Long-distance reciprocals and copy-theory of anaphora*

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1. The puzzle of long-distance reciprocals

1.1. A simple analysis of the reciprocal as operating on a 2-place relation

(1) $[\![\textbf{each-other}]\!] = \lambda R_{<e,et>}.\ \lambda x_e.\ \forall y_e \sqsubset x_e.\ R(x - y)(y)$

(2) D_e contains atoms and sums (pluralities).
$x \sqsubset y$:= x is an (atomic) part of y
$x - y$:= the (largest) part of x that is disjoint from y

This gives a much simplified and idealized rendition of the truth-conditions. Many refinements are needed that are orthogonal to today's concerns. We will stick to the special case of pluralities with just two atomic parts.

(3) (a) John and Mary like each other.
(b) **[[each-other]]([[like]])([[John and Mary]])**
(c) $\forall y \sqsubset j+m$: y likes [j+m]–y
(d) The two atomic parts of j+m are j amd m. [j+m]–j = m, and [j+m]–m = j.
Therefore, (c) is equivalent to (e):
(e) j likes m & m likes j

1.2. The classic "long-distance" example

(4) John and Mary want to defeat each other.

"long-distance" LF for (4): *eo* scopes over matrix verb:

(5) J and M [each-other λ_1. want to defeat t_1]
j wants to defeat m & m wants to defeat j

This LF yields the correct meaning. But should the syntax be able to generate it?

(6) *John and Mary want Bill to visit each other.

Generally, the scope of *eo* is limited to the local clause.

1.3. Why not a short-distance analysis?

Is there another way to get the right meaning for (4), without violating this locality constraint?

"short-distance" LF for (4): *eo* scopes only over embedded verb:

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(7) [[**want**]](λx. ∀y Π x. y defeats x–y)([[**John and Mary**]])

What does (7) mean? Could this possibly be the correct meaning too?

How is the [[**want**]]-relation defined for non-atoms?

Perhaps:

(8) [[**want**]](P)(x) = 1 iff for every w' which conforms to the desires of every atom in x, P(w')(x) = 1

i.e., j+m want P iff j+m have P in all worlds in which both j and m get their wishes.

(9) predicted meaning for (7):
if j and m both get what they want, j will defeat m & m will defeat j.

Objections to this analysis:

(10) impossibility:
j's and m's desires may contradict each other. In that case, we predict vacuous truth.

(11) "crossing" scenarios:
Suppose John wants Mary to defeat him, and Mary wants John to defeat her.
(7) is predicted equally true in this scenario!

Speculation: Both objections might be overcome by independently needed refinements to the semantics of attitude reports. Relation to well-known issues:
– attitudes with contradictory contents
– obligatory *de se* reading of PRO

But at present, I don't know how to do this, particularly for the "crossing scenarios" problem.

Tentative conclusion: long-distance readings are real.

2. Long-distance readings in Heim, Lasnik & May (1990a,b)

Goal: reconcile the existence of LD readings with the fact that *eo* generally needs a local antecedent.

Basic idea: *eo* contains two anaphoric elements, one subject to locality, the other not.

Semantics of *eo* (simplified)

(12) [[**each-other**]] = $\lambda x_e.\ \lambda y_e.\ y - x$
x = "contrast argument" of *eo*, y = "range argument" of *eo*

Syntax:

(13) *eo*'s contrast argument must be coindexed with a local antecedent (subject to Binding Theory condition A).

(14) *eo*'s contrast argument must be bound by a distributive operator (**D** operator).

(15) *eo*'s range argument must be coindexed with the host of the same **D** operator which binds its contrast argument.

Semantics of the **D** operator:

(16) $[\![\mathbf{D}]\!] = \lambda P_{<e,t>}.\ \lambda x_e.\ \forall y_e \sqcap x_e.\ P(y)$

Simple example:

(17) John and Mary like each other.
LF: [J and M]$_2$ D λ_1. t_1 like eo(pro$_1$)(pro$_2$)
underlined items:
[J and M]$_2$: range antecedent (coindexed with range argument)
y t_1 : contrast antecedent (coindexed with contrast argument)
predicted meaning: $\forall y \sqcap$ j+m: y likes [j+m]–y

LD example:

(18) John and Mary want to defeat each other.
LF: [J and M]$_2$ D λ_1. t_1 want PRO$_1$ to defeat eo(pro$_1$)(pro$_2$)
[J and M]$_2$: range antecedent (not local)
PRO$_1$: contrast antecedent (local)
predicted meaning: $\forall y \sqcap$ j+m; y wants y to defeat [j+m]–y

Predictions about the distribution of LD readings:

(19) *John and Mary want Bill to defeat each other.
To satisfy (13), *Bill* would have to be contrast antecedent, but this violates (14).

(20) HLM predict:
In LD readings, the distant antecedent always binds a pronoun where a local antecedent would have to be.

(21) (a) J and M are convinced they will defeat each other.
(okay only under bound reading of *they*)
(b) *J and M are convinced that Bill will defeat each other.

Why HLM needed the stipulation in (15):

(22) The women talked to the younger ones among them about each other. (Rooth)
≠ 'The women talked to each younger woman x about the women other than x'
(contrast antecedent: trace of *the younger ones*, range antecedent: *the women*)

3. Dimitriadis (2000): problems for HLM

Problem 1: The range-antecedent sometimes would have to be extracted from an island.

(23) The people who voted for Street and Weinberg thought they would defeat each other.
intended reading: 'those who voted for Street thought Street would defeat Weinberg, and those who voted for Weinberg thought Weinberg would defeat Street'

To meet HLM's conditions, we must posit the following LF for this reading:

(24) *[Street and Weinberg]*$_1$ D_2
[the people who voted for t_2 thought *they*$_2$ would defeat eo(pro_2)(pro_1)]

Problem 2: There are reciprocals whose range argument has no antecedent at all.

(25) John and Mary said that their candidates would defeat each other.
intended reading: 'John said that his candidate would defeat Mary's candidate,
and Mary said that her candidate would defeat John's candidate'
cannot mean: *'John said his candidate would defeat Mary, and vice versa'

(26) an LF that expresses this reading:
[John and Mary]$_1$ each D_2 [t_2 said [their$_2$ candidate]$_3$ defeat eo(pro_3)(pro_4)]
where context maps 4 to the plurality [j's candidate + m's candidate]

No expression in this sentence refers to the plurality of the two candidates. Yet, this plurality appears be the denotation of the range argument. Taking *John and Mary* instead to be the range antecedent (as HLM would require) does not yield the intended reading; in fact, it yields an ungrammatical reading.

Problem 3: There are reciprocals whose contrast-argument is not bound by any D.

(27) John and Mary want each other to like each other. (Williams)[1]
intended reading: 'John wants Mary to like him,
and Mary wants John to like her'
("chained reciprocals")

(28) an LF that expresses this reading:
[John and Mary]$_1$ D_2 [t_2 want [eo(pro_2)(pro_1)]$_3$ to like eo(pro_3)(pro_1)]

But the second reciprocal here violates HLM's stipulation (14).

Dimitriadis's conclusion (informally): There are no truly "long-distance" reciprocals. The range argument is always recovered from the same local antecedent as the contrast argument.

But how?

Two steps to a solution, based on ideas of Dimitriadis (2000):

- Variables wear their ranges on their sleeves.[2]
- *eo* has the power of a variable-binder, i.e., can look at alternative assignments.[3]

[1] Not all speakers may accept this type of example. Higginbotham (1980) and HLM assumed it was ungrammatical.

[2] This step of the solution is presupposed, but not actually spelled out, in Dimitriadis (2000).

[3] Instead of this step, Dimitriadis exploits Jacobson's Variable-Free Semantics and a higher semantic type for *eo*. A deeper comparison between Dimitriadis's proposal and the present one would require more work.

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4. Step one: a copy-theory of traces and anaphoric pronouns

(sources: Fox, Sauerland, Elbourne)

(29) QR: traces as converted copies
John read every book.
move: every book λ_1. John read every book$_1$
convert trace: every book λ_1. John read the$_1$ book

(30) semantics of the converted trace:
$[\![\textbf{the}_i]\!]^g = \lambda P_{<e,t>}$: P(g(i)) = 1. g(i)
e.g., $[\![\textbf{the}_i \textbf{ book}]\!]^g$ = g(i) if g(i) is a book, otherwise undefined

(31) pronominal anaphora: pronouns as NP-deletion (e.g. Elbourne, reviving Postal)
Every boy lost his cap.
underlying: every boy lost the$_1$ boy's cap
move: every boy λ_1. every boy$_1$ lost the$_1$ boy's cap
convert: every boy λ_1. the$_1$ boy lost the$_1$ boy's cap

Distributive operators:

(32) standard view:
D takes arguments of type e (a plurality) and type <e,t> (a predicate).
Semantics of **D** introduces Π (part-of relation) to recover a predicate from the type-e argument.

(33) an alternative implementation:
D takes two arguments of type <e,t> (predicates), like ordinary Q-Dets.
Π is syntactically represented.

(34) old syntax: [John and Mary] [**D** VP]

(35) new syntax: [**D** [Π [John and Mary]]] VP

(36) QR of **D**-phrase in copy theory:
John and Mary frowned.
underlying: [**D** Π John and Mary] frowned
move: [**D** Π John and Mary] λ_1. [**D** Π John and Mary]$_1$ frowned
convert: [**D** Π John and Mary] λ_1. [the$_1$ Π John and Mary] frowned

(37) interpretation of the trace:
$[\![\textbf{the}_i \textbf{ Π John and Mary}]\!]^g$ = g(**i**), if g(**i**) Π j+m, otherwise undefined.
i.e., 'that part of j+m which is g(**i**)'

(38) distributive plural with bound pronoun:
John and Mary say they won.
underlying: [**D** Π John and Mary] say [the$_1$ Π John and Mary] won
move & convert:
[**D** Π John and Mary] λ_1. [the$_1$ Π John and Mary] say [the$_1$ Π John and Mary] won

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5. Step two: reciprocals as variable-binders

Semantics of *eo*:[4]

(39) old (HLM) analysis: *eo* has two separate arguments (contrast and range).
new analysis: *eo* has only one argument, which the semantics uses twice.
eo also manipulates the variable assignment, hence has an index.

(40) $[\![\textbf{each-other}_i\ \alpha]\!]^g = [\sigma x.\ \exists y.\ x = [\![\alpha]\!]^{g^{i/y}}] - [\![\alpha]\!]^g$
where σ is Link's sum-operator: $\sigma x.\ \phi[x]$:= the sum of all elements of $\{x: \phi[x]\}$

(41) Intuitive idea: construct the range by the following recipe:
Find all alternative values that the contrast antecedent gets under different variable assignments. Form their sum. This is the range.

Syntax:

(42) *eo*'s one argument must have a local antecedent. (cf. (13) of HLM)

(43) *eo*'s index must be bound by a **D**-operator. (cf. (14) of HLM)

Since all anaphoric pronouns are now copies of their antecedents, this applies also to the argument of *eo*.

simple example:

(44) John and Mary like each other.
underlying: [D Π John&Mary] like [eo_1 [the_1 Π John&Mary]]
move & convert: [D Π J&M] λ_1. [the_1 Π J&M] like [eo_1 [the_1 Π J&M]]

(45) computing the range:
$\sigma x.\ \exists y.\ x = [\![\textbf{the}_1\ \Pi\ \textbf{J\&M}]\!]^{g^{1/y}}$
$= \sigma x.\ \exists y.\ x = y\ \&\ y\ \Pi$ j+m
$= \sigma x.\ x\ \Pi$ j+m
= j+m

standard long-distance example:

(46) J&M want to defeat each other.
LF: [D Π J&M] λ_1. [the_1 Π J&M] want [the_1 Π J&M] to defeat [eo_1 [the_1 Π J&M]]
(semantic computation: see above)

Note that controlled PRO, as well as the argument of *eo* that it antecedes, is a copy of (the trace of) its controller. This way, the information needed to recover the range gets passed all the way down from the LD antecedent.

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[4] Thanks to Gennaro, Kai, and Danny for debugging the entry in (40).

Dimitriadis examples:

(47) J&M say their candidates will defeat each other.
LF: [D Π J&M] λ_1. [the$_1$ Π J&M] say
[[the$_1$ Π J&M]'s candidate] defeat [eo$_1$ [[the$_1$ Π J&M]'s candidate]]

(48) computing the range:
$\sigma x.\ \exists y.\ x = [\![\textbf{the}_1\ \Pi\ \textbf{J\&M's candidate}]\!]^{g^{1/y}}$
$= \sigma x.\ \exists y.\ x =$ the candidate of $[\![\textbf{the}_1\ \Pi\ \textbf{J\&M}]\!]^{g^{1/y}}$
$= \sigma x.\ \exists y\ [x =$ the candidate of $y\ \&\ y\ \Pi$ j+m$]$
$= \sigma x.\ [x =$ the candidate of m $\vee\ x =$ the candidate of j$]$
= j's candidate + m's candidate

(49) The people who voted for Street and Weinberg thought they would defeat each other.

Dimitriadis: *they* is an E-Type pronoun, basically *they = the ones they voted for*.
The implicit bound pronoun inside the E-type pronoun must be represented as a copy also.
The analysis of the sentence then parallels the one for (47).

(50) J&M want each other to like each other. (Williams' chained reciprocals)
LF: [D Π J&M] λ_1. [the$_1$ Π J&M] want
[eo$_1$ [the$_1$ Π J&M]] to like [eo$_1$ [eo$_1$ [the$_1$ Π J&M]]]

(51) computing the ranges:
1st *eo*: range = j+m (see above)
hence $[\![\textbf{eo}_1\ \textbf{the}_1\ \Pi\ \textbf{J\&M}]\!]^g$ = j+m – g(1), if g(1) **Π** j+m, otherwise undefined
2nd *eo*: $\sigma x.\ \exists y.\ x = [\![\textbf{eo}_1\ \textbf{the}_1\ \Pi\ \textbf{J\&M}]\!]^{g^{1/y}}$
$= \sigma x.\ \exists y\ [\ x =$ j+m – y $\&\ y\ \Pi$ j+m $]$
$= \sigma x.\ [\ x =$ j+m – m $\vee\ x =$ j+m – j $]$
= j+m

In all above LFs, *eo* is coindexed with a variable in its argument. In simple and standard LD cases, this variable is the argument itself. In Dimitriadis' cases, it is further embedded within the argument.

Do we have to stipulate that *eo* is coindexed with something in its argument? No. Semantic anomaly will result when it isn't.

(52) Suppose **i** does not occur in α. Then:
$[\sigma x.\ \exists y.\ x = [\![\alpha]\!]^{g^{i/y}}] - [\![\alpha]\!]^g =$
$[\sigma x.\ \exists y.\ x = [\![\alpha]\!]^g] - [\![\alpha]\!]^g =$
$[\sigma x.\ x = [\![\alpha]\!]^g] - [\![\alpha]\!]^g =$
$[\![\alpha]\!]^g - [\![\alpha]\!]^g$ undefined!

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6. Discussion

- If this is on the right track, it adds more evidence for the need for "informative" traces and anaphors.
- But the mechanism employed in the entry of *eo*, which both binds a variable and leaves it free, is powerful and unusual.
- There is also no explanation for the fact that *eo*'s antecedent always is plural. Is it plausible that this is a purely syntactic/morphological requirement?

(53) John and Mary say their [ok]candidates/*candidate will defeat each other.

Note that the analysis in (47)/(48) did not interpret plural on *candidates*.

Outlook: We should try harder still to make suitable sense of LFs like (7) above. Maybe then we can explain long-distance readings away as plain short-distance readings, after all.

Main reference:

Dimitriadis, Alexis (2000) *Beyond Identity: Topics in Pronominal and Reciprocal Anaphora*, Universtity of Pennsylvania PhD thesis (available on author's website)