases a quotational analysis would be inadequate, as the situations reported need not have involved thought or speech; and (iii) that nonetheless, Role Shift applied to action reports comes with a requirement that whatever can be interpreted iconically should be so interpreted. The suggestion is thus that Action Role Shift provides an argument against a quotational analysis, and provides independent evidence for positing a rule of context shift, *combined* with a mechanism of 'iconicity maximization' under Role Shift.

To get a sense for the main facts, consider (41): in this action report under Role Shift, the signer's happy face is naturally taken to reflect the agent's attitude. By contrast, in a control sentence

without Role Shift, it can be taken to reflect the speaker's attitude. Thus *under Action Role Shift, a happy face on the agent's part is normally attributed to the agent* (see Schlenker 2015 for refinements, and for LSF data).

- (41) SEE THAT ARROGANT FRENCH SWIMMER IX-a? YESTERDAY IX-a ANGRY.
- a. RS_a
 7 IX-a 1-WALK-WITH-ENERGY(CL-ONE).
 He left with energy.'
- b. :-)-----
 RS_a
 3.6 IX-a 1-WALK-WITH-ENERGY(CL-ONE).
Rating under the meaning: the SPEAKER is displaying his happiness that the French swimmer was leaving
 He left with energy.'
 (ASL, 14, 233)

Schlenker 2015 took these and related to suggest that iconic material is preferably understood to reflect properties of the reported action under Role Shift.

The analysis proposed in Schlenker 2015 posits that Attitude and Action Role Shift alike should be analyzed as context shift, but with an important addition: expressions that appear under Role Shift should be interpreted *maximally iconically*, i.e. so as to maximize the possibilities of projection between the signs used and the situations they make reference to. Following a long tradition (e.g. Clark and Gerrig 1990), Schlenker 2015 argues that quotation can be seen as a special and particular stringent case of iconicity, and that the condition of Maximal Iconicity can thus capture properties of both Attitude and Action Role Shift.¹⁹

If this analysis is on the right track, one key question is why context shift in sign language should come with a condition of iconicity maximization. One possibility is that such a condition exists in spoken language context as well but hasn't been described yet (however Anand 2006 argues that in Zazaki context shift need not be quotational). Another possibility is that iconicity maximization under context shift is a specific property of sign language. Be that as it may, it seems clear that if Role Shift is to be analyzed as context shift, special provisions must be made for iconic effects.

6 Theoretical Directions

If the foregoing is on the right track, it should be clear that sign language has, along some dimensions, strictly richer expressive resources than spoken language does, in particular due to its ability to incorporate iconic conditions at the very core of the logical engine of language. There are two conclusions one might draw from this observation.

¹⁹ More specifically, putting together the non-iconic (context-shifting) part of the analysis developed in Section 3.1 and these iconic conditions, the theory has the following structure:

- (i) Role Shift has a broadly uniform semantics across attitude and action cases: it shifts the context of evaluation of the role-shifted clause.
 - (ii) In ASL and LSF, role-shifted indexicals are obligatorily shifted. Things are different in Catalan and German Sign Language, where mixing of perspectives is possible.
 - (iii) In ASL and LSF, all indexicals can appear under Attitude Role Shift, but only some indexicals can appear under Action Role Shift (this was captured formally by assuming that Action Role Shift gives rise to different kinds of shifted contexts than Attitude Role Shift).
 - (iv) Under Attitude and Action Role Shift alike, signs are interpreted maximally iconically in the scope of the context shift operator.
- In an attitude reports, every sign can be interpreted as being similar to an element of the situation which is reported – namely by way of quotation.
 - In action reports, this is not so (as these need not involve speech or thought act), but all potentially iconic features of signs are interpreted iconically and thus taken to represent features of the reported situations.
- In both cases, expressions that appear under Role Shift are both used (as these are instances of indirect discourse) and mentioned because they have a strong iconic (and sometimes quotational) component.

(i) One could conclude that spoken language is, along some dimensions at least, a kind of 'simplified' version of what sign language can offer. Specifically, as a first approximation one could view spoken language semantics as a semantics for sign language from which most iconic elements have been removed, and indices have been made covert. From this perspective, if one wishes to understand the full scope of Universal Semantics, one might be better inspired to start from sign than from spoken language: the latter could be understood from the former once the iconic component is disregarded, but the opposite path might prove difficult.

(ii) An alternative possibility is that our comparison between sign and spoken language was flawed in the first place; in Goldin-Meadow and Brentari's words (to appear), "sign should not be compared to speech – it should be compared to speech-plus-gesture". What might be special about sign language is that signs and co-speech gestures are realized in the same modality. By contrast, they are realized in different modalities in spoken language, which has led many researchers to concentrate solely on the spoken component. This leaves open the possibility that *when co-speech gestures are reintegrated to the study of spoken language*, sign and spoken languages end up displaying roughly the same expressive possibilities.

Let us give a few illustrations of how the debate could be developed.

1. Plural pronouns

We noted in Section 4.2 that plural pronouns in ASL and LSF can give rise to instances of 'structural iconicity' when a plural locus is embedded within another plural locus. One could view this as a case in which sign language has a mechanism which is entirely missing in spoken language. But the realization of sign language loci makes it possible to use them simultaneously as diagrams. From this perspective, the right point of comparison for our examples with 'complement set anaphora' in Section 4.2 are spoken language examples *accompanied* with explicit diagrams with the same shape as embedded loci in (28), and to which one can point *as one utters the relevant pronouns*. For this reason, a comparison between spoken and sign language should start with situations in which speakers can use gestures to define diagrams. This comparison has not been effected yet.

2. High loci




As summarized in Section 4.3, it was argued in Schlenker et al. 2013 and Schlenker 2014 that high loci have an iconic semantics, and in addition that their height specifications behave like 'features' in some environments, notably under ellipsis: just like gender features, height specifications can apparently be disregarded by whatever mechanism interprets ellipsis resolution. We fell short of arguing that this shows that height specifications *are* features, for good reason. First, Schlenker 2014 shows that it is hard to find cases in which height specifications really behave differently from other elements that contribute presuppositions on the value of a referring expression (some paradigms displaying this difference were found in ASL but not in LSF). Second, when co-speech gestures are taken into account in spoken language, it appears that they too can be disregarded under ellipsis (Schlenker, to appear)²⁰. Thus in (42)a the co-speech gesture (for a tall person) that accompanies the Verb Phrase can be disregarded under ellipsis; whereas in the control in (42)b, deviance is obtained if the gesture that accompanies the antecedent Verb Phrase is explicitly repeated in the second clause (whereas a gesture for a short person is acceptable).

(42) I had two guys standing in front of me, one of them very short and the other one very tall.



a. The tall one allowed me to remove  [his glasses], but the short one didn't.

²⁰ More sophisticated work on this issue is being conducted by J. Gajewski at University of Connecticut.

- b. The tall one allowed me to remove  [his glasses], but the short one didn't allow me to remove  [his glasses]/ok  [his glasses]

These observations suggest that one could account for height specifications of loci in at least two ways. One could analyze them by analogy with features in spoken language, and argue that they share their behavior under ellipsis. Alternatively, one could seek to analyze height specifications as co-speech gestures that happen to be merged with signs, and to explain their behavior under ellipsis by the fact that other co-speech gestures can somehow be transparent to ellipsis resolution.

3. Role Shift²¹

We suggested above that Role Shift is 'visible context shift', with an important addition: Attitude and Action Role Shift alike have an iconic component ('Maximize Iconicity!') which has not been described for spoken language context shift. But one could challenge this analysis by taking Role Shift to be in effect indicative of the fact that *the role-shifted signs have a demonstrative, gestural component*, and thus are in effect both signs and co-speech gestures. This is the theoretical direction explored by Davidson, to appear. Following Lillo-Martin 1995, 2012, Davidson takes Role Shift to behave in some respects like the expression 'be like' in English, which has both quotational and co-speech uses, as illustrated in (43).

- (43) a. John was like "I'm happy".
 b. Bob was eating like [gobbling gesture]. (Davidson, to appear)

More specifically, Davidson suggests that in Role Shift the signer's body acts as a classifier and is thus used to *demonstrate* another person's signs, gestures or actions. She draws inspiration from Zucchi's analysis of classifier constructions, briefly discussed in Section 5.1 above. Thus for Davidson, no context shift is involved; rather, the signer's body is used to represent another individual in the same way as the classifiers discussed in Section 5.1 represent an object. A potential advantage of her analysis is that it immediately explains the iconic effects found in Role Shift, since *by definition* Role Shift is used to signal the presence of a demonstration. We refer the reader to Schlenker 2015 for a comparison between the context-shifting and gestural analyses.

4. Telicity

Strickland et al. (to appear) revisit Wilbur's Hypothesis of Event Visibility, discussed in Sections 3.2 and 5.2 above. 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. These results can be interpreted in at least two ways. One is that Wilbur's principle is such a strong principle of Universal Grammar that it is accessed even by non-signers. An alternative possibility is that these use general and abstract iconic principles to determine when a sign/gesture can or cannot represent a telic event. This leaves open the possibility that Event Visibility derives from a general property of cognition rather than from specific properties of sign language – and possibly that similar effects could be found with co-speech gestures in spoken language (see Schlenker, to appear d, for potential differences between iconic enrichments in signs vs. gestures).

²¹ This paragraph borrows from Schlenker 2015.

References

- Anand, Pranav & Nevins, Andrew: 2004. Shifty Operators in Changing Contexts. R. Young (ed.), SALT XIV 20-37, Ithaca, NY: Cornell University.
- Anand, Pranav: 2006. *De De Se*. Ph.D dissertation, University of California, Santa Cruz.
- Bahan, B., Kegl, J., MacLaughlin, D., & Neidle, C. (1995). Convergent evidence for the structure of determiner phrases in American Sign Language. In L. Gabriele, D. Hardison, & R. Westmoreland (Eds.), FLSM VI, *Proceedings of the sixth annual meeting of the Formal Linguistics Society of Mid-America* (Vol. 2, pp. 1–12). Bloomington, IN: Indiana University Linguistics Club Publications.
- Bhatt, Rajesh and Pancheva, Roumyana: 2006. Conditionals. In *The Blackwell Companion to Syntax*, M. Everaert and H. van Riemsdijk (eds.), Vol 1: 638-687. Boston and Oxford: Blackwell.
- Bittner, Maria. 2001b. Topical referents for individuals and possibilities. In: *Proceedings of Semantics and Linguistic Theory XI* (Rachel Hastings, Brendan Jackson, and Zsafia Zvolenszky, eds.), 36–55. CLC, Ithaca.
- Brentari, Diane & Coppola, Marie: 2013. What sign language creation teaches us about language. *WIREs Cogn Sci* 4:201–211. doi: 10.1002/wcs.1212
- Brody, Michael & Szabolcsi, Anna: 2003. Overt scope in Hungarian. *Syntax* 6.1: 19–51.
- Cecchetto, Carlo, Geraci, Carlo & Zucchi, Sandro: 2006. Strategies of relativization in Italian Sign Language. *Natural Language and Linguistics* 24: 945–975.
- Clark, Herbert H. and Gerrig, Richard G.: 1990, Quotations As Demonstrations. *Language* 66: 764-805.
- Clark N, Perlman M, Johansson Falck M: 2013, Iconic pitch expresses vertical space. In *Language and the creative mind* (eds B Dancygier, M Borkent, J Hinnell), pp. 393–410. Stanford, CA: SCLI Publications.
- Cogill-Koez, D.: 2000, SIHned language classifier predicates: Linguistic structures or schematic visual representation? *SIHn Language and Linguistics*, 3(2):153-207.
- Cooper, Robin: 1983. Quantification and Syntactic Theory. *Synthese Language Library* 21.
- Cresswell, Max J.: 1990, *Entities and indices*. Studies in linguistics and philosophy, vol. 41. Kluwer. Academic Publishers, Dordrecht.
- Cuxac, Christian: 1999, French SIHn Language: Proposition of a Structural Explanation by Iconicity. In A. Braort et al. (eds), *Gesture-based Communication in Human-Computer Interaction*. Springer, pp. 165-184
- Cuxac, Christian & Sallandre, Marie-Anne: 2007. Iconicity and arbitrariness in French Sign Language : Highly Iconic Structures, degenerated iconicity and diagrammatic iconicity. In Pizzuto, E., P. Pietrandrea, R. Simone (eds.) : /Verbal and Signed Languages : Comparing Structures, Constructs and Methodologies/. Berlin : Mouton de Gruyter. 13-33.
- Davidson, Kathryn: to appear, Quotation, Demonstration, and Iconicity. To appear in *Linguistics & Philosophy*.
- Dekker, Paul: 2004. Cases, adverbs, situations and events. In H. Kamp & B. Partee (Eds.), *Context dependence in the analysis of linguistic meaning*. Amsterdam: Elsevier.
- Delaporte, Yves: 2007. *Dictionnaire étymologique et historique de la langue des signes française: Origine et évolution de 1200 signes*. Les Essarts-le-Roi, France: Éditions du Fox.
- Delaporte, Yves & Shaw, Emily: 2009. Gesture and Signs through History. *Gesture* 9(1): 35–60.
- Eckart, Regine: 2014, *The Semantics of Free Indirect Discourse How Texts Allow Us to Mind-read and Eavesdrop*. Brill.
- Elbourne, Paul: 2005. *Situations and individuals*. Cambridge, MA: MIT Press.
- Emmorey, Karen: 2002. Language, cognition, and the brain: Insights from sign language research. Mahwah, NJ: Erlbaum
- Emmorey, Karen: 2014. Iconicity as structure mapping. *Phil. Trans. R. Soc.* 369(1651). <http://dx.doi.org/10.1098/rstb.2013.0301>
- Emmorey, K. & Herzig, M. (2003). Categorical versus gradient properties of classifier constructions in ASL. In K. Emmorey (Ed.), *Perspectives on Classifier Constructions in Signed Languages*, Lawrence Erlbaum Associates, Mahwah NJ, pp. 222–246
- Emmorey, Karen & Ozyurek, Asli: 2014. Language in our hands: Neural underpinnings of sign

- language and co-speech gesture. *The cognitive neurosciences* **56**: 657-665.
- Evans, Gareth: 1980. Pronouns, *Linguistic Inquiry*, 11(2), 337–362.
- Finer, Daniel: 1985, The syntax of switch-reference. *Linguistic Inquiry* 16, 1: 35-55
- Geach, Peter. 1962. Reference and generality. An examination of some medieval and modern theories. Ithaca/NY: Cornell University Press.
- Giorgolo, Gianluca: 2010, *Space and Time in Our Hands*, Uil-OTS, Universiteit Utrecht.
- Goldin-Meadow, Susan and Brentari, Diane: to appear, Gesture, sign and language: The coming of age of sign language and gesture studies. To appear as a target article in *Behavioral and Brain Sciences*.
- Greenberg, Gabriel: 2013. Beyond Resemblance. *Philosophical Review* 122:2, 2013
- Groenendijk, Jeroen & Stokhof, Martin: 1991. Dynamic predicate logic. *Linguistics and Philosophy*, 14(1), 39–100.
- Halle, Morris : 1978. Knowledge unlearned and untaught: what speakers know about the sounds of their language. In Morris Halle, Joan Bresnan, and George Miller, eds., *Linguistic Theory and Psychological Reality*, MIT Press, Cambridge.
- Heim, Irene: 1982. *The semantics of definite and indefinite noun phrases*. Ph.D. Dissertation, University of Massachusetts, Amherst.
- Heim, Irene: 1990. E-type pronouns and donkey anaphora. *Linguistics and Philosophy*, 13, 137–177.
- Heim, Irene: 1991, ‘The first person’, Class handouts, MIT.
- Heim, Irene: 2008. Features on bound pronouns. In Daniel Harbour, David Adger, Susana Bejar (eds), *Phi-theory: Phi-features across modules and interfaces*, Oxford University Press.
- Heim, Irene & Kratzer, Angelika: 1998. *Semantics in Generative Grammar*. Oxford: Blackwell.
- Herrmann, Annika & Steinbach, Markus: 2012. Quotation in Sign Languages – A Visible Context Shift. In I. van Alphen & I. Buchstaller (eds.). *Quotatives: Cross-linguistic and Cross Disciplinary Perspectives*.
- Hockett, Charles F.: 1966, What Algonquian is Really Like. *IJAL* 31 (1): 59–73. JSTOR 1263449.
- Jacobson, Pauline: 1999. Towards a variable free semantics. *Linguistics and Philosophy* **22**:117–184.
- Jacobson, Pauline: 2012, Direct Compositionality and ‘Uninterpretability’: The Case of (Sometimes) ‘Uninterpretable’ Features on Pronouns. *Journal of Semantics*, 29: 305–343
- Hübl, Annika & Steinbach, Markus: 2012. Quotation across Modalities: Shifting Contexts in Sign and Spoken Languages. Talk delivered at the workshop *Quotation: Perspectives from Philosophy and Linguistics*, Ruhr-University Bochum.
- Iatridou, Sabine: 1994. On the contribution of conditional *Then*. *Natural Language Semantics*, 2 , 171 – 199 .
- Izvorski, Roumyana: 1996. The syntax and semantics of correlative proforms . In K . Kusumoto , (ed.), *Proceedings of NELS 26* . Amherst, MA : GLSA
- Kamp, Hans: 1981. A theory of truth and semantic representation. In J. A. G. Groenendijk, T. M. V. Janssen, & M. J. B. Stokhof (Eds.), *Formal methods in the study of language*. Amsterdam: Mathematical Centre.
- Kaplan, David: 1989. Demonstratives. In Almog, Perry, and Wettstein (eds.), *Themes from Kaplan*, Oxford University Press.
- Kegl, Judy: 2004. ASL Syntax: Research in progress and proposed research. *SIHn Language & Linguistics* **7**:2. Reprint of an MIT manuscript written in 1977.
- Kiss, Katalin É.: 1991, Logical structure in linguistic structure. In Huang--May, eds., *Logical Structure and Linguistic Structure*. Kluwer, pp. 387-426.
- Koulidobrova, Elena: 2011, SELF: Intensifier and ‘long distance’ effects in American Sign Language (ASL). Manuscript, University of Connecticut.
- Kratzer, Angelika: 2009. Making a pronoun: Fake indexicals as windows into the properties of pronouns. *Linguistic Inquiry* **40**(2): 187–237.
- Kuhn, Jeremy : 2015. Iconicity in the grammar: pluractionality in (French) Sign Language. Refereed talk, LSA 89
- Kuhn, Jeremy: to appear, ASL Loci: Variables or Features? To appear in *Journal of Semantics*.
- Kuhn, Jeremy & Aristodemo, Valentina: 2015. Iconicity in the grammar: pluractionality in French Sign Language. Manuscript, New York University and Institut Jean-Nicod.

- Lascarides, Alex and Stone, Matthew: 2009. A Formal Semantic Analysis of Gesture. *Journal of Semantics*, 26(4):393-449.
- Lewis, David K: 1986, *On the Plurality of Worlds*. Blackwell, Oxford.
- Liddell, Scott K.: 2003. *Grammar, Gesture, and Meaning in American SIHn Language*. Cambridge: Cambridge University Press.
- Lillo-Martin, Diane: 1991. *Universal grammar and American Sign Language: Setting the null argument parameters*. Dordrecht: Kluwer Academic Publishers.
- Lillo-Martin Diane: 1995, The Point of View Predicate in American Sign Language. Emmorey, K. and J. Reilly, *Language, Gesture, and Space*. Hillsdale, NJ. Lawrence Erlbaum Associates, 155-170.
- Lillo-Martin, Diane: 2012, Utterance reports and constructed action. In R. Pfau, M. Steinbach, and B. Woll, *Sign Language: An International Handbook*. De Gruyter Mouton, 365-387.
- Lillo-Martin, Diane and Klima, Edward S.: 1990, Pointing out Differences: ASL Pronouns in Syntactic Theory. In Susan D. Fischer & Patricia Siple (Eds.), *Theoretical Issues in Sign Language Research*, Volume 1: Linguistics, 191-210. Chicago: The University of Chicago Press.
- Macken, E., Perry, J., and Haas, C.: 1993, Richly grounding symbols in ASL. *SIHn Language Studies*, (81):375-94.
- MacSweeney, Mairéad, Woll, Bencie, Campbell, Ruth, McGuire, Philip K., David, Anthony S., Williams, Steven C. R., Suckling, John, Calvert, Gemma A. & Brammer, Michael J.: 2002. Neural systems underlying British Sign Language and audio-visual English processing in native users. *Brain* **125**(7):1583-93.
- MacSweeney M, Capek CM, Campbell R, Woll B: 2008, The signing brain: the neurobiology of sign language. *Trends Cog Sci* **12**:432-440.
- Maier, Emar: 2014, Mixed Quotation. Survey article for the *Blackwell Companion to Semantics*. Manuscript, U. of Groningen.
- Maier, Emar: to appear, Mixed Quotation: The grammar of apparently transparent opacity. To appear in *Semantics & Pragmatics*.
- Meir, Irit : 2010. Iconicity and metaphor: constraints on metaphorical extension of iconic forms. *Language* **86**(4) : 865–896. doi:10.1353/lan.2010.0044
- Meir, Irit., Sandler, Wendy, Padden, Carol & Aronoff, Mark: 2010. Emerging sign languages. In *Oxford Handbook of Deaf Studies, Language, and Education*, Vol. 2, eds M. Marschark and P. Spencer (Oxford: Oxford University Press), 267–280.
- Meier, Richard: 2012, Language and Modality. In: Roland Pfau, Markus Steinbach, & Bencie Woll (eds.), *Handbook of Sign Language Linguistics*. Berlin: Mouton de Gruyter
- Neidle, Carol, et al.: 2000, *The Syntax of American SIHn Language: Functional Categories and Hierarchical Structure*. MIT Press.
- Nouwen, Rick: 2003, *Plural pronominal anaphora in context*. Number 84 in Netherlands Graduate School of Linguistics Dissertations, LOT, Utrecht.
- Okrent, Arika: 2002, A modality-free notion of gesture and how it can help us with the morpheme vs. gesture question in sign language linguistics, or at least give us some criteria to work with. In R.P. Meier, D.G. Quinto-Pozos, & K.A. Cormier (eds). *Modality and structure in signed and spoken languages* (pp. 175-198). Cambridge: Cambridge University Press.
- Padden, Carol A.: 1986, Verbs and role-shifting in American Sign Language. In *Proceedings of the Fourth National Symposium on Sign Language Research and Teaching*, ed. Carol Padden. Silver Spring, MD: National Association of the Deaf.
- Partee, B. 1973 : Some structural analogies between tenses and pronouns in English. *The Journal of Philosophy*, 70, 601 – 609.
- Perlman, M. & Cain, A.: to appear, Iconicity in vocalizations, comparisons with gesture, and implications for the evolution of language. *Gesture*.
- Perlman, M., Dale, R. & Lupyan, G.: 2015, Iconicity can ground the creation of vocal symbols. *Royal Society Open Science*, 2, 150152.
- Quine, Williard V.: 1960. Variables explained away. *Proceedings of the American Philosophical Society* **104**(3): 343–347.
- Quer, Josep: 2005, Context shift and indexical variables in sign languages. In: *Proceedings of Semantic and Linguistic Theory (= SALT) XV*. Ithaka, NY: CLC Publications.

- Quer, Josep: to appear, Attitude ascriptions in sign languages and role shift. In Geer, L.C. (ed.), *Proceedings of the 13th Texas Linguistics Society Meeting*.
- Recanati, François: 2001, Open Quotation. *Mind* 110: 637–687. DOI: 10.1093/mind/110.439.637
- Reinhart, Tanya: 1983, Point of view in language—The use of parentheticals. In: Rauch, G. (Ed.) *Essays on Deixis*, Gunter Narr Verlag, Tuebingen. pp.169-194
- Rothstein, Susan: 2004. Structuring events: a study in the semantics of lexical aspect. (*Explorations in Semantics 2*). Malden, MA & Oxford: Blackwell.
- Sandler, Wendy & Lillo-Martin, Diane: 2006, *Sign Language and Linguistic Universals*. Cambridge University Press.
- Schlenker, Philippe: 1999. *Propositional Attitudes and Indexicality: a Cross-Categorial Approach*. Doctoral dissertation, MIT.
- Schlenker, Philippe: 2003. A Plea for Monsters, *Linguistics & Philosophy* 26: 29-120.
- Schlenker, Philippe: 2004b. Conditionals as definite descriptions (a referential analysis). *Research on Language and Computation*, 2, 3, 417 – 162. Stone, M. 1997: The anaphoric parallel between modality and tense, IRCS Report 97 – 06, Philadelphia, PA: University of Pennsylvania Press.
- Schlenker, Philippe: 2004b, Context of thought and context of utterance", *Mind & Language* 19/3, 279-304.
- Schlenker, Philippe: 2011a. Iconic Agreement. *Theoretical Linguistics* 37(3-4): 223–234.
- Schlenker, Philippe: 2011b. Donkey Anaphora: the View from Sign Language (ASL and LSF). *Linguistics and Philosophy* 34(4): 341-395.
- Schlenker, Philippe: 2011c. Quantifiers and Variables: Insights from Sign Language (ASL and LSF). In Partee, B.H., Glanzberg, M., & Skilters, J. (eds), *Formal Semantics and Pragmatics: Discourse, Context, and Models*. The Baltic International Yearbook of Cognition, Logic and Communication, Vol. 6, 2011.
- Schlenker, Philippe: 2011d, Indexicality and De Se Reports. In *Semantics*, edited by von Stechow, Ralf, Maienborn and Portner, Volume 2, Article 61, Mouton de Gruyter.
- Schlenker, Philippe: 2013a. Temporal and Modal Anaphora in Sign Language (ASL). *Natural Language and Linguistic Theory* 31(1): 207-234.
- Schlenker, Philippe: 2013b. Anaphora: Insights from Sign Language (Summary). In *L'Interface langage-cognition The Language-cognition Interface. Actes du 19e Congrès International des Linguistes, Genève, 22-27 juillet 2013*, editorial coordination by S. R. Anderson, J. Moeschler and F. Reboul.
- Schlenker, Philippe: 2014. Iconic Features. *Natural Language Semantics* 22(4): 299-356.
- Schlenker, Philippe: to appear, a. Super Monsters - Part I. Accepted for publication with minor revisions in *Semantics & Pragmatics*.
- Schlenker, Philippe: to appear, b. Featural Variables. To appear in *Natural Language and Linguistic Theory*.
- Schlenker, Philippe: to appear, c. Visible Meaning: Sign Language and the Foundations of Semantics. To appear as a target article in *Theoretical Linguistics*.
- Schlenker, Philippe: to appear, c. Iconic Enrichments: Signs vs. Gestures [Short Commentary]. To appear in *Behavioral and Brain Sciences*.
- Schlenker, Philippe: 2015. Super Monsters - Part II. Manuscript, Institut Jean-Nicod and New York University.
- Schlenker, Philippe, Lamberton, Jonathan & Santoro, Mirko: 2013. Iconic Variables. *Linguistics & Philosophy* 36(2): 91-149.
- Schlenker, Philippe and Mathur, Gaurav, 2013. A Strong Crossover Effect in ASL (squin). *Snippets* 27. doi: 10.7358/snip-2013-027-schl
- Sharvit, Yael: 2008. The puzzle of free indirect discourse. *Linguistics and Philosophy* 31: 353 - 395.
- Shaw, Emily & Delaporte, Yves: 2010. New Perspectives on the History of American Sign Language. *Sign Language Studies* 11(2): 158-204. Doi 10.1353/sls.2010.0006
- Stechow, Arnim von: 2004. Binding by Verbs: Tense, Person and Mood under Attitudes. In *The Syntax and Semantics of the Left Periphery*, eds. Horst Lohnstein and Susanne Trissler, 431 – 488. Berlin – New York: Mouton de Gruyter.
- Stone, M. 1997: The anaphoric parallel between modality and tense, IRCS Report 97 – 06, Philadelphia, PA: University of Pennsylvania Press.

- Strickland, Brent, Geraci, Carlo, Chemla, Emmanuel, Schlenker, Philippe, Kelepir, Meltem & Pfau, Richard G. (in press). Event representations constrain the structure of language: Sign language as a window into universally accessible linguistic biases. *Proceedings of the National Academy of Sciences*.
- Szabolcsi, Anna: 2000, The syntax of scope. In: Mark Baltin and Chris Collins (eds.), *Handbook of Contemporary Syntactic Theory*, pp. 607–634. Oxford: Blackwell.
- Taub, Sarah F.: 2001, *Language from the body*. Cambridge University Press.
- Vendler, Zeno: 1967, *Linguistics in Philosophy*. Ithaca, NY: Cornell University Press.
- Wilbur, Ronnie B. : 2003. Representations of telicity in ASL. *Chicago Linguistic Society* **39** : 354–368.
- Wilbur, Ronnie B.: 2008. Complex Predicates Involving Events, Time and Aspect: Is This Why Sign Languages Look So Similar?. In: Quer, J. (ed.) *Signs of the Time*, pp. 217–250. Signum, Hamburg.
- Wilbur, Ronnie B. & Malaia, Evie : 2008. Event Visibility Hypothesis: Motion Capture Evidence for Overt Marking of Telicity in ASL. Chicago, IL: Linguistic Society of America.
- Winston, E. (1995). Spatial mapping in comparative discourse frames. In K. Emmorey & J. S. Reilly (Eds.), *Language, gesture, and space* (pp. 87–114). Hillsdale, NJ: Lawrence Erlbaum.
- Xu, Jiang, Gannon, Patrick J., Emmorey, Karen, Smith, Jason F. & Braun, Allen R.: 2009. Symbolic gestures and spoken language are processed by a common neural system. *Proceedings of the National Academy of Sciences of USA* **106**(49) : 20664–20669. doi: 10.1073/pnas.0909197106
- Zucchi, Sandro: 2011. Event Descriptions and Classifier Predicates in Sign Languages. Presentation FEAST in Venice, June 21, 2011.
- Zucchi Sandro : 2012. Formal Semantics of Sign Languages. *Language and Linguistics Compass* **6**(11): 719–734.