Multiply quantified sentences and scope

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1 Multiply quantified sentences

So far we have only discussed the interpretation of sentences containing one quantifier phrase. But of course many sentences of English contain more than one. Consider, for example, 'Every cat loves a dog.'

Sentences like this seem to be associated with more than one tree in our semantics; nothing in the transformation rule distinguishes between the two quantifier phrases. What trees are associated with the above sentences?

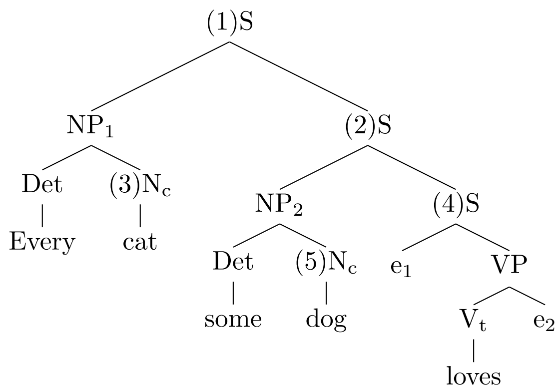
Sentences like this give rise to two questions which we don't yet know how to answer:

1. How do we derive the truth conditions of trees like this?
2. When we have sentences like this which seem to be associated with more than one tree, how do we tell which tree gives the real logical form of the sentence?

We'll discuss these questions in turn.

2 Scope and truth conditions

Consider the following tree:



How can we derive its truth conditions?

Here we have two quantifier phrases. One – 'every cat' – has large scope with respect to the other – 'some dog.' This means that the first branching node which dominates 'every cat' is not the first branching node which dominates 'some dog', but does dominate it. When this is the case we say that the first quantifier has wide or large scope relative to the latter quantifier, and, conversely, that the latter quantifier has narrow or small scope relative to the first quantifier.

A good first step is to start with the quantifier which has largest scope, and work our way from there. We already know how to do this. Our rules for last time tell us that:

$$[\![(1)]\!]^{M,g}{=}1 \text{ iff for all } u \in U, \text{ if } u \in [\![(3)]\!]^{M,g}, \text{ then } [\![(2)]\!]^{M,g^{[u/e_1]}}{=}1$$

But how do we go from here?

The answer is that our rules from last time already tell us how to do this. Just as we use

$$g^{[u/e_1]}$$

to mean 'the assignment which differs from g only in assigning u as the value of e_1', we can use

$$g^{[u/e_1[u*/e_2]]}$$

to mean 'the assignment which differs from the assignment which differs from g only in assigning u as the value of e_1 only in assigning $u*$ as the value of e_2.' Given the lexical entry for 'a', this lets us derive:

$$[\![(1)]\!]^{M,g}{=}1 \text{ iff for all } u \in U, \text{ if } u \in [\![(3)]\!]^{M,g}, \text{ then for some } u* \in U,\ u* \in [\![(5)]\!]^{M,g} \text{ and } [\![(4)]\!]^{M,g^{[u/e_1[u*/e_2]]}}{=}1$$

How would you go from there?

What would the corresponding formula be for the other tree we considered for our original sentence? Do these assign the two trees different truth conditions?

3 Scope ambiguities in English

This leaves open the question, when we are given a sentence containing multiple quantifier expressions, of how to determine which of these have large scope relative to which other ones. Recall our sentence

> Every cat loves some dog.

One view is that this is ambiguous, and that the ambiguity is traceable to a distinction between two trees – two syntactic structures – that might be associated with that sentence. When this is the case, let's say that a sentence is syntactically ambiguous. (This is to distinguish it from lexical ambiguities like 'John went to the bank', which are not due to the sentence being associated with structurally distinct trees, but rather to the lexicon assigning more than one meaning to one of the expressions in the sentence.)

If multiply quantified sentences are syntactically ambiguous, then we don't need rules to decide which tree is associated with a multiply quantified sentence; all of the different scope disambiguations are acceptable trees for that sentence.

The problem is that at least some standard tests for syntactic ambiguities don't confirm the view that our sentence is syntactically ambiguous. These are 'constituency tests', which are various ways of identifying the constituents of a sentence. Consider the sentence

> John hit a boy with a pair of binoculars.

This sentence is syntactically ambiguous, and this can be shown by constituency tests. One constituency test is based on the idea that only constituents of a sentence can be joined together with 'and.' The fact that, on one interpretation, the above sentence follows from

> John hit a dog, a boy with a pair of binoculars, and a girl.

suggests that, on that interpretation, 'a boy with a pair of binoculars' is a constituent of the sentence. A different constituency test is the 'answer' test, which relies on the principle that only constituents of a sentence can be questioned. The fact that the above sentence can be an answer to

> How did John hit a boy?

suggests that ‘with a pair of binoculars’ is a constituent of the sentence, on that interpretation. But it is hard to show that there is a syntactic ambiguity in ‘Every cat loves some dog’ using constituency tests; and this fact casts some doubt on the claim that there really is a syntactic ambiguity here.

This leaves open two possibilities: either the ambiguity in our sentence is a lexical ambiguity, or there really is no ambiguity, and the appearance of an ambiguity is due to pragmatic effects.

We’ve already briefly discussed the first possibility. The second possibility is most naturally carried out by saying that the tree associated with ‘Every cat loves some dog’ gives ‘every cat’ wide scope, and that the other (stronger) reading is sometimes pragmatically conveyed. But then we need general rules to tell us which quantifiers should get wide scope in which English sentences.

You might think: the first one (leftmost one) should get wide scope. That does work for the above sentence, but does not work for others:

> There was a name tag near every plate.
> A flag hung in front of every window.
> A student guide took every visitor to a museum.

The difficulty of giving a general theory of this sort which delivers the right results is one reason for positing a syntactic ambiguity here.

4 Quantifiers and negation

We get scope ambiguities, not just with multiply quantified sentences, but also with sentences which contain both a quantifier phrase and a sentence operator like ‘It is not the case that.’ Consider, for example,

> It is not that case that some cat is cute.

What two trees correspond to this sentence? Do they differ in truth conditions?

5 Scope and the puzzle of nonexistence

Scope relations between quantifiers and negation have been the source of philosophical confusion. In fact, Russell (1905) argued that one of the oldest philosophical puzzles – the puzzle of non-existence – could be dissolved simply by noticing these scope ambiguities. Consider the sentence

> The golden mountain does not exist.

This sentence appears to be true. But it also seems to say that the golden mountain has a certain property – namely, the property of not existing. (Or, if this is not a property, at least that it is a member of the set of non-existing things.) But surely for a thing to have a property, or be a member of a set, it must have being. Hence, there is a golden mountain.

Arguments of this sort have been used to argue for the surprising conclusions that change is impossible (Parmenides) and that there is a distinction between being and existence, so that there are some non-existent things (Meinong (1960)).

Russell thought that the key to responding to these arguments was to begin by giving an adequate logical analysis of problematic sentences like the one above. (These are called 'negative existentials,' since they negate existence claims.) And, once we do that, he thought, we come to see that this sentence is ambiguous. On one interpretation, it is true, but does not lead to any surprising results. On the other interpretation, the sentence is false. The idea that the sentence is both true and implies metaphysically surprising conclusions is just due to a failure to see that the sentence is ambiguous.

References

Alexius Meinong, 1960. On the Theory of Objects (Translation of 'Über Gegenstandstheorie', 1904). In *Realism and the Background of Phenomenology*, edited by Roderick Chisholm, 76–117. Free Press.

Bertrand Russell, 1905. On Denoting. *Mind* 14:479–493.