Natural Logic with Iconicity

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Goal: Putting together recent and ongoing work on the formal semantics of sign language pronouns (ASL, but also LSF), we argue that in some respects *the logic of spoken language is a degenerate (= simplified) version of the logic of sign language*. The reason is that at its core (which involves variables), the logic of sign language has an iconic component, which is absent from spoken language; furthermore, this iconic component is not an add-on to the grammar, but is fully integrated with it. Our analysis suggests that formal semantics is bound to miss important properties of Universal Grammar if it limits itself to spoken languages.

Our argument is constructed as follows: I. Sign language loci (= positions in signing space used to refer to objects) share many of the formal properties of indices according to current theories of spoken languages. II. Despite these similarities, loci are sometimes simplified pictorial representations of what they denote. III. But this iconic component behaves like standard φ-features in remaining uninterpreted in some designated grammatical environments (ellipsis, focus): it is a deep part of the grammar, not an add-on to it.

I. Similarities between spoken language indices and sign language loci

In sign language, the relation between a pronoun and its antecedent is often mediated by *loci*. These are positions in signing space that can be introduced by noun phrases, and retrieved by pronouns (Sandler and Lillo-Martin 2006). Thus in (1), the signs for *former senator* and *current senator* are immediately followed by the pointing signs *IX-a* and *IX-b* respectively, and these establish the initial loci *a* and *b,* which are then retrieved by the pronouns (also signed as pointing signs *IX-a* and *IX-b*) which appear in the second sentence:

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

Since there appears to be an arbitrary number of possible loci, it was suggested that loci 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). Importantly, there are some striking similarities between sign language pronouns and their spoken counterparts, which thus seem to be part of the same abstract system:

–Sign language pronouns obey several syntactic constraints on binding (Lilla-Martin 1991, Sandler and Lillo-Martin 2006, Koulidobrova 2011), notably Condition A; Condition B; Strong Crossover.

–In simple cases, the same ambiguity between strict and bound variable readings is found in both modalities (see Lillo-Martin and Sandler 2006, Schlenker 2011)

–Similarly, as argued in Schlenker 2011, the same cases of 'donkey anaphora' are found in sign and in spoken language: both modalities have general properties of a dynamic logic (or of an E-type alternative).

II. The iconic dimension of sign language loci

In Schlenker et al. 2013, three examples are discussed in which sign language loci have a pictorial component. We focus on two: plural loci, which are normally realized as circular areas of space; and high loci, which are normally used to refer to tall or important entities.

(i) When plural loci are embedded within each other, *relations of inclusion and relative complementation are preserved by the interpretation function*. This accounts for the availability of 'complement set readings' in (2)-1a but not in its English counterpart in (2)2a. The key is a condition of 'structural iconicity' stated in (2).

(2) **Structural Iconicity of Plural Loci:** if a locus a is a sub-part of a large locus ab, a locus b thereby becomes available, and its denotation s(b) satisfies s(b) = s(ab) - s(a). In ASL and English alike, the grammar makes available a discourse referent a for the 'maximal set' (= students who came to class) and the 'restrictor set' ab (= all students); only with embedded loci is there a locus b = ab - a, which denotes s(ab) - s(a), i.e. the 'complement set'.
1. POSS-1 STUDENT IX-arc-ab MOST IX-arc-a a-CAME CLASS. 2. Most of my students came to class.

a. IX-arc-b b-STAY HOME	a. #They [intended: those who didn't come] stayed home.
b. IX-arc-a a-ASK-1 GOOD QUESTION	b. They [= those who came] asked me good questions.
c. IX-arc-ab SERIOUS CLASS.	c. They [= the students] are a serious class.'

(ii) Height specifications of loci have in two respects the same behavior as gender features: (a) their semantics is presuppositional, not assertive (Schlenker et al., 2013); (b) it is indexical, i.e. assessed with respect to the context, not world of evaluation. Still, these loci also have an iconic component(=(3)): tall people may not be denoted with high loci if they are in lying rather than standing position:

(3) **Formal Iconicity of High Loci:** high loci can be used to refer to tall people in standing but not lying position.
Context: People seek self-knowledge in the weirdest of situations.
YESTERDAY VERY TALL PHILOSOPHER PERSON

(a) CL-stand$_a$ (b) CL-sit$_a$ (c) CL-lie$_a$ PARK.
SUDDENLY IX-a$^{high / normal / low}$ UNDERSTAND SELF-a$^{high / normal / low}$
'Yesterday a very tall philosopher was (a) standing (b) sitting (c) lying in the park. Suddenly he understood himself.'
SELF^{high} is acceptable in condition (a) [=standing position] but not condition (c) [= lying position] (Schlenker et al.)

We thus claim that in (2)-(3) the interpretation function must preserve certain geometric properties of signs; we call this requirement 'formal iconicity', which is reminiscent of the projection-based semantics introduced in Greenberg 2012 to define a formal semantics for pictures.

III. The grammatical nature of iconic features

This iconic component has no counterpart in spoken language φ-features, so we must ask whether ASL/LSF iconic loci form a natural class with them. We suggest that they do in that they remain uninterpreted in two environments in which φ-features are uninterpreted: ellipsis and focus-sensitive constructions.

(i) In *I did my homework, and John did too*, a bound reading is possible, but ellipsis cannot produce a sentence: *John λi t_i did my$_i$ homework too*, as the features of *my* would yield a presupposition failure – hence they must remain uninterpreted.

(ii) A similar logic applies to *Only I did my homework:* on its bound reading, it must have an LF like *[Only I] λi t_i did ~~my~~$_i$ homework,* with uninterpreted features on ~~my~~$_i$ (Heim 1991,2005,2007; Stechow 2002).

(i') Using the ellipsis test, we show that when a high or plural locus from the antecedent clause cannot be interpreted in the elided clause, bound variable readings are nonetheless possible(=(4)-(5)). (For these ASL data, we provide ratings on a 7-point scale, with 7 = best.)

(4) **Bound readings with uninterpreted *high loci* under ellipsis are possible (in a.)**
Context: Tomorrow there is a swimming competition. A very tall man competes against a dwarf.
RS_____
EVERYONE LIKE WHAT PEOPLE LIKE IX-1. SO [VERY TALL MAN LIKE]$_a$ PEOPLE SUPPORT **IX-a**. DWARF$_b$ a,b-SAME.
'Everyone likes people who like him. So the very tall man likes people who support him, and the dwarf does too.'
a. high locus for IX-a: 7 b. normal locus for IX-a: 7 c. low locus for IX-a: 2 (14, 225; 226)

(5) **Bound readings with uninterpreted *plural loci* under ellipsis are possible**
Context: Tomorrow there is a swimming competition. A team of 6 French swimmers competes against a single German swimmer. RS_____
EVERYONE LIKE WHAT PEOPLE LIKE IX-1. SO...
6 **THE-SIX-OF-THEM-arc-a** FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc. [THAT GERMAN SWIMMER]$_b$ SAME.**
'Everyone$_i$ likes people who like him$_i$. So the six French swimmers like people who support them, and that German swimmer does, too.' (14, 229; 230; 14, 227; 228)

(ii') The same argument extends to examples with *only*, as shown by the ASL examples in (6) and (7).

(6) **Bound readings with uninterpreted high loci are possible under *only* (in a.)**
Context: Tomorrow there is a swimming competition. A very tall man competes against a dwarf.
[HEIGHT PEOPLE]$_a$ LIKE WHAT SELF-a. WAIT(ONE) OPPOSITE COMPARE DWARF$_b$ OFTEN HATE SELF-b. SO ONLY [VERY HEIGHT MAN]$_a$ SUPPORT SELF-a.
a. high locus: 6 b. normal locus: 7 c. low locus: 2 **Inference:** dwarves don't support dwarves.
'Tall people often like themselves. By contrast, dwarves often hate themselves. For this reason, only the very tall man supports himself.' (14, 239; 240)

(7) **Bound readings with uninterpreted plural loci are possible under *only***
Context: Tomorrow there is a swimming competition. A team of 11 French swimmers competes against a single German swimmer. RS_____
[FRENCH PEOPLE]$_a$ LIKE WHAT PEOPLE LIKE IX-1. WAIT(ONE) OPPOSITE COMPARE [GERMAN PEOPLE]$_b$ OFTEN HATE SELF-b.
RS_____
IX-b LIKE WHAT PEOPLE LIKE OTHER PEOPLE. SO
7 **ONLY IX-arc-a ELEVEN** FRENCH SWIMMER LIKE PEOPLE SUPPORT **IX-arc-a.**
Inference: the German swimmer doesn't like people who support him.
'French people often like themselves. By contrast, German often hate themselves. For this reason, only the eleven French swimmers like people who support them' (14, 241; 242)

We conclude that plural and height specifications of loci combine two properties: (i) they are sometimes iconic, in the sense that some of their geometric properties are preserved by the interpretation function; (ii) they are *bona fide* φ-features, in that they remain uninterpreted in environments in which other φ-features are uninterpreted. Thus the inventory of features made available by Universal Grammar includes some that have a clearly iconic component: iconic features exist at the core of Universal Grammar, something that could not be guessed by restricting attention to spoken languages.