

Modals

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1 SYNTAX OF MODALS

Sometimes, in English, modals seem to combine with sentences to form sentences, as in

Necessarily, $2+2=4$.

It is possible that the number of beer bottles on Notre Dame's campus is odd.

Other times, though, devices for expressing modality seem to occur as parts of verb phrases, as in

John must die.

No dog can play chess.

These also seem to be claims about necessity and possibility in some sense.

I'll follow the text in treating these uses of modal expressions in pretty much the same way we treated tense, and thinking of them as undergoing movement, and functioning syntactically like sentence operators. Hence we can think of the logical form of the first sentence above as roughly [_S must [_S John dies]].

2 SEMANTICS FOR MODALS

One confusing aspect of modal expressions in English is that they appear to have different interpretations. A good example is the word ‘must.’ Consider the following three sentences:

The smallest prime number greater than 10 billion must be odd.

The murderer must have been in Malloy Hall at midnight.

Students must respect, indeed revere, their professors.

Here ‘must’ seems to have a different meaning in each sentence. These are examples of, respectively, alethic, epistemic, and deontic uses of ‘must.’ As you might expect, each of these uses must get a different semantic treatment.

2.1 Alethic modals

Alethic uses of modals make claims about how the world could (or could not) be. Alethic modals are naturally interpreted in just the way that we interpreted ‘ \Box ’ and ‘ \Diamond ’ when we introduced intensionality. So a first step would be to divide alethic modals into devices for expressing possibility (‘can’, ‘might’, ‘could’) and devices for expressing necessity (‘must’) (keeping in mind that these same words can be used to express something other than alethic modality), and then to treat them with the same semantics suggested before. So we have

$$\begin{aligned} \llbracket \text{must } S \rrbracket^{M,w,i,g} = 1 & \text{ iff for every } i^* \in I \text{ and every } w^* \in W, \llbracket S \rrbracket^{M,w^*,i^*,g} = 1 \\ \llbracket \text{can } S \rrbracket^{M,w,i,g} = 1 & \text{ iff for some } i^* \in I \text{ and some } w^* \in W, \llbracket S \rrbracket^{M,w^*,i^*,g} = 1 \end{aligned}$$

Does this capture every alethic use of, for example, ‘can’t’? How about

Cats can’t talk.

This sentence corresponds to two trees, depending on whether ‘can’ or ‘not’ takes wide scope. Does either get the truth conditions of the sentence right? Does the preferred reading of this sentence really imply that there is no possible worlds where cats talk?

One way to approach this sort of sentence is by thinking of them as a kind of counterfactual conditional – which is another way of expressing claims about alethic modality which we have not yet discussed. Consider the sentence

If cats could talk, they would say profound things.

How might we understand the truth conditions of this sentence in the sort of framework we have been developing?

Using counterfactuals, is there a way to understand the truth conditions of ‘Cats can’t talk’? One might try something like

It is not the case that, if cats tried to talk, they would.

Can you think of any counterexamples to this analysis of ‘can’ and ‘can’t’ sentences? How would it fare with respect to

Jeff can’t speak Russian.

Jeff can’t make a free throw.

A different sort of example is

Massive objects must attract each other.

Could we understand this as a claim about truth in some subset of the possible worlds – perhaps all the worlds that meet a certain condition?

2.2 Epistemic modals

The second use of ‘must’ above seems to express a claim which has something to do with our knowledge. The claim is not that the murderer is in Malloy Hall in every possible world, but rather, intuitively, something more like the claim that the murderer is in Malloy Hall in every world compatible with what we know about the situation.

Let’s call the set of propositions we know about the situation K . We might try to write out this truth condition in something like the following way:

[[The murderer must have been in Malloy Hall at midnight]] $^{M,w,i,g=1}$ iff for all w^* in W and all i^* in I , if every member of K is true in w^* at i^* , then [[The murderer was in Malloy Hall at midnight]] $^{M,w^*,i^*,g=1}$

We could then apply our usual treatment of tense to derive the truth condition for this sentence (even if it contains expressions, like prepositional phrases, that we don’t know how to handle yet).

But this leaves us with a puzzle: where did K come from? If our semantics is going to be compositional, we need some principled way of finding the relevant set of truths. The fact that the truth condition involves some such set of truths will presumably be part of the lexical entry for the epistemic modal ‘must’ – but it seems that the particular set of truths which gets into the truth condition will vary from context to context.

For example, I might say, at the beginning of the inquiry,

The murderer might have been in Decio at midnight.

and it seems that this could well be true. Then, as more information comes in, and we know more about the case, I might say, truly,

The murderer must have been in Malloy at midnight.

and, at this stage, the sentence about Decio which was true will now be false. Apparently, to give a satisfactory treatment of epistemic modals, we need to be able to explain in our theory the way in which semantic values sometimes depend on a context of utterance. This is something which we will address in a few weeks.

One interesting consequence of the above sort of analysis is that it implies a connection between alethic and epistemic modals. In particular, it seems to imply that ‘must S’ in the alethic sense implies ‘must S’ in the epistemic sense. Can you see why? Is this problematic?

2.3 Deontic modals

In effect, the suggestion above was to understand epistemic modals by restricting the set of relevant worlds in a certain way. Deontic modals, like

Students must respect, indeed revere, their professors.

involve the notions of permission and obligation. Can you think how these might, similarly, be understood using restrictions on the set of possible worlds?

3 MODALS, QUANTIFIERS, AND SCOPE AMBIGUITIES

Consider the sentence

The greatest mathematician is necessarily a mathematician.

Our discussion of modals so far suggests that, in a sentence like this with a quantifier phrase and a modal which will undergo movement, we should get an ambiguity in this sentence depending on whether the modal, or the quantifier, has wide scope. Do we? What are the two interpretations?

Brief discussion of Quine’s objection to the intelligibility of the interpretation on which the description has wide scope.