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Anaphora #212

Introduction

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pronouns#variables#coreference#discourse#quantification

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Anaphora refers to referentially dependent expressions in natural language which contribute their meaning by identifying another expression to give them their semantic value.

1. Introduction

Anaphora, in its primary instances, is the establishment of a referential dependency between two (or more) expressions. The pronoun *him* in the example below is one such instance of anaphora:

Mark felt that there was someone watching *him*.

On the understanding that *him* refers to Mark, the pronoun is the *anaphor* and the expression *Mark* is the *antecedent*. Both expressions refer to the same individual. The relationship between these expressions is not an equal one, however, since the reference of the pronoun is dependent upon the reference of its antecedent, whereas the reference of the

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be distinguished from the phenomenon of *accidental coreference*. This occurs when two independently referring expressions happen to refer to the same individual. So, for instance, in the following example the two italicized expressions will be coreferential, "accidentally", just in case the president of the company is also the company's best employee:

The president of the company rewarded the best employee.

This requires an understanding where the company has a self-rewarding president, but there is no anaphoric connection established between the expressions. Thus, anaphora is a matter of coreference, and something more.

2. Anaphor-antecedent relations

Anaphors depend upon their antecedents to determine their referential content. One reflection of

coreferentially, the pronoun would c-command its antecedent, and a referential connection cannot be established. The reference for the pronoun in these instances needs to be determined by other means, such as finding a another, appropriate antecedent for it, or by providing it with a *deictic* interpretation (see Section 5).

One class of pronouns that has also received extensive attention is that of *reflexive pronouns*, exemplified below:

We found *ourselves* with too much to do.

The professor taught *herself* French.

These differ from the other personal pronouns in important respects. Primarily, the syntactic relation to their antecedents are much more limited. In general, reflexive pronouns may only have antecedents within the same clause, though

when the antecedent Noun Phrase has a clear referential value, as with proper names.

The dean who placed *no student* on probation told *her* to check back in the fall.

The dean who placed *Hillary* on probation told *her* to check back in the fall.

The first sentence has no bound variable interpretation, because the antecedent is in a syntactic position which precludes this possibility. The relation that must hold, in the case of bound variable readings, is for the antecedent Noun Phrase to c-command the pronoun.

The phenomenon of anaphora is much broader than the personal pronouns discussed thus far. One form of anaphora that has received much attention is *temporal anaphora* (Partee, 1984). This applies not only to pronouns referring back to time Noun Phrases,

The mail arrived *this morning*. I was at home *then* (=this morning)

but also to the time introduced by the *tense*

3. Discourse anaphora

"Discourse" is the normal mode of communication: the use of more than one independent sentence or utterance put together in a way that "makes sense". The discussion above was limited to those instances of anaphora that take place within the boundaries of a sentence. Anaphora takes place across sentence boundaries as well. Many instances of anaphora that appear within sentence boundaries take place as well in discourse.

Several team members were suspended. Reportedly, *they* had missed a practice.

Most people want to *win a million dollars*. Doris doesn't ____.

Certain cases of anaphora that occur within the boundaries of a sentence do not function as discourse anaphors. For instance, the phenomena of reflexive pronouns, gapping, relative pronouns, and bound variable anaphora do not appear to be able to function this way.

One treatment of discourse anaphora is to treat all such pronouns as *free variables*, which are assigned a reference independently by an *assignment function*, which designates a referential value for any free variables within its domain (e.g. Cooper and Parsons, 1976). It becomes coreferential with a Noun Phrase in a previous sentence by virtue of being assigned the same reference [see also the contribution on Dynamic Semantics]. So, if a function assigns the same referential value as the proper name *Leonard* has, to the pronoun *he* in the following sentence, then a coreferential reading arises.

Leonard is a famous conductor. *He* writes operas.

On the other hand, if *he* is assigned a different value (e.g. Fred), then the discourse will be understood as saying that Fred writes operas, and no coreferential reading will occur. All phrases that the pronoun is coreferential with must have a reference value in the first place, if this is to be the appropriate analysis. The case of indefinite Noun Phrases in discourse raises questions, though. Indefinite Noun Phrases are those which appear with a number of different determiners, most prominently the indefinite article *a(n)*. Such noun phrases can be "referred back to" by anaphors in discourse.

A man walked into the room. *He* sat down.

Most researchers, however, question whether an indefinite Noun Phrase should be properly assigned a reference value (Kamp, 1981). This is because the reference value determines the truth-conditions of the sentence, and if one assigns a certain individual as the reference of *a man* in a sentence such as the one above, then it would be true if that *particular* man walked into the room, and false if he did not (regardless of whether any other man walked in). However, these are not the truth-conditions for such a sentence, since (an utterance of) the sentence will be true if any man whatsoever walked into the room (and false only if no man at all did). If one assigned a reference for *a man* as some particular man, one could not characterize these truth conditions. It appears that the truth-conditions of the sentences are best represented quantificationally, with an existential quantifier binding a variable:

$\exists x [\text{man}(x) \ \& \ x$

taken to be the meaning of the indefinite article. However, the only consistent representation available is essentially as follows:

$\$x$ [donkey(x) & Every farmer who owns x beats x]

The truth-conditions of this (which are directly reflective of the meaning), however, are very different from the truth-conditions of the sentence itself. This formula is true just in case there is some donkey or other that every owner of it beats, which is

This approach raises issues of its own, as illustrated in the following sentence.

There is a man in the garden. The dog is barking at *him*.

The "There is..." construction in English quite plausibly introduces an existential quantifier of its own, rendering the variable contributed by "a man" unavailable for binding by text closure. But the pronoun in the second sentence could be bound by text closure. If this is so, then the text would have the meaning "Some man is in the garden. The dog is barking at someone." Another problem with text closure is that the representation:

$$\exists x [\text{man}(x) \ \& \ x \text{ is in the garden} \ \& \ \text{the dog is barking at } x]$$

will be true also in cases where there are more men in the garden than just one. However, the original text means--or possibly strongly implies--that there is one and only one man in the garden.

Evans (1980) has argued that there is a need for still another category of pronoun, which he calls *E-type pronouns*. These pronouns, like the bound variable and coreferential pronouns, share all the same forms, but function differently: they are disguised definite descriptions, picking out a unique individual given the information present in the context. Informally, the analysis of the pronoun *him* would be:

the There is a man in the garden. The dog is barking at him (= *the man that is in the garden.*)

Since these descriptions can contain pronouns, or variables of isnce

4. Identity of Sense and Identity of Reference Anaphora

A traditional distinction is made between what are called "Identity of sense" and "Identity of reference" anaphora. The distinction between sense and reference goes back to the writings of the philosopher Gottlob Frege. In the case of Noun Phrase meanings, this distinction concerns whether the individuals designated by the antecedent and the anaphor must be interpreted as identical. So, in the first example below the cars driven by Lyle and Maria must have been the same; however, in the second example they need not:

Lyle drove *a car*. Maria drove *it*, too.
Lyle drove *a car*. Maria drove *one*, too.

The difference between the anaphors *it* and *one* (the latter taking a noun meaning as its antecedent) would seem to suggest that anaphors themselves fall into these two classes. While this is so to a certain extent, many instances of anaphora can be identified in which the same form can play both roles. Consider the following:

The President (of the United States) walked off the plane. *He* waved to the

Zelda will *get up early* if Harry does_____.

The question that arises in this case is whether verb phrases themselves have a sense/reference distinction in their meanings to begin with. If, for instance, verb phrases have individual events as

proposal that attempts to deal with this phenomenon (Grosz, Joshi, and Weinstein, 1995).

Another area requiring pragmatic knowledge to resolve reference of anaphora is *bridging inferences* (Clark 1975). The listener or reader must make use of real-world knowledge to appropriately interpret a definite noun phrase. For example:

John bought *a new car*. *The engine* was painted bright red.

Here, one knows that the engine is the engine in the car that John bought, making use of real-world knowledge that cars have engines.

Much work in "pragmatic anaphora" focuses not on the process of selecting an appropriate antecedent from candidates given in the text or discourse, but on instances where the sentence or discourse itself provides no possible

Most (but not all) instances of anaphora may be pragmatically controlled, including certain instances of reflexive pronouns and *logophoric* pronouns. These are pronouns, indicated by specialized forms in some languages, which are canonically used in indirect discourse to make reference to the person whose speech is reported (e.g. "Ariel said that *he*[logophoric] was going to write a paper.") Below are instances of other types of anaphora that may be controlled pragmatically:

[Picking up a coat from the coat-check attendant] "*This* is torn!"

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For further reading

Chomsky, N.

donkey anaphora: instances where the appropriate anaphor-antecedent relation cannot be expressed as a formula of classical logic. This is so in instances such as "Every farmer who owns a *donkey* beats *it*."

gapping: a form of null anaphora where the antecedent is a verb or verb complex in a previous conjoined sentence (e.g. "Rich *will review* your proposal, and you, ___ Rich's proposal."

sluicing: a form of null anaphora which replaces an indefinite noun phrase in a previous sentence with a question word, with anaphora to the remainder of the previous sentence (e.g. "*I heard* someone *come into the office*, but I don't who ____ (i.e. who *I heard come into the office*).

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