

# A Predicativist Semantics of Modals based on Modal Objects

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## Abstract

I will outline a novel ‘predicativist’ semantics of modals in natural language, by focusing not on possible worlds and quantifiers ranging over them, but on what I will call modal objects and their satisfaction conditions.

## 1 The standard view and the predicativist view of modals

On the standard view, modal expressions, modal verbs and adjectives, act semantically as quantifiers ranging over a (contextually restricted) set of possible worlds. Modals of necessity on the standard view represent universal quantifiers ranging over worlds, whereas modals of possibility represent existential quantifiers ranging over world. Thus the logical forms of (1a) and (1b) will be as in (2a) and (2b) respective:

- (1) a. John may leave.  
b.  $\exists w (w \in f(w_o) \ \& \ [John \ leave]^w = \text{true})$
- (2) a. John must leave.  
b.  $\forall w (w \in f(w_o) \rightarrow [John \ leave]^w = \text{true})$

Following Kratzer(1977) , the different readings of modal expressions (dentic, epistemic circumstantial etc) are generally accounted for by restricting the set of worlds to a contextually given modal base and ordering source. For motivating the present approach to modals, it is first useful to take into consideration not just modal auxiliaries such as may and must, but the full range of modal predicates in English:

- (3) a. might, may, must, should (modal auxiliaries)
- b. ought to, need to, have to (modal verbs)
- c. is possible that, is necessary that, is able to, is capable of (modal adjectives)

There are two semantic issues regarding modal predicates that the standard account does not address, but that bear on the present approach:

- [1] What do nominalizations of modal predicates describe?
- [2] What if any is the Davidsonian (event) argument of modal predicates?

The present view is that the answers to 1 and 2 will shed light on the semantics of modal verbs and motivate the view that modals are predicates of ‘modal objects’, the Davidsonian arguments of modal predicates.

What are modal objects? Modal objects are the sorts of entities we would refer to with nominalizations of modal predicates, that is, entities we refer to as an ‘obligation’ as a ‘permission’, as a ‘possibility’, a ‘necessity’ and ‘an ability’. Some modal verbs, in particular modal auxiliaries do not come with nominalizations that could serve to refer to modal objects. Nonetheless they will involve modal objects in their semantics. I take modal objects to be the implicit, Davidsonian arguments of modal predicates. Modal objects as implicit argument of modal predicates are the things adverbials are predicated of. However, modal objects are not events or states. They differ in their properties from the latter, in particular in being able to in having satisfaction conditions and thus satisfiers (or violators).<sup>1</sup> An obligation can be fulfilled and an invitation accepted, but not so for a state or event. Modal objects are in that respect on a par with certain cognitive and illocutionary products, in the sense of Twardowski’s (1911) distinction between actions and products (see also Moltmann 2013, Chap. 4 and Moltmann 2014, to appear). Cognitive products are the nonenduring products of cognitive act. Thus a judgment is the cognitive product of an act of judging and a decision is the cognitive product of an act of deciding. Similarly, a command is the illocutionary product of an act of commanding, and a promise the illocutionary product of an act of promising. A command can be complied with, but not the act of commanding and a promise can be broken, but the act of promising. Some modal objects are also products of illocutionary acts. Thus an obligation may be the product of an act of commanding or an act of promising, and a permission the product of an act of offering. Such modal objects thus are modal products. Modal products also include laws, the products of acts of declaration or passing. Note that laws are entities not tied to particular nominalizations. Not all modal objects are the products of intentional acts, though. Some modal objects exist without the intentionality of an agent, for example abilities and perhaps metaphysical and logical necessities and possibilities.

The semantic proposal then is that (4a), with a modal of necessity, has roughly the logical form of (4b), namely as in (4c):

- (4) a. John needs to leave.
- b. John has a need to leave.
- c.  $\exists d(\text{need}(d) \ \& \ [\textit{John to leave}](d))$

A modal of possibility as in (5a) leads to the very same logical form, namely as in (5c), which is also roughly, the logical form of (5b):

- (5) a. John is permitted to leave.
- b. John has a permission to leave.
- c.  $\exists d(\text{is permitted}(d, \text{John}) \ \& \ [\textit{John to leave}](d))$

In fact, there are even syntactic arguments in favor of the logical form in (4c) and in (5c). Thus, Harves / Kayne (2012) argue that the sentence (14a) is derived from (14b), with the noun *need* being prior in the linguistic derivation to the verb *need*.

The logical form of modal sentences with modal auxiliaries will similarly be as below:

- (6) a. John must help.
- b.  $\exists e(\text{must}(e) \ \& \ [\textit{John help}](e))$

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<sup>1</sup> The ability of modal objects to have satisfaction conditions is reflected in natural in the *by*-locution, as below:

- (1) a. John’s need was fulfilled by having X be done.
- b. The obligation was met by doing X.

- (7) a. John may leave.  
 b.  $\exists e(\text{may}(e) \ \& \ [\text{John leave}](e))$

## 2 Truthmaker semantics for modals

How can clauses act predicates of modal objects? On the present view they do so by specifying the truthmaker and falsifiers or better satisfiers and violators of the modal object in roughly the sense Kit Fine's (2012, 2014, to appear) truthmaker semantics. Central on Fine truthmaker semantics is the notion of exact truthmaking or satisfaction, which, for Fine, holds between an action or situation and a sentence  $S$  iff  $s$  is wholly relevant for the truth of  $S$ . I will apply the notion of exact truthmaking/satisfaction also to modal objects (as well as cognitive and illocutionary products). Thus, satisfiers of a modal object are situations or actions fulfilling or complying with the condition associated with the modal object, and as such they should be exact satisfiers of the modal object, in the sense of Fine's exact truthmaking relation. Violators of modal objects are situations or actions incompatible with or contravening the condition associated with the modal object. Thus, John's obligation to help has as satisfiers actions of John helping and as violators actions of refraining to help. What distinguishes John's obligation to leave from John's permission to leave is that the former has satisfiers and violators, whereas the latter has only satisfiers, namely actions of John of leaving. That is, permission only enable things, but do not exclude anything, whereas obligations enable some things and exclude others. The difference between modal predicates of necessity and of possibility thus is not traced to a difference in logical form, as universal and existential quantification over worlds, as on the standard view. Rather it consists entirely in a difference in the satisfaction conditions of the two sorts of modal objects, that is, in the nature of the two sorts of modal objects themselves.

Not only modal objects have satisfiers and violators, also attitudinal objects may and that can account for relevant semantic connections between attitude verbs and modal verbs.

Thus, a modal object of obligation that results from an act of requesting may share its satisfiers with the request, the illocutionary product resulting from the act of requesting.

On Fine's (2012, 2014, to appear) truthmaker semantics, a sentence  $S$  has as its meaning a pair consisting of a set of (exact) truthmakers (situations or actions wholly relevant for the truth of  $S$ ) and a set of exact falsmakers (or violators). The exact truth making relation applies to more complex sentences as below, which are fairly standard:

- (8) a.  $s \models P \text{ and } Q$  iff for some  $s'$  and  $s''$ ,  $s = \text{sum}(s', s'')$  and  $s' \models P$  and  $s'' \models Q$ .  
 b.  $s \models P \text{ or } Q$  iff  $s \models P$  or  $s \models Q$   
 c.  $s \models \exists x S$  iff  $s \models S[x/t]$  for some term  $t$

What is new on Fine's truthmaker semantics is the relation of (exact) falsmaking  $\models$  ( $s \models S$ :  $S$  is false in virtue of  $s$ ). The falsmaking relation is involved in the truthmaking condition on negative sentences:

- (9)  $s \models \text{not } S$  iff  $s \models S$ .

That is, a situation  $s$  is an exact truthmaker of  $\text{not } S$  in case  $s$  is a falsmaker of  $S$ .

Imperatives have as their meaning a pair consisting of a set of actions complying with the imperative and a set of actions contravening the imperative (Fine, to appear).

On the present approach, the relation of exact satisfaction and violation will also be a relation between situations or actions and modal objects. Modal objects of necessity and modal objects of possibility differ in whether they have violators. Modal objects of necessity have both satisfiers and violators, but modal objects of possibility have only satisfiers and lack violators. An obligation can be satisfied by actions and it can be violated by actions. By contrast, a permission, an invitation, or an offer only sets up options: actions of satisfying or 'taking up' the permission, invitation, or offer. The predicative denotation of a

clausal subject or complement (or a preajacent) S can then be given as a property of (modal) objects  $\text{pred}([S])$ , as below, where  $\text{pos}(S)$  is the set of verifiers of S and  $\text{neg}(S)$  the set of falsifiers of S:

$$(10) \text{pred}([S]) = \lambda d[\forall s(s \Vdash d \rightarrow s \in \text{pos}(S)) \ \& \ \forall s(s \Vdash d \rightarrow s \in \text{neg}(S))]$$

That is, the predicative denotation of a sentence S is the property that holds of a modal object d just in case all exact satisfiers of d are exact truthmakers of S and all exact violators of d are exact falsifiers of S. (10) is suited to characterize both modal objects of necessity (the second conjuncts applying non-vacuously) and modal objects of possibility (the second conjunct applying vacuously).

The duality of modals of necessity and of possibility ( $\text{must} \neg S \leftrightarrow \neg \text{may} S$ ) is straightforwardly accounted for once the existential quantifiers in the logical form of modal sentences are allowed to quantify over a contextually highly restricted domain. A modal product whose satisfiers make S false and whose violators make S true is not a modal product that has only satisfiers that make S true, and vice versa. Suppose the domain contains just one relevant modal object, the obligation for John to help. Then *John is obliged to help* implies *John is not permitted not to help* because the modal object of obligation just is not a modal object that has only satisfiers, namely actions of John's not helping. Similarly, if there is just one relevant modal object of the permission for John to leave the house, *John is allowed to leave the house* implies *John is not obliged not to leave the house* because then the modal object of John's permission is not a modal object that has as satisfiers actions of not leaving the house and as violators actions of leaving the house. The contextual restriction also takes care of Kratzer's (1977) insight that modals generally have a highly context-dependent interpretation.

The predicativist account applies particularly well to deontic modals, since we have a good sense of obligations and permissions as objects having particular sorts of satisfiers and violators. But of course the predicativist account is meant to apply to all modals. Application to other modalities. Going through the various sorts of (readings) of modals must await other occasions. Here I just give some indications of how the account extends. First, the account has a plausible application to ability modals:

(11) John is able to / can walk.

Abilities are modal objects, though not modal products, the products of illocutionary or cognitive acts. There is a good intuitive sense in which of an ability has what should take the role of satisfiers, namely its physical manifestations. Abilities are like permissions and not like obligations in that they only have satisfiers and not violators.

The account should also extend to epistemic modals, though the modal objects here are somewhat less straightforward. It appears there may be a variety of ways of introducing modal objects for epistemic modals. For example, a modal object for epistemic *must* maybe 'generated' by a piece of evidence and assigned situations supported by the evidence as satisfiers and situations excluded by the evidence as falsifiers. The same piece of evidence may alternatively generate a modal object of possibility, an object assigned only satisfiers, situations supported by the evidence. Instead of a particular piece of evidence, a set of accepted facts or the 'common ground' may generate modal objects in that way. Epistemic modal verbs have approximatively the following analysis:

- (12) a. John must be at home.  
 b.  $\lambda e[\exists d(dRe \ \& \ \text{must}(d) \ \& \ [John \ be \ at \ home](d))]$

Here e is meant to be the speech event, and R a relation of 'close connection'

### 3 Connections between modals and propositional attitudes

As mentioned, not only modal objects have satisfiers and possibly violators, also attitudinal objects may do so. Thus requests have satisfiers and violators and invitations have only satisfiers. (13a) and (13b) will then have the same logical form, as in (14a) and in (14b) respectively, based on the predicative meaning of the complement clause in (14c):

- (13) a. John asked Mary to come.  
       b. John invited Mary to come.  
 (14) a.  $\exists e(\text{ask}(e, \text{John}, \text{Mary}) \ \& \ [\text{Mary come}](\text{product}(e)))$   
       b.  $\exists e(\text{invite}(e, \text{John}, \text{Mary}) \ \& \ [\text{Mary come}](\text{product}(e)))$   
       c.  $[\text{Mary come}_{emb}] = \lambda d[\forall s(s \parallel d \rightarrow s \in \text{pos}(\text{Mary come})) \ \& \ \forall s(s \parallel d \rightarrow s \in \text{neg}(\text{Mary come}))]$

Moreover modal objects may share their satisfiers and possibly violators with attitudinal objects. In general, the modal product that may result from an illocutionary act shares its satisfiers and possibly verifiers with the illocutionary product resulting from that very same act. Thus sharing of satisfaction conditions explains the validity of the inferences below, on a suitable reading of *must* and *may*:

- (15) a. John asked Mary to leave.  
       Mary must leave.  
       b. John offered Mary to take an apple.  
       Mary may take an apple.

Modal products, though, differ in nature from the corresponding illocutionary products. Illocutionary products can generally not endure past the time of the illocutionary act, but modal products can. This is reflected in the choice of tense with modal products, as opposed to illocutionary products as below:

- (16) a. Yesterday, John promised to help (today).  
       b. (Today) John's obligation is to help.  
       c. John's promise was / ??? is to help.

The illocutionary product that is the product of John's act of promising will not last beyond the act of promising, but the resulting modal product, the obligation will. The illocutionary act produces both a (non-enduring) illocutionary product and an (enduring) modal object, and the illocutionary product and the modal object share exactly the same satisfiers (and violators).

The nouns *permission* and *offer* are actually ambiguous between describing illocutionary products and describing modal products, the latter being their meaning in the sentences below:

- (16) d. John still has the permission to use the huse.  
       e. The offer still stands.

The fact that modal objects may be the result of illocutionary acts explains certain cases of modal concord or 'harmonic' modals, as below:

- (17) a. John requested that Mary *should* leave.  
       b. John offered Mary that she *could* use the house.

The occurrence of the modal in such sentences is best seen as a performative use of a modal in an embedded context. In independent sentences, performative uses of modals as in (18a) and (19a) lead to statements roughly equivalent to the use of sentences with a performative use of an illocutionary verb – one of request as in (18b) with a modal of necessity and one of offer as in (19a), the two of which correspond to the two uses of the imperative, as in (18c) and (19c):

- (18) a. You must leave.

- b. I hereby ask that you leave.
  - c. Leave!
- (19) a. You may take an apple.
- b. I hereby offer you to take an apple.
  - c. Take an apple!

Independent sentences within the present view are considered predicates of illocutionary products or modal products produced by the illocutionary acts performed by uttering the sentence. An imperative will thus denote the property  $\lambda d[[\textit{leave!}](d)]$ , to be predicated of the illocutionary product meant to be produced by the utterance of the sentence. This then allows the analysis of performatives as in (18a) and (19a) as roughly in (20a) and (21a), and similarly of the performative modals in (18b, 19b) as in (20b) and (21b):

- (20) a.  $\lambda e[\textit{ask}(e, \text{speaker}) \ \& \ [(\text{addressee}) \ \textit{leave}](\text{product}(e))]$   
       b.  $\lambda d[\textit{must}(d) \ \& \ [(\text{addressee}) \ \textit{leave}](d)]$
- (21) a.  $\lambda e[\textit{offer}(e, s) \ \& \ [(\text{addressee}) \ \textit{take an apple}](\text{product}(e))]$   
       b.  $\lambda d[\textit{may}(d) \ \& \ [(\text{addressee}) \ \textit{take an apple}](d)]$

Harmonic modals such as *should* in (17a) will then contribute to the meaning of the embedded sentence as below:

- (22)  $[\textit{that Mary should leave}] = \lambda d[\textit{should}(d) \ \& \ [\textit{Mary leave}](d)]$

There will be two interpretations of illocutionary act reports. One of them involves predicating the clausal complement of the illocutionary product of the described illocutionary act, the Davidsonian event argument of request. The other involves predicating the clausal complement of the modal product of the illocutionary act that is the Davidsonian event argument. The latter is of course the one relevant for harmonic modals as in (17a), as in the analysis below:

- (23)  $\exists e(\textit{request}(e, \text{John}) \ \& \ [\textit{that Mary should leave}](\text{modal-product}(e)))$

The very same account is applicable to harmonic modals of possibility such as *could* in (17b).

The predicativist account also has a nice application to modal concord, as below:

- (24) a. John could possibly have missed the train.  
       b. John must obligatorily fill out the form.  
       c. John may optionally fill out the back of the form.

On the present view, modal adverbs just like modal verbs act as predicates of modal objects. Then (24b), on the modal concord reading, involve simple predication of two modal predicates of the same modal object, as below:

- (25)  $\exists d(\textit{must}(d) \ \& \ \textit{obligatorily}(d) \ \& \ [\textit{John fill out the form}](d))$

Of course there is in principle another reading available, on which the modal adverb and the modal verb each introduce an existential quantifier ranging over modal objects.

The account immediately explains a constraint on modal concord, namely that the two modals be of the same sort (both need to be modals of necessity or modals of possibilities):

- (26) a. ??? John must possibly have missed the plane.  
       b. ??? John may obligatorily fill out the form.

This constraint does not come out on the one alternative semantic account of modal concord offered in the literature within the standard view, namely according to which the two modals apply to the same modal base (Anand, P. / A. Brasoveanu 2010).

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