Donkey Anaphora in Sign Language I: E-type vs. Dynamic Accounts[1]

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Abstract. There are two main approaches to the problem of donkey anaphora (e.g. *If John owns a donkey, he beats it*). Proponents of dynamic approaches take the pronoun to be a logical variable, but they revise the semantics of quantification so as to allow an indefinite to bind a variable that is not within its scope. *Older dynamic approaches* took this measure to apply solely to indefinites; *recent dynamic approaches* have extended it to all quantifiers. By contrast, proponents of *E-type analyses* take the pronoun to go proxy for a definite description (with *it* = *the donkey*, or *the donkey that John owns*); in order to satisfy its uniqueness presupposition, they combine this approach with an analysis of *if*-clauses as quantifiers over situations. While competing accounts make very different claims about the coindexing relations that should be found in the syntax, these relations are not morphologically realized in spoken languages. But they *are* arguably realized in sign languages, namely through pointing. We argue that data from French and American Sign Language favor *recent dynamic approaches*. First, in those cases in which E-type analyses and dynamic analyses make different predictions about the formal connection between a pronoun and its antecedent, dynamic analyses are at an advantage. Second, it appears that the same formal mechanism is used irrespective of the indefinite or non-indefinite nature of the antecedent, which argues for recent dynamic approaches over older ones.

Keywords: anaphora, E-type anaphora, dynamic semantics, sign language

1 The Debate

1.1 The Problem

We attempt to bring new light on the debate on donkey anaphora by investigating data from two sign languages, French Sign Language (LSF) and American Sign Language (ASL). Our enterprise is motivated by the following considerations:

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(i) Competing approaches to donkey anaphora make different predictions about the patterns of coindexing that are found in different examples.
(ii) In sign languages, coindexing is arguably realized overtly, by way of pointing (Sandler and Lillo-Martin 2006).
(iii) Therefore sign languages could bring new light to this debate, which has remained open despite quite a bit of work in formal semantics.

The problem is illustrated in (1) and (2).

(1) **Indefinites**
a. John owns a donkey. He beats it.
b. If John owns a donkey, he beats it.

(2) **Non-Indefinites**
a. John owns fewer than 5 donkeys. He beats them
b. If John owns fewer than 5 donkeys, he beats them.

In each case, the pronoun is semantically dependent on the quantifier; but it is not c-commanded by it. This poses a problem if the following two standard assumptions are adopted:
(i) Pronouns are logical variables.
(ii) The semantics of quantifiers gives rise to a standard notion of scope, namely c-command.

Dynamic approaches preserve (i) but revise (ii) (e.g. Kamp 1981, Heim 1982, Groenendijk and Stokhof 1991). E-type approaches preserve a version of (ii) but revise (i), taking pronouns to go proxy for definite descriptions (e.g. *the donkey*, or *the donkey that John owns;* e.g. Evans 1980, Heim 1990, Ludlow 1994, Elbourne 2005). As we will see below, however, when all the necessary refinements of the E-type approach are taken into account, the two theories diverge considerably less than this cursory characterization suggests – so much so that under certain conditions the E-type approach can converge with the dynamic approach (Dekker 2004). Thus we cannot reasonably hope to distinguish empirically all conceivable E-type approaches from all dynamic analyses; but we will draw a distinction between some of those.

1.2 E-type Approaches

E-type approaches have the following general ingredients:

(3) **Pronouns as descriptions**
Pronouns are treated as being (syntactically and/or semantically) definite descriptions in disguise. Depending on the approach, (1)a is analyzed as in a. or b. below, where *it* has the semantics of the definite description operator.
a. If John owns a donkey, he beats it~~ donkey he has~~
b. If John owns a donkey, he beats it~~ donkey~~ (Elbourne 2005)

(4) **Quantification over situations / events**
In order for the uniqueness presupposition of the definite description to be satisfied, *if*-clauses (and more generally all operators) must be taken to quantify over very fine-grained situations or events.

(5) **Formal Link**
In order to account for the classic contrast between a. and b. below, E-type theories must establish a 'formal link' between the pronoun and its antecedent.

a. Every man who has a wife is sitting next to her.
b. ?* Every married man is sitting next to her (Heim 1990)
Elbourne 2005 takes the formal link to result, quite simply, from a syntactic ellipsis of the NP (e.g. *her = the ~~wife~~*).

Importantly, E-types accounts treat in a uniform fashion the case of indefinite and non-indefinite antecedents, as is illustrated in (6).

(6) a. If John owns a donkey, he beats it ~~donkey~~.
b. If John owns fewer than 5 donkeys, he beats them ~~donkeys~~.

1.3 Dynamic Approaches

Dynamic approaches share the following properties:

(7) **Pronouns as variables**
Pronouns are treated as logical variables, and can be coindexed with non-c-commanding indefinites, as illustrated in a. and b.
a. John owns $[\text{a donkey}]_i$. He beats it_i.
b. If John owns $[\text{a donkey}]_i$, he beats it_i.

(8) **Revision of quantification**
Quantification is revised so as to make it possible for a variable to depend on a non-c-commanding quantifier. This can be done in purely semantic terms, by way of quantification over assignment function (Heim 1983, Groenendijk and Stokhof 1991); or through syntactic stipulations such as those illustrated in a. and b., where $\exists$ and $\forall$ are unselective quantifiers (cf. Heim 1983, Kamp 1981; in these implementations, indefinites are taken to introduce variables).
a. $\exists$ [John owns $[\text{a donkey}]_i$. He beats it_i.]
b. $\forall[\text{John owns } [\text{a donkey}]_i]$ [he beats it_i]

(9) **Formal Link: coindexing**
Coindexing provides a formal link between a pronoun and its antecedent, and it has a direct semantic reflex.

Dynamic approaches differ in their treatment of donkey pronouns that depend on quantifiers that are not indefinites. To see why there is an issue in the first place, consider the truth conditions that a simple-minded extension of (8)a would predict:

(10) **Problem**
a. John owns [at least 2 donkeys]. He beats them.
Bad prediction: $\exists X$ [John owns X & $\geq$2 donkeys(X) & John beats X]
b. John owns [fewer than 5 donkeys]. He beats them.
Bad prediction: $\exists X$ [John owns X & <5 donkeys(X) & John beats X]

It is immediate that the truth conditions captured by (10) are inadequate.
-Intuitively, (10)a entails that John beats *all the donkeys that he has*. But this entailment is not captured by the proposed truth conditions: the fact that the pronoun refers to the *maximal* group of donkeys that John owns is left unaccounted for.
-The same problem arises in (10)b: the inference that John beats all the donkeys that he has is not captured. But in addition, the proposed truth conditions do not even entail that John owns fewer than five donkeys (all they entail is that one can find a group of fewer than five donkeys that John owns – which is far too weak).

There are two broad solutions to the problem. One is a mixed approach (Kamp and Reyle 1993): for indefinite antecedents, the standard dynamic line is adopted; for other antecedents, a version of the E-type approach is posited, one in which the quantifier has its 'usual' meaning but the pronoun goes proxy for a definite description – which directly accounts for the maximality condition observed in (10)a.

(11) **Mixed Solution** (Kamp & Reyle 1993)
a. Indefinites are treated in the dynamic way.
b. Other quantifiers are treated with some version of the E-type account.

The alternative is a pure dynamic approach, one in which *all* quantifiers (not just indefinites) introduce discourse referents and can bind variables that they do not c-command. In order to address the problems seen in (10), quantifiers such as *at least two* and *fewer than five* are taken to introduce discourse referents *together with explicit maximality conditions*. As is illustrated in (12), this measure makes it possible to derive the correct truth conditions within a pure dynamic system.

(12) **Pure Solution** (cf. van den Berg 1996, Nouwen 2003, Brasoveanu 2006)
a. John owns [at least 2 donkeys]. He beats them.
∃X [John owns X **& X = [Max Y: donkey(Y) & John owns Y]** & ≥2 donkeys(X) & John beats X]
b. John owns [fewer than 5 donkeys]. He beats them.
∃X [John owns X **& X = [Max Y: donkey(Y) & John owns Y]** & <5 donkeys(X) & John beats X]

1.4. The Complexity of the Debate

The debate between E-type and dynamic approaches is more subtle than it looks at first sight. In a nutshell, some recalcitrant examples have forced the E-type approach to adopt a mechanism of quantification over extremely fine-grained situations, which looks quite a bit like quantification over assignment functions (Dekker 2004). Consider the sentences in (13):

(13) a. A bishop met a bishop. He blessed him.
b. If a bishop meets a bishop, he blesses him.

The potential difficulty is immediate for Elbourne's (2005) theory: if *he* and *him* are both construed as *the bishop*, it is not clear how their uniqueness presuppositions can be satisfied. But versions of the E-type analysis that resort to a longer descriptive content are no better off: resolving *he* as *the bishop that met a bishop* and *him* as *the bishop that a bishop met* won't help a bit. The difficulty is that, to put it roughly, the two bishops of the antecedent clause play entirely symmetric roles.

How can the symmetry be broken? There are in fact two difficulties, which we illustrate on the example of (13)b (which is discussed in detail in Elbourne 2005).
(i) First, situations must be made fine-grained enough that the 'symmetry' between the bishops mentioned in the antecedent can in principle be broken. An old insight, called 'Chierchia's Conjecture' in Dekker 2004, is that in the end situation-theoretic analyses might have to make situations as fine-grained as assignment functions. Dekker 2004 shows that with quite a few assumptions – which he takes to go against the spirit of the framework – situations are indeed isomorphic to assignment functions. One of these assumptions is that a situation in which *bishop B meets bishop*

B' is different from a situation in which *situation B' meets bishop B*. Such an assumption is accepted by Elbourne 2005; it is an important ingredient of his solution. (ii) Second, *even* if situations are made extremely fine-grained, the situation-theoretic analysis must endow the pronouns in the consequent clause with enough descriptive content to pick out different individuals. Suppose for instance that we took *if*-clauses to quantify over situations that are just tuples of individuals – thus accepting Dekker's isomorphism between situations and tuples of individuals. We would *still* have to explain how the pronouns *he* and *him* manage to pick out different individuals in the same situation (i.e. in the same tuple). One way to do so would be to stipulate that they come with some equivalent of indices, so that for instance he_1 evaluated with respect to a situation s with s = <B, B'> denotes B, while in the same situation he_2 denotes B'. But it is immediate that such a radical step would make the situation-theoretic analysis even closer to its dynamic competitors.

These formal points are worth keeping in mind when one seeks to assess the donkey anaphora debate on empirical grounds. If indeed the two approaches can in principle converge, it might be hard to decide the debate in favor of one analysis and against all versions of the other. Rather, we can only hope to show something weaker, namely that a given theory is incorrect *or* must borrow essential formal tools from its competitor. This is what we will conclude about the E-type approach. To reach this result, we elicited examples from LSF with one main informant (Informant A), who became deaf around the age of 6, and two additional informants (Informants B and C) who were born deaf and are thus genuine native signers. We also elicited examples from ASL with a native signer (Informant 1, born deaf to deaf parents).

2 Predictions for Sign Language

2.1 Pronouns in Sign Language

In the sign languages that have been described, the relation between a pronoun and its antecedent is usually realized through the intermediary of *loci*, which are positions in signing space that are associated with nominal elements (Sandler and Lillo-Martin 2006). A pronoun that depends on a proper name will thus point towards (or 'index') the locus in which the proper name was signed. Since there appears to be an arbitrary number of possible loci, it was suggested that the latter are the morphological realization of indices (Sandler and Lillo-Martin 2006). This makes it particularly interesting to use sign language to investigate a theoretical debate that revolves around the nature of coindexing relations.

Of course, it could be that the anaphoric system of sign language is entirely different from that found in spoken languages. If so, we would be getting from sign language morphological evidence on a *different* system from the one that had originally prompted the donkey anaphora debate. But despite the difference in modality, there are some striking similarities between sign language pronouns and their spoken language counterparts.

In the following, sign language sentences are glossed in capital letters; subscripts correspond to the establishment of locations ('loci') in signing space; pronouns, glossed as IX (for 'index') as well as other expressions can then point back towards these locations. In such cases, the

location is suffixed to the pronoun, so that *IX-a* is a pronoun that points words location a, while *IX-b* is a pronoun that points towards location b; the number 1 corresponds to the position of the signer (hence 1st person).

(i) First, in simple cases, the same ambiguity between strict and bound variable readings is found in both modalities, as is illustrated in (14) and (15).

(14) **LSF**
a. FANTASTIC. PIERRE LIKE WIFE POSS-a. IX-b JEAN TOO.
(Informant **A** 369; cf. Informant **C**, 193)
'It's fantastic. Pierre loves his wife, and Jean does too [= like Pierre's wife].'
b. COMPLICATED. PIERRE LIKE WIFE POSS-a. IX-b JEAN IX-b TOO.
(Informant **A**, 374; cf. Informant **C**, 201)
'Things are complicated. Pierre loves his wife, and Jean does too [= love Jean's wife]'

(15) **ASL**
IX-1 POSS-1 MOTHER LIKE. IX-a TOO. (Inf **1** 108)
I like my mother. He does too [= like my / his mother]

(ii) Second, sign language pronouns appear to be constrained by at least some of the syntactic constraints on binding studied in syntax. For instance, versions of the following constraints have been described for ASL (Sandler and Lillo-Martin 2006): Condition A; Condition B; Strong Crossover[2].

Still, it would be an overstatement to claim that *all* uses of indexing are pronominal. First, in some cases indexing serves to *establish* a locus rather than to *refer back* to one. Second, it has been argued in Bahan et al. 1995 that some uses of indexing in ASL correspond to a definite determiner. We are neutral on the latter matter, but we will seek to establish that for purposes of anaphora resolution indexing *also* plays the role of formal indices in dynamic semantics.

2.2 The Importance of Bishop Sentences

The simplest donkey sentences may seem to provide initial evidence in favor of dynamic accounts because pronouns appear to index antecedents that do not c-command them.

(16) **LSF**
a. $_{a}$STUDENT $_{b}$PRIEST BOTH-a,b DISCUSSED. IX-b KNOW BIBLE IX-a NOT-KNOW
'I talked to a student and a priest. The priest knew the Bible but the student didn't know it'. (Informant **E**; 2, 62)
b. EACH-TIME $_{a}$LINGUIST $_{b}$PSYCHOLOGISTALL-THREE- b,a,1 TOGETHER WORK, IX-a HAPPY BUT IX-b HAPPY NOT.
'Whenever I work with a linguist and a psychologist, the linguist is happy but the psychologist is not happy.'(Informant **E**; 2, 63)

[2] In ongoing work, Gaurav Mathur and I have extended these results (originally due to Lillo-Martin) to Weak Crossover effects in ASL.

While these examples can be taken to display coindexing without c-command, they are by no means decisive. The E-type approach could account for them as follows:
(i) In sign language, a pronoun indexes the Noun Phrase that provides its descriptive content. In the implementation of Elbourne 2005, we may simply posit that a pronoun points towards the Noun Phrase which provides its antecedent under NP ellipsis. Since we already know from spoken languages that some formal link must be provided between the pronoun and its antecedent, it comes as no particular surprise that the same phenomenon can be observed in sign language.
(ii) In all cases such as (16), pronouns index exactly the syntactic element that they should – in particular under Elbourne's approach. Therefore (some) E-type approaches make exactly the same predictions as standard dynamic approaches.

When it comes to bishop sentences such as (13), however, things are different: some E-type accounts make different predictions from dynamic accounts. One conceivable E-type account (which corresponds to my understanding of Elbourne 2005) posits that *extra-linguistic material* is used to enrich the descriptive content of the pronouns to allow them to pick out different bishops. Following Elbourne 2005, we can introduce some additional material ***D*** and ***N*** to refer to the 'distinguished' and 'non-distiguished' bishop in a situation (one would need to say more about the *semantics* of ***D*** and ***N***; but we assume, following Elbourne, that situations are fine-grained enough that the two bishops can indeed play asymmetric roles).

(17) If a bishop meets a bishop, he **D** ~~bishop~~ blesses him **N** ~~bishop~~.

The formal link between a pronoun and its antecedent is provided in this analysis by syntactic ellipsis. But in the case of (17) the very same results are obtained no matter which antecedent is used, since all that is elided is the noun *bishop*. For this reason, both pronouns could in principle take the same NP as their antecedent under ellipsis. There certainly are other cases in which two elided NPs can have the same antecedent, as is shown in (18); so this possibility should be open in (17) as well.

(18) If two bishops meet, one ~~bishop~~ blesses the other ~~bishop~~.

Thus we end up with the following prediction:

(19) a. E-type theories in which the denotations of the pronouns in (17) are distinguished by extra-linguistic material allow both pronouns to have the same antecedent under ellipsis. Thus if pointing in sign language realizes ellipsis resolution (Elbourne 2005), both pronouns should be allowed to index the same antecedent (while still denoting different individuals).
b. For dynamic analyses, by contrast, coindexing is semantically interpreted, and thus the two pronouns cannot index the same antecedent given the intended truth conditions.

Let us now turn to the facts of LSF and ASL (see Sinha 2009 for relevant work on anaphora in Indian Sign Language within a dynamic framework).

3 Bishop Sentences in ASL and LSF

3.1 Standard Cases

The patterns of indexing found in standard bishop sentences in ASL and LSF are in agreement with the predictions of dynamic analyses, and contradict the version of the

E-type analysis discussed above:

(20) **ASL**
WHEN $_{a}$ONE a-MEET-b $_{b}$ONE
a. IX-a TELL IX-b HAPPY a-MEET-b (Inf 1, 2, 285; 111)
b. IX-b TELL IX-a HAPPY a-MEET-b (Inf 1, 2, 285; 111)
c. # Any patterns in which both pronominals index the same position.
'When someone meets someone, he tells him that he is happy to meet him'

(21) **LSF**
a. PRIEST $_{a}$IX $_{b}$IX ONE PRIEST a-MEET-b. $_{b}$IX BLESS-a.
'A priest met a priest. He blessed him.' (Informant **B**; 323)
b. WHEN ONE PRIEST $_{a}$CL MEETS OTHER PRIEST $_{b}$CL, a-GIVE-b book
'When a priest meets another priest, he gives him a book.' (Informant **A**; 28)

These patterns extend to cases in which several semantically parallel propositions are conjoined in the antecedent of a conditional:

(22) **ASL**
a. IF $_{a}$FRENCH MAN HERE OTHER $_{b}$FRENCH MAN HERE IX-a GREET IX-b (Informant 1, 2, 114)
'If a Frenchman were here and another Frenchman were here, he would greet him'
b. IF $_{a}$FRENCH MAN HERE OTHER $_{b}$FRENCH MAN HERE OTHER $_{c}$FRENCH MAN HERE IX-a GREET THE-TWO-b, c (Informant 1, 2, 115)
'If a Frenchman were here and another Frenchman were here and yet another Frenchman were here, the first would greet the second and the third'.

(23) **LSF**
$_{a}$PRIEST DISCUSS. ALSO OTHER $_{b}$PRIEST DISCUSS. BOOK BIBLE IX-a a-GIVE-b
'I talked to a priest. I also talked to another priest. The former gave a Bible to the latter.' (Informant **E**; 2, 69)

The latter observation matters because it has sometimes been suggested within event semantics that the thematic roles corresponding to the subject vs. object of *meet* are crucial to break the symmetry between the indefinite antecedents in examples such as (20). It does not seem that this strategy can extend to cases of propositional conjunction in (22)-(23), where the antecedents bear exactly the same thematic role – but can still be distinguished by pointing.

3.2 Intransitive Cases

Elbourne 2005 argues that in some cases a 'symmetry problem' does in fact arise in bishop sentences:

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

Elbourne argues that the contrast in (24) is predicted by his E-type analysis, but not by its dynamic competitors. Without taking a stance on the analysis of the English data, we note that such examples appear to be unproblematic in ASL – as is predicted

by dynamic analyses if pointing is the morphological realization of coindexing. Furthermore, all indexing patterns predicted by dynamic analyses are in fact realized:

(25) **ASL**
WHEN $_{a}$ONE AND $_{b}$ONE a-MEET-b
a. IX-a TELL IX-b HAPPY a-MEET-b (Inf 1, 2, 306)
b. IX-b TELL IX-a HAPPY a-MEET-b (Inf 1, 2, 306)
'When someone meet someone, he tells him that he is happy to meet him'

(26) **ASL**
WHEN $_{a}$ONE AND $_{b}$ONE AND $_{c}$ONE MEET
a. IX-a TELL THE-TWO-b, c HAPPY MEET
b. IX-b TELL THE-TWO-a, c HAPPY MEET
c. IX-c TELL THE-TWO-a, b HAPPY MEET (Inf 1, 2, 307)
'When someone meets someone, he tells him that he is happy to meet him'

4. Anaphora to Negative Quantifiers

Having determined that our sign language data favor dynamic approaches over (some) E-type accounts, it remains to see whether we can distinguish between the two main dynamic accounts. Let us remind ourselves of their main properties:

(27) a. Mixed Solution (Kamp and Reyle 1993)
-Donkey pronouns with indefinite antecedents are treated as variables which are dynamically bound.
-Donkey pronouns with non-indefinite antecedents are treated as E-type pronouns.
b. Pure Solution (e.g. van den Berg 1996, Nouwen 2003, Brasoveanu 2006)
-All donkey pronouns are treated as variables which are dynamically bound.
-Non-indefinite quantifiers introduce not just discourse referents, but also maximality conditions.

Thus the prediction of pure dynamic accounts is that the formal link between a donkey and its antecedent should be the same when the latter is indefinite as when it is non-indefinite. Mixed dynamic accounts make no such prediction. We will now show that the same formal link is used whether the antecedent is indefinite or not. This does not strictly refute the mixed account – it could be that both types of anaphoric links are realized in the same way; but it makes this account less plausible.

The striking fact, then, is that in all the following examples the very same mechanism (establishment of a locus for the antecedent, pointing towards that locus for the pronoun) is used for non-indefinite antecedents as for indefinite antecedents.

(28) **LSF**
a. LESS FIVE $_{a}$STUDENT COME PARTY. IX-a-plural STAY.
'Less than five students came to the party. They stayed.' (Informant **A**; 37)
b. PIERRE FOUR LESS $_{b}$STUDENTS. IX-b HATE IX-a.
'Pierre has less than 4 students. They hate him.' (Informant **B**; 328)

(29) **LSF**
a. IF LESS FIVE $_{a}$STUDENT COME PARTY, IX-a-plural BE-BORED
'If less than five students come to the party, they will be bored.' (Informant

C; 210)
b. IF FOUR $_a$CL-plural LESS COME CLASS DANCE, IX-a-plural HAPPY NOT
'If less than four people come to the dance lesson, they won't be happy.' (Informant **A**; 233)
c. LESSON DANCE IF $_a$PEOPLE FEW IX-a HAPPY NOT
'If few people show up at the dance lesson, they won't be happy' (Informant **E**; 2, 73c)

(The same generalizations hold in ASL.)

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All in all, then, LSF and ASL data provide evidence in favor of dynamic accounts over (some) E-type accounts; and within dynamic accounts they favor pure accounts over mixed ones (without strictly refuting the latter).

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