

Iconic Agreement*

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Abstract: We suggest that that two apparently contradictory insights about sign language can be made compatible within a formal semantic analysis: (i) the claim that directional verbs incorporate agreement markers/pronouns (e.g. Lillo-Martin and Meier 2011); (ii) the observation that directional verbs have an iconic component (e.g. Liddell 2003). We sketch formal rules that integrate iconic requirements with standard semantic conditions (be they presuppositional or assertive).

In Lillo-Martin and Meier 2011 and in past work, the authors have forcefully and insightfully argued that directional verbs in sign language include agreement markers. At the same time, other researchers (notably Liddell 2003 and Taub 2001) have observed that directional verbs display iconic properties.¹ Lillo-Martin and Meier grant this point², but maintain that it does not contradict their own analysis. However, since their goal is primarily syntactic, they do not lay out a semantic procedure that can make these two insights compatible. We sketch a formal semantics that seeks to do justice to both (we leave for future research a comparison with Zucchi's recent account of some iconic effects in terms of hidden demonstratives (Zucchi 2011)).

1 The Pronominal Nature of Directional Verbs

Lillo-Martin and Meier 2011 provide several arguments for the following theory:

- (1) a. "An agreeing verb copies the index of its argument, including values for person (first/non-first) and number."
b. "Co-indexing is interpreted as coreference at the meaning level, and is expressed by directing the sign (pronoun or verb) to the same locus."

The agreement theory can be spelled out as follows:

- (2) Directional verbs have overt or null arguments whose features *and referential index* they copy. This gives rise to two cases, depending on whether the arguments are overt or null.
 - (i) Overt arguments
a-MARY a-INFORM-b b-SUE a-IX PASS TEST (Lillo-Martin and Meier 2011)
'Mary₁ informs Sue₂ that she₁ passed the test.'
 - (ii) Null arguments
A. Did John send Mary the letter?

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¹ Other researchers have long argued for the importance of iconicity in sign language – see for instance Friedman 1977 and Cuxac 1999.

² For instance, they write: "we agree that a locus cannot be understood as a geometric point; we also agree that the process which determines the physical locations used in reference must make direct connection with the gestural component of language. However, we do not exclude the possibility of postulating abstract morphemes with indeterminate form."

B. YES, a-SEND-b (Lillo-Martin and Meier 2001)
analyzed as Ø-a a-SEND-b Ø-b
 where Ø-a and Ø-b are null pronouns licensed by agreement.

One particularly striking argument for this analysis of directional verbs goes back to Lillo-Martin 1991, who showed that Strong-Crossover effects (i) hold in ASL, (ii) are obviated by resumptive pronouns, and (iii) are *equally* obviated by (apparently) bare directional verbs. The latter point strongly suggests that directional verbs can always license null pronouns, which in these cases behaves like resumptive pronouns. To give an idea of this line of investigation, let me sketch a paradigm that Gaurav Mathur and I have explored in recent work; it extends to Weak Crossover Lillo-Martin's observation about Strong Crossover. The examples in (3) (which are preliminary) suggest that, for some signers at least, Lillo-Martin's main result can be replicated: a Weak Crossover effect is essentially obviated when a directional verb replaces a plain verb without a resumptive pronoun (note that *LOVE* comes in two varieties, one of which is a plain verb – hence just *LOVE*, and the other one of which is a directional verb – hence *LOVE-a*).³

- (3) **a. Weak Crossover effect without resumptive pronouns**
 *?WHO-a POSS-a PARENT LOVE NO-MATTER WHAT?
 (Inf 1, 7, 161. 7, 162; 7, 269; 8, 65)
Intended meaning: Which person x is such that x's parents love x unconditionally?
b. Obviation of Weak Crossover effects with directional verbs
 (?) WHO-a POSS-a PARENT LOVE-a NO-MATTER WHAT?
Intended meaning: Which person x is such that x's parents love x unconditionally?
 (Inf 1, 7, 144. 7, 145; 8, 66)

This observation is also helpful in view of the cross-linguistic data available about Weak Crossover. As McCloskey 2006 writes, "it was established early (...) that [resumptive pronouns] quite generally show no Weak Crossover effects." In this way, ASL patterns like many spoken languages, and ASL directional verbs pattern like constructions with full (here: resumptive) pronouns. I take this line of argumentation, and more generally the arguments discussed by Lillo-Martin and Meier 2011, to establish rather strongly that directional verbs have an agreement/pronominal component.

Still, other researchers have argued that directional verbs – and more generally constructions involving loci – have iconic elements that make a grammatical analysis hopeless. We will list a couple of these effects and suggest that they can be made compatible with Lillo-Martin and Meier's claims within a formal semantic analysis that does justice to iconic requirements.

2 Iconic Effects in Pronouns and Agreement

Let us list a few iconic effects, together with simplified semantic rules that could handle them.

³ Note that in both cases *WHO* is signed with the right (dominant) hand, while at the same time the left index establishes locus *a*. The judgments were obtained on a 7-point scale, with three iterations for (3)a (scores for the intended reading: 2, 2, 3) and two iterations for (3)b (scores: 5, 6).

□ *High Loci*

Pronouns that refer to powerful entities can or must be placed high in the signing space. An example is given in (4), where ‘my father’ differs from ‘my (younger) brother’ in allowing for the use of a ‘high’ locus, written as a^+ :⁴

- (4) a. POSS-1 FATHER IX- a^+ SELF- a^+ BUSINESS MAN. IX- a^+ RICH.
‘My father is a businessman. He is rich.’ (Inf 1, 8, 17-18)

- b. ??POSS-1 BROTHER IX- a^+ SELF- a^+ BUSINESS MAN. IX- a^+ RICH.
Intended: ‘My (younger) brother is a businessman. He is rich.’ (Inf 1, 8, 19-20)

We propose to account for this fact by a rule modeled after the presuppositional lexical entries that are often used to interpret feminine or second person English pronouns. A feminine pronoun with an index i carries a presupposition that i denotes a female person, as is illustrated in (5)a; similarly, an index that points towards a ‘high’ locus i will come with a presupposition that i denotes a powerful entity, as is illustrated in (5)b.

- (5) Let c be a context of speech and s be an assignment function (c_a denotes the author of c , i.e. the signer).

- a. If f is a feminine feature, 2 a second person feature, and i is in index,

$[[\text{pro-}f_i]]^{f,s} = \#$ iff $s(i) = \#$ or $s(i)$ is not female. If $[[\text{pro-}f_i]]^{f,s} \neq \#$, $[[\text{pro-}f_i]]^{f,s} = s(i)$.

- b. If i is a locus that appears high in the signing space,

$[[\text{IX-}i]]^{f,s} = \#$ iff $s(i) = \#$ or $s(i)$ is not powerful relative to the signer c_a . If $[[\text{IX-}i]]^{f,s} \neq \#$, $[[\text{IX-}i]]^{f,s} = s(i)$.

In these rules, $\#$ represents presupposition failure. Thus the rule in (5)a tells us that $\text{pro-}f_i$ results in failure if i fails to denote (condition $s(i) = \#$) or if i denotes a non-female entity (condition $s(i)$ is not female); the other rules can be read analogously.

Now to take into account the iconic component of the constraint on ‘high’ loci, we propose to restate (5)b in a slightly different way:

- (6) If i is a locus that appears high in the signing space,

$[[\text{IX-}i]]^{f,s} = \#$ iff $s(i) = \#$ or $\langle 1, i \rangle$ is not iconically projectable to $\langle c_a, s(i) \rangle$ along the ‘power’ dimension. If $[[\text{IX-}i]]^{f,s} \neq \#$, $[[\text{IX-}i]]^{f,s} = s(i)$.

We assume that the context provides a variety of possible ‘iconic projections’ between the signing space and reality; the projections may be geometric or metaphorical – we will leave this point open, specifying in each case along which dimension (e.g. ‘power’, ‘body’, etc) the projection is supposed to be effected. In the present case, the high position of the index i relative to the position of the signer (glossed as 1) is put in correspondence with the relation of power that holds between the denotation of index i and the denotation of index I . We write this as: $\langle 1, i \rangle$ (i.e. the pair of positions in signing space that includes as members the signer’s position and the locus i) is *iconically projectable to* $\langle c_a, s(i) \rangle$ (i.e. the pair of real-world individuals that includes the agent of the context c_a and the denotation of the index i) *along the ‘power’ dimension* (i.e. one needs an assumption that people represented higher in the signing space have more power than people represented lower).

⁴ On a 7-point scale, our consultant rated (4)a as 7 and (4)b as 3.5.

□ *Demonstrative loci*

When someone is present in the context of speech, the associated locus normally corresponds to this person's actual location. We formalize this constraint with the presuppositional rule in (7):

(7) If i is a locus,

$[[IX-i]]^{f,s} = \#$ iff $s(i) = \#$ or $s(i)$ is present in the extra-linguistic situation and $\langle 1, i \rangle$ is not iconically projectable to $\langle c_a, s(i) \rangle$ along the 'position' dimension. If $[[IX-i]]^{f,s} \neq \#$, $[[IX-i]]^{f,s} = s(i)$.

Here by $\langle 1, i \rangle$ is iconically projectable to $\langle c_a, s(i) \rangle$ along the 'position' dimension, we simply mean that 1 corresponds to the position of the signer (which is normally the case) and that the locus i corresponds to the actual physical position of the person it denotes, namely $s(i)$.

This entry predicts that when one refers to a person in the extra-linguistic situation, one should have *no choice* but to use a locus that corresponds to that person's real location. The prediction has some 'bite' because there are cases in which the locus assigned to an individual 'moves' in signing space. Specifically, when an individual has been associated with a location in previous discourse, one can refer to him by pointing towards the locus *associated with that location* (though pointing to the original locus associated with the individual is often possible too). This phenomenon, which we may call 'locative agreement', is illustrated in (8) (from Schlenker, to appear; see Padden 1988 for data and discussion).⁵

- (8) JOHN_a[WORK IX-a FRENCH CITY] SAME_c[WORK IX-c AMERICA CITY].
IX-a IX-1 HELP IX-a+⁶, IX-c IX-1 NOT HELP IX-c+.
'John does business in a French city and he does business in an American city.
There [= in the French city] I help him. There [= in the American city] I don't help him.'
(Inf 1, 4, 66b; Inf 1, 4 67 & 10.05.06, 10.05.11, Inf 1 7, 214, 7,234)

The lexical entry in (7) predicts that for demonstratively used pronouns, this possibility should be precluded. Since our primary focus in this note is on directional verbs, we directly tested this prediction in its 'directional verb' guise, with a directional form of the verb *HELP*:⁷

- (9) a. JOHN IX-b WORK_a[IX-a FRENCH CITY] SAME WORK_c[IX-c AMERICA CITY]. IX-a IX-1 1-HELP-a. IX-c IX-1 NOT 1-HELP-c.
'John does business in a French city and he does business in an American city.
There [= in the French city] I help him. There [= in the American city] I don't help him.'
(Inf 1, 8, 1; 2, 24)
b. *?IX-2 WORK_a[IX-a FRENCH CITY] SAME IX-2 WORK_c[IX-c AMERICA CITY]. IX-a IX-1 1-HELP-a. IX-c IX-1 NOT 1-HELP-c.
Intended: 'You do business in a French city and you do business in an American city. There [= in the French city] I help you. There [= in the American city] I don't help you.' (Inf 1, 8, 1; 2, 24)
c. *?IX-1 WORK_a[IX-a FRENCH CITY] SAME IX-1 WORK_c[IX-c AMERICA CITY]. IX-a IX-2 2-HELP-a. IX-c IX-2 NOT 2-HELP-c.
Intended: 'I do business in a French city and I do business in an American city. There [= in the French city] you help me. There [= in the American city] you don't help me.' (Inf 1, 8, 3; 4, 25)

While more work is clearly needed, it would seem that (7) makes interesting and possibly correct predictions about the way in which an iconic requirement interacts with another rule, namely locative agreement.

⁵ On a 7-point scale, the ratings we obtained from our consultant were: 7, 7.

⁶ Here $a+$ indicates that pointing is a bit above locus a .

⁷ On a 7-point scale, the ratings we obtained from our consultant were: 6 for (9)a., and 2 for (9)b. and c. We obtained conflicting judgments for the (crucial) case in which the subject of *WORK* is a third person demonstrative pronoun (Inf 1, 8, 9, 8, 10; 26; 55).

□ *Gradient Iconicity*

Emmorey and Herzig 2003 showed that in the case of classifier constructions, gradient iconicity effects are obtained by native signers of ASL: as the position of a classifier with an *F* handshape classifier is gradually modified relative to a horizontal *B*-handshape (representing a flat object), natives signers derive gradually different inferences about the situations that make this description true. Emmorey and Herzig describe this part of their experiment as follows:

Participants were asked to place a dot (a 1/2 inch round sticker) in relation to a bar (a line) drawn in the center of a square frame. Where the sticker should be placed was indicated by a native signer (on videotape), who produced a classifier construction in which the *F* handshape (specifying a small round object—the dot sticker) was positioned in signing space either above or below a horizontal *B*-handshape (specifying a flat, surface-prominent object—the bar).

The result was that deaf signing participants placed the dot in a position that corresponded to the position of the *F*-handshape classifier relative to the *B*-handshape.

We can capture these inferences with the rule in (10). Note that we need to assume that the interpretation function specifies the extension of the *B*-predicate; for simplicity, we take this predicate to denote a single object if it denotes at all, and we provide the rule in (10) to derive the appropriate truth conditions. The important point is that the non-presuppositional part of the rule is entirely iconic:

(10) If *i* is a locus,

$[[F\text{-classifier}_i B]]^{f,s} = \#$ iff $s(i) = \#$ or $[[B]]^{f,s} = \#$. If $[[F\text{-classifier}_i B\text{-predicate}]]^{f,s} \neq \#$, $[[F\text{-classifier}_i B\text{-predicate}]]^{f,s} = 1$ iff $\langle i, B \rangle$ is iconically projectable to $\langle s(i), [[B]]^{f,s} \rangle$ along the ‘geometric’ dimension.⁸

Here, $\langle i, B \rangle$ is iconically projectable to $\langle s(i), [[B]]^{f,s} \rangle$ along the ‘geometric’ dimension means that there is a natural geometric projection that maps the relative position of locus *i* and sign *B* and the objects they denote, namely $s(i)$ and $[[B]]^{f,s}$. This captures the gradient iconicity effect observed by Emmorey and Herzig.

□ *Iconicity Effects in Directional Verbs*

Liddell 2003 forcefully argues that loci cannot be viewed as geometrical points, but should be seen instead as an entire area with a structure. An important argument is provided by directional verbs:

“Just as ASK-QUESTION^{-y} is directed toward the chin/neck area, other directional verbs also have specific parts of the body toward which they are directed (Liddell 1990). The sign COMMUNICATE-TELEPATHICALLY-1^[RECIPIENT] (...) is directed toward the forehead; SAY-NO-TO^{-y} (...) is lower, moving toward the addressee’s nose/chin; GIVE^{-y} (...) is lower still, moving toward the addressee’s chest.”

To handle these idiosyncracies within a formal semantics with iconicity, we will need to define iconic lexical entries for these predicates. But we will also need to revise our assumption that loci are just points in signing space. We will henceforth distinguish between two kinds of loci, ‘narrow’ and ‘broad’:

-non-capital letters represent points in signing space, which are ‘narrow’ loci; indexes point towards narrow loci;

⁸ Does this rule contravene to the principle of Strong Compositionality? The latter states that the meaning of a complex expressions is determined by the meaning of its immediate constituents *and the way they are put together*. At this point, we could appeal to the underlined part to claim that we have not violated Strong Compositionality. Whether this line of argumentation works in full generality remains to be seen.

-but in general a narrow locus i is part of a broader area – a ‘broad locus’ – which we will designate using the corresponding capital letter, I .

We assume that assignment functions assign values to broad loci; we can thus retain our earlier analyses, replacing what we wrote about $s(i)$ with $s(I)$.

With these tools in hand, we define presuppositional lexical entries for some directional verbs. These entries will impose requirements on the denotation of the arguments of these predicates. To see a similar logic at work in a more familiar setting (one without iconicity), we start by defining a simplified presuppositional lexical entry for the verb *am_working*, on the assumption that we want its first person requirement to be semantically encoded. This predicate is of type $\langle e, t \rangle$, so that it takes an argument x of individual type (i.e. of type e) to produce a truth value (of type t).

- (11) For any object x of the individual type (i.e. of type e), for any context c and assignment function s ,
 $\llbracket \text{am_working} \rrbracket^{c,s}(x) = \#$ iff $x = \#$ or $x \neq c_a$. If $\llbracket \text{am_working} \rrbracket^{c,s}(x) \neq \#$, $\llbracket \text{am_working} \rrbracket^{c,s}(x) = 1$ iff x is working.

A derivation is given for illustrative purposes in (12), with the assumption that in a context c the word I denotes the agent of c , i.e. c_a .

- (12) If j (the denotation of *John*) is not the agent of the context c ,

- a. $\llbracket I \text{ am_working} \rrbracket^{c,s} = \llbracket \text{am_working} \rrbracket^{c,s}(\llbracket I \rrbracket^{c,s}) = \llbracket \text{am_working} \rrbracket^{c,s}(c_a)$. It is immediate that $\llbracket \text{am_working} \rrbracket^{c,s}(c_a) \neq \#$, and $\llbracket I \text{ am_working} \rrbracket^{c,s} = 1$ iff c_a is working.
- b. $\llbracket \text{John am_working} \rrbracket^{c,s} = \llbracket \text{am_working} \rrbracket^{c,s}(\llbracket \text{John} \rrbracket^{c,s}) = \llbracket \text{am_working} \rrbracket^{c,s}(j) = \#$ since by assumption $j \neq c_a$; a presupposition failure is obtained.

With this background in mind, consider the lexical entries in (13); unlike *am_working*, they are transitive rather than intransitive, and thus they must take an individual argument y , followed by an individual argument x , to yield a truth value.

- (13) For any objects x and y of the individual type (i.e. of type e),

- a. $\llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(y)(x) = \#$ iff $x = \#$ or $y \neq \#$ or $s(I) \neq y$ or $\langle I, i \rangle$ is not iconically projectable to $\langle \text{body}(s(I)), \text{chin}(s(I)) \rangle$ along the ‘position’ dimension. If $\llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(y)(x) \neq \#$, $\llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(y)(x) = 1$ iff x asks questions to y ($= s(I)$).
- b. $\llbracket \text{COMMUNICATE-TELEPATHICALLY-1-}i \rrbracket^{c,s}(y)(x) = \#$ iff $x = \#$ or $y \neq \#$ or $s(I) \neq y$ or $\langle I, i \rangle$ is not iconically projectable to $\langle \text{body}(s(I)), \text{forehead}(s(I)) \rangle$ along the ‘position’ dimension. If $\llbracket \text{COMMUNICATE-TELEPATHICALLY-1-}i \rrbracket^{c,s}(y)(x) \neq \#$, $\llbracket \text{COMMUNICATE-TELEPATHICALLY-1-}i \rrbracket^{c,s}(y)(x) = 1$ iff x communicates telepathically with y ($= s(I)$).
- c. $\llbracket \text{SAY-NO-TO-}i \rrbracket^{c,s}(y)(x) = \#$ iff $x = \#$ or $y \neq \#$ or $s(I) \neq y$ or $\langle I, i \rangle$ is not iconically projectable to $\langle \text{body}(s(I)), \text{nose}(s(I)) \rangle$ along the ‘position’ dimension. If $\llbracket \text{SAY-NO-TO-}i \rrbracket^{c,s}(y)(x) \neq \#$, $\llbracket \text{SAY-NO-TO-}i \rrbracket^{c,s}(y)(x) = 1$ iff x says no to y ($= s(I)$).

To illustrate, consider the sentence *John asks me a question*, where we assume that the object pronoun is null. At the first step of the semantic derivation, we just ‘feed’ the verb its arguments. *JOHN* denotes the individual j , and \emptyset_i denotes whatever the assignment function specifies that the broad locus I denotes. We take this broad locus to correspond to the signer, i.e. c_a , and thus we have the following step:

- (14) $\llbracket \text{JOHN ASK-QUESTION-}i \emptyset_i \rrbracket^{c,s} = \llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(\llbracket \emptyset_i \rrbracket^{c,s})(\llbracket \text{JOHN} \rrbracket^{c,s}) = \llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(s(I))(j) = \llbracket \text{ASK-QUESTION-}i \rrbracket^{c,s}(c_a)(j)$

We can now apply the lexical entry in (13)a, with $y = c_a$ and $x = j$. It is immediate that $x \neq \#$ and $y \neq \#$, and by assumption $s(I)$ is the signer c_a . Taking these facts into account, we can

derive the presupposition of interest here (we make use of the fact that $s(I) = c_a$ – in other words, the broad locus I denotes the signer):

- (15) $\llbracket \text{JOHN ASK-QUESTION-i } \emptyset_i \rrbracket^{f,s} = \#$ iff $\llbracket \text{ASK-QUESTION-i} \rrbracket^{f,s}(c_a)(j) = \#$, iff $\langle I, i \rangle$ is not iconically projectable to $\langle \text{body}(c_a), \text{chin}(c_a) \rangle$ along the ‘body’ dimension.

So at this point, we have correctly derived the requirement that the sign *ASK-QUESTION-i* should point towards the chin of the signer, rather than some other part of his or her body. When this presupposition is satisfied, we derive the desired truth conditions:

- (16) If $\llbracket \text{JOHN ASK-QUESTION-i } \emptyset_i \rrbracket^{f,s} \neq \#$, $\llbracket \text{JOHN ASK-QUESTION-i } \emptyset_i \rrbracket^{f,s} = 1$ iff $\llbracket \text{ASK-QUESTION-i} \rrbracket^{f,s}(c_a)(j) = 1$, iff j asks questions to c_a .

It is worth noting that the rules in (13) as stated predict that Liddell’s iconic requirements should hold irrespective of whether the object of the verb denotes someone present in the discourse or not. This accounts for the contrast in (17), where different height requirements hold of *ASK* and *COMMUNICATE-TELEPATHICALLY* when the object denotes a third person not present in the discourse; here a^{++} a very high locus, appropriate for the latter verb but not for the former:⁹

- (17) a. ??YESTERDAY _a[LINGUIST PERSON] MEET _c[PHILOSOPHER PERSON]. IX- a^{++} a^{++} -ASK- b^{++} QUESTION.

Intended: ‘Yesterday, a linguist met a philosopher. He [= the linguist] asked him [= the philosopher] a question.’ (Inf 1, 8, 41; 42)

- b. YESTERDAY _a[LINGUIST PERSON] MEET _c[PHILOSOPHER PERSON]. THE-TWO- a^{++} , b^{++} THINK COMMUNICATE-TELEPATHICALLY- a^{++} , b^{++} .

‘Yesterday a linguist met a philosopher. They exchanged thoughts without words.’ (Inf 1, 8, 43; 44)

In sum, our lexical entries incorporate a presupposition triggered by an agreement marker, exactly as was the case for *am_working* in (11)-(12); but they *also* have an explicit iconic component.

Liddell 2003 writes (p. 139):

“Each individual verb has specific gestural characteristics associated with it. (...) For those that do point, if they are directed at a person, they are directed at specific parts of the person (e.g. forehead, nose, chin, sternum). These are not general characteristics of gestural ‘accompaniments’ to signing. These are specific, semantically relevant, properties of individual verbs.”

We hope to have shown that these observations can be made compatible with Lillo-Martin and Meier’s important insights, and more generally with an account in which sign language indexes and directional verbs are part of the larger domain of anaphoric constructions in natural language.

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⁹ On a 7-point scale, our consultant rated (17)a as 4 and (17)b as 7.

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