Foundations of Semantics: Binding and Anaphora

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1 Binding & co-reference

(1) a. John adores his friends. co-reference
b. { Every / No } actress adores her friends. binding

Bound pronouns are like variables:

(2) Every actress$_i$ thinks she$_i$ is beautiful. $\sim \forall x[actress(x) \rightarrow think(x, beautiful(x))]$

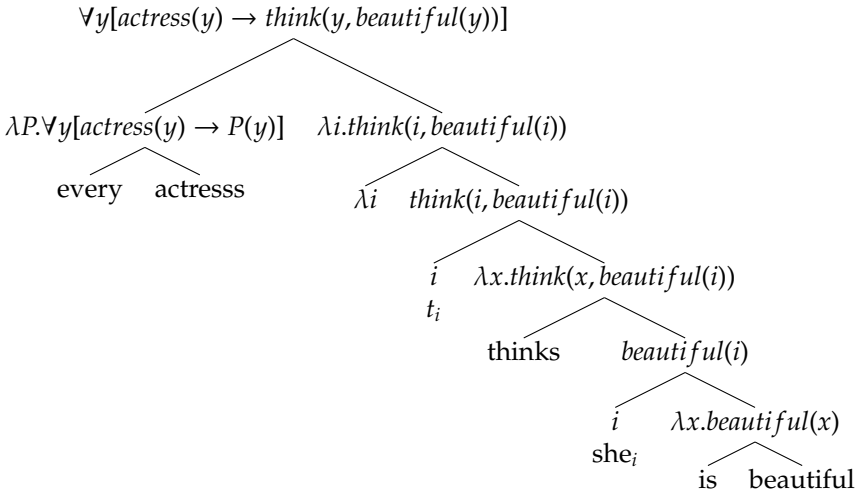
Descriptively, we may use indices to indicate what reading we are after:

(3) a. John$_i$ adores his$_i$ friends $\sim$ John adores John's friends
b. John$_i$ adores his$_j$ friends $\sim$ John adores the friends of (say) Bill

(4) a. Every actress$_i$ adores her$_i$ friends.
b. Mary$_j$ is very influential. Every actress$_i$ adores her$_j$ friends.

Indices may also have a more technical use. For instance, it is standard to assume that co-indexed nodes in a logical form share the same variable name. You can use this for pronouns, if we assume co-indexation with a quantifier involves co-indexation with the lambda abstraction caused by QR.

(5)



Even (6-a) can be seen as involving variable-binding.

(6) a. John adores his friends.

b. [John [λi [t_i [adores [his$_i$ friends]]]]]

Note that this doesn't mean co-reference does not exist. Cases like (7) are evidence that some cases of anaphora are only co-referential.

(7) John$_i$ came in. He$_i$ sighed.

But is there any evidence that LFs like (6-b) really occur? To show that the answer is 'yes', we need to look at ellipsis cases. First, consider the following principle:

> **Ellipsis and LF identity** — A constituent may be deleted at PF only if it is a copy of another constituent at LF.

(8) John owns a blue sweater. Bob doesn't.
a. Bob doesn't own a blue sweater.
b. #Bob doesn't own a sweater.

Now consider a case of ellipsis that involves a pronoun:

(9) (Guess what Bill told me!) John visited his mother. But Luke didn't.

Available readings:

(10) a. John visited Bill's mother. Luke didn't visit Bill's mother.
b. John visited John's mother. Luke doesn't visit John's mother.
c. John visited John's mother. Luke doesn't visit Luke's mother.

Not available:

(11) a. #John visited Bill's mother. Luke didn't visit John's mother.
b. #John visited Bill's mother. Luke didn't visit Luke's mother.
c. #John visited John's mother. Luke didn't visit Bill's mother.
d. etc.

Let us first look at cases of co-reference.

(12) a. Guess what Bill$_i$ told me! John$_j$ visited his$_i$ mother. But Luke$_l$ didn't ~~visit his$_{i/*j//*l}$ mother~~.
b. Guess what Bill$_i$ told me! John$_j$ visited his$_j$ mother. But Luke$_l$ didn't ~~visit his$_{*i///*l}$ mother~~.

This accounts for the reading in (10-a) (that is, (12-a)) and the reading in (10-b) (that is, (12-b)). It excludes the unavailable readings in (11-a), (11-b), etc. Not however, that it also excludes the available reading in (10-c). This is the so-called *sloppy identity reading*. On closer inspection, however, this reading is only excluded as a case of co-reference. It is expected to arise if we treat the proper names as quantifiers binding the pronouns.

(13) [John [λk [t_k visited [his$_k$ mother]]]]
[Luke [λk [t_k [didn't [~~visit [his$_k$ mother]~~]]]]]

2 Beyond binding and co-reference

Bound pronouns need to be c-commanded by their antecedent:

(14) The woman who met every boy$_i$ didn't like him$_{*i}$.

This particular example does not allow a bound interpretation since the QR-ed version (which would create a c-command relation) is prohibited by constraints on movement.

Peter Geach's donkey sentences:

(15) a. Every farmer who owns a donkey$_i$ beats it$_j$.
b. $\forall x \forall y[farmer(x) \wedge donkey(y) \wedge own(x, y) \rightarrow beat(x, y)]$

Problem 1: no c-command
Problem 2: the relative clause is an island for movement
Problem 3: *a donkey* suddenly appears to contribute a universal quantifier

Geach himself proposed that pronouns are (almost) always like bound variables and that the puzzle with donkey sentences is why indefinites are sometimes like universal quantifiers.

Gareth Evans' e-type pronouns: a generalisation on pronouns like those in donkey sentences. In general, a pronoun is often called e-type if it is not bound, nor co-referential.

(16) Mary owns a donkey$_i$. John hates it$_i$.

E-type pronouns form a semantic challenge. It was standard, following Russell (1905), to think that indefinite descriptions correspond to existential quantification.

(17) $\exists x[donkey(x) \wedge own(m, x)] \wedge hate(j, x)$

The pronoun in (17) cannot be bound (it is out of the scope of the quantifier), nor can it co-refer (the quantifier does not refer).

Notice that e-type pronouns are specific to indefinite antecedents:

(18) a. A man$_i$ came in. He$_i$ sighed.
b. Every actress$_i$ arrived late. She$_{*i}$ missed the bus.

One solution is to assume that there is a fundamental distinction between existential and universal quantification: existential quantification is in some sense referential. (Kamp 1981; Heim 1982). For instance, one could change predicate logic in such a way that (19-b) holds, which turns (16) into a case of variable binding.

(19) a. $\forall x[\varphi] \wedge P(x) \not\Leftrightarrow \forall x[\varphi \wedge P(x)]$
b. $\exists x[\varphi] \wedge P(x) \Leftrightarrow \exists x[\varphi \wedge P(x)]$

Evans' own solution was different. E-type pronouns do not co-refer, nor are they bound, rather their reference is recovered from the context:

(20) A man$_i$ came in. He$_i$ sighed. he ~ the man who came in

(21) Every man$_i$ who owns a donkey beats it$_i$.
   a. For every x who owns a donkey: x beats it.
   where *it* refers to the donkey(s) owned by x

In other words, *it* is co-referential, but only in each instance of the sentence 'x beats it'. Evans' theory begs the question of how the reference of a pronoun is recovered and which constraints govern this process. It turns out important to have a good theory of how the underlying definite description is recovered. A purely pragmatic theory where the definite description is formed out of whatever material is salient will not do. This is because there is a *formal link* between pronouns and what they refer to.

(22) (Heim 1982)
   a. Every man who has a wife is sitting next to her.
   b. ??Every married man is sitting next to her.

(23) (Heim 1982 via Partee)
   a. I dropped ten marbles and found all except for one. It's probably under the sofa.
   b. I dropped ten marbles and found only nine of them. ??It's probably under the sofa.

Evans himself believed that the reference of a pronoun corresponds to that of a definite description that is recovered from the antecedent and the clause the antecedent occurs in.

(24) a. A man came in. The man who came in sighed.
   b. Every man who owns a donkey beats the donkey(s) he owns.

Discuss the following examples in terms of Evans' theory.

(25) If a bishop meets a bishop, he greets him.

(26) Every student wrote a paper. They each sent it to a journal.

(27) Every student wrote an essay. They were very good.

(28) Most students came to my party. They had a good time.

(29) Very few students came to my party. They were too busy preparing for their exams.

(30) Every chess set comes with a spare pawn. It is taped to the box.

(31) a. A wolf might come in. #It has sharp teeth.
   b. A wolf might come in. It might eat you.

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