**Clauses as Semantic Predicates: Difficulties for Possible-Worlds Semantics**

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The standard view of clauses when they are embedded under attitude verbs or modal (or other sentence-embedding) predicates is that they act as singular terms standing for propositions. There are a range of difficulties for that view, which have n alternative approach to the meaning and semantic contribution of embedded sentences has been pursued by various of authors, namely according to which clauses act as predicates of content-bearing objects, such as a mental state, a cognitive or illocutionary act or product, or a modal object (whether that object is given by the content of the embedding predicate or the discourse context). In this note I want to point out some serious difficulties for possible-worlds semantics that arises when clauses embedded under attitude verbs or modal predicate are considered predicates of a content-bearing object. I will argue instead for a situation-semantic account, based on the notion of an exact truthmaker or satisfier (Fine 2014, to appear a, b). This account allows embedded sentences to apply to content-bearing objects of various sorts in virtue of a single meaning.

**1. The standard view of clausal complements of attitude verbs and of modal sentences**

Let me start with the standard view of clausal complements of attitude verbs of the sort of *assume* and *hope*, before turning the attention to sentences embedded under modal predicates and other sorts of sentence-embedding predicates.

The standard view of clausal complements of attitude verbs as in (1a) is that they act as singular terms standing for propositions, which in turn act as arguments of the embedding attitude verb. The standard view takes the form of the Relational Analysis given for (1a) in (1b):[[1]](#footnote-1)

(1) a. John assumes that Mary is happy.

b. assume(John, [*that Mary is happy*])

Propositions are generally taken to play three roles: to be (the primary bearers) of truth values, the meanings of sentences (or referents of embedded clauses), and the contents or ‘objects’ of propositional attitudes. There are both linguistic and philosophical difficulties for the Relational Analysis.[[2]](#footnote-2) First the Relational Analysis is considered problematic in that it fails to make a distinction between the content and the object of an attitude (treating propositions as things agents have attitudes to, rather than as the contents of attitudes). Second, there are problems for the notion of an abstract proposition as such, which are a major topic of discussion in contemporary philosophy of language (they concern in particular the graspability and truth-directedness of propositions). But also the linguistic plausibility of the Relational Analysis has been put into question. The difficulties it raises include accounting for the Substitution Problem, the problem of the unacceptability of (2b) as an inference from (2a), and the Objectivization Effect, the difference in the understanding between (3a) and (3b):

(2) a. John assumed that S

b. John assumed the proposition that S.

(3) a. John fears that S

b. John fears the proposition that S.

Another issue concerns the analysis of nominal construction. It has long been observed that clausal complements of nouns as in (3) do not behave like arguments, since they are not obligatory even if the verb requires the complement:

(4) John’s assumption that S

Also semantically, the clausal complement relates to what the nominal construction stands for, a proposition-like object, rather than providing an object entering a thematic relation to the event described by the verb. Moreover, clauses can appear with underived noun with which it could not possibly fill in an argument position, as in *the idea that* S and *the thesis that* S (Moulton 2009). The syntactic status of clausal complements of nouns, though, is far from obvious and there is a significant syntactic controversy surrounding it. Some researchers assimilate them to relative clauses (Arsenevic, Moulton, Kayne 2008, 2010).[[3]](#footnote-3) Others have argued against such an assimilation (de Cuba 2017). The proposal that I will discuss later, that clauses asemantically act as predicates, would ho along well with the view that clausal complement of nouns, and even verbs, are relative clauses, but the proposal is not strictly tied to that syntactic view, but is compatible with a different syntactic view; all that matters is that embedded (and independent sentences) be interpreted as a property that permit them to act semantically as predicates.[[4]](#footnote-4)

There are also various phenomena where the choice of a category or expression in the clause appears to depend on the semantics of the embedding verbs and thus indicates that the clause does not act as a referentially independent singular term, phenomena emphasized by Kratzer (2016). In particular this concerns the choice of mood and modals. Thus, as Kratzer points out, deontic modals with relevant sorts of speech act verbs as below display two readings, one of which does not contribute to the content of the reported speech, but is, as she calls it, a *harmonic modal*:

(5) He motioned / proposed / insisted / suggested / recommended / advised / demanded /

petitioned / urged / begged / requested / required / wanted / pleaded that we *should* set up

an emergency fund.

This reading is not available with other verbs of saying (*say, mention, claim*) etc.

As expected, there are also harmonic uses of modals of possibility, with suitable embedding verbs:

(6) a. John offered Mary that she *could* use the house.

b. The document indicates that Bill *might* be guilty.

c. John suggested that Bill *might* be at home.

For Kratzer, harmonic modals indicate that complement clauses are not referentially independent. They spell out the inherent modality of the content-bearing object of which the clause is to be predicated (a demand or offer, for example).

Let me briefly turn to the standard analysis of modals. The standard analysis of modals is the Quantificational Analysis, according to which a modal of necessity as in (7a) has the analysis in (7b), and a modal of possibility the analysis as in (8a) the one in (8b):

(7) a. John is allowed to leave.

b. ∃w (w ∈ f(wo) & [*John leave*]w = true)

(8) a. John needs to leave.

b. ∀w(w ∈ f(wo) → [*John leave*]w = true)

Here, the contextually given function *f* maps the world of evaluation wo to the relevant set of world, the modal base.

The quantificational account of modals was extended to verbs expressing belief and knowledge by Hintikka, and the Hintikka-style analysis has since become a common approach to the semantics of attitude verbs in natural language semantics. The assimilation of attitude verbs to modals has been used, for example , to account for the presupposition projection behavior of the complement of attitude verbs (Heim 1992) and for the understanding of epistemic modals in the complements of attitude verbs (Anand /Hacquard 2013). Thus (9a) on that view has the analysis in (9b), where belw, j is the set of worlds compatible with what John believes in w:

(9) a. John believes that S

b. ∀w’(w’ ∈ belw, j 🡪 S true in w)

(9b) can be reformulated making use of a proposition *p* (the set of worlds in which the sentence *S* is true) as an argument of the attitude verb:

(9) believe(J, p) iff ∀w’(w’ ∈ belw, j 🡪 w’ ∈ p).

The modal analysis of attitude verbs has generally has been applied only to attitude verbs that are taken to involve universal quantification over worlds, such as belief and knowledge.[[5]](#footnote-5) It is not obvious that there are verbs expressing mental attitudes that are correlates of modals of possibility and thus would involve not universal, but existential quantification over worlds. Yet, at the same time, it is not obvious that there aren’t. For example, there seem to be uses of *think* that functions that way; thinking in the sense of taking a possibility into consideration (and of course *hypothesize*). Clearly, there are speech act verbs that correspond to modals of possibility. While, an act of promising or demanding may result in an obligation, an act of allowing results in a permission and acts of inviting and offering in invitations and offers, modal objects associated with possibility, not necessity.

There is a notorious problem for possible-world semantics to account for explicit or ‘heavy’ permissions.[[6]](#footnote-6) With verbs describing such acts, the complement does not serve to say what is true in some world in which what is permitted invited or offered obtains. The contrast is particularly clear when contrasting simple predicates (*be* + impersonal adjectival passive) as in (10a), which allow for a light reading, with the corresponding complex predicates consisting of a light verb (*give, have*) and an explicit nominal for the product of an acting of permitting, as in (10b, c):

(10) a. Mary is permitted to take a walk.

b. John gave the permission for Mary to take a walk.

c. Mary has the permission to take a walk.

Complex predicates allow only for a ‘heavy’ reading (involving reference to an explicitly given permission). Complements of verbs that describe explicit forms of permission do not serve to characterize some world in which what is permitted holds, but would need to characterize all such worlds, but then the difference to obligations is lost. The same issue arises for epistemic modals (and attitude verbs), which display the same sort of distinction between weak and strong readings (Przyjemski 2017).

**2. Clauses as semantic predicates**

In order to account for the various problems that arise for the view that clauses act as singular terms standing for propositions, an alternative view has been pursued, namely according to which clauses characterize the content of a content-bearing object that is given by the semantic or pragmatic context.

Let me briefly elaborate a version of the view according to which clauses act as semantic predicates predicated of a content-bearing object, such as a claim, an assumption, a permission, or an obligation. One way in which a clause can act as a predicate of a content-bearing object is by specifying its truth conditions.[[7]](#footnote-7) Where does the content-bearing object come from? For different kinds of embedded clauses, the content-bearing object may have different sources. First, complements of volunteered-stance verbs such as *assume* and *fear*, the object should be closely related to the Davidsonian event argument. In the case of the verb *fear*, this would be the state of fear that is its event argument, so that we have (11b) for (11a):

(11) a. John fears that S.

b. ∃e(fear(e, John) & [S](e))

In the case of *assume*, it is more plausibly be the product of the act of assuming, the assumption, a bearer of representational properties and truth conditions, unlike the act, which intuitively lacks such properties (Twardowksi 1911, Moltmann 2003, 2013, 2014, 2017a), as in (12b) for (12a):

(12) a. John assumes that S.

b. ∃e(assume(e, John) & [S](product(e)))]

This analysis straightforwardly accounts for nominal constructions as in (13a), which would be analysed as in (13b), with the *that*-clause acting as a predicate of the referent of the NP:

(13) a. John’s assumption that S

b. ιd[assumption(d, John) & [S](d)]

Not all embedded clauses should receive the analysis in (11b) or (12b). It is hardly applicable to factive complements, where the complement more plausibly characterizes a fact (however that may be conceived), in addition to characterizing the content of a mental state. It is also implausible for response-stance verbs such as *agree, deny, repeat* or *confirm,* where the complement arguably characterizes a contextually given content bearer, say a claim, as well as the (product of) the act of agreement. In such a case, we have the analysis below, where *d* is a contextually given claim (Moltmann 2017c):[[8]](#footnote-8)

(14) a. John agreed that S.

b. ∃e(agree(e, John) & [*that S*](product(e)) & [*that* S](d))]

Also in subject position a clause arguably gives the content of a contextually given content-bearer (Moltmann 2015a):

(15) That S is true.

The question now is, how exactly does clause characterize the content of a content-bearing object? Given possible-worlds semantics, the property below would be the most obvious candidate, a view endorsed by Kratzer (2006, 2016):

(16) [S] = λd[∀w(w ∈ f(d) 🡪 S is true in w)]

Here f(d) is the set of worlds compatible with the content of d (or in which the conditions represented by d are fulfilled). f thus represents the modality associated w ith the content-bearing object d, and various features or elements of the clause S, so Kratzer’s idea, may relate to it.

The general view that clauses act semantically as predicates of content-bearing objects naturally carries over to modals as well. This is most intuitive for deontic modals as in *it is obligatory to do* V and *it is permitted to do* V.(Moltmann 2015b, 2017a). (Deontic) modals arguably take as implicit (Davidsonian) arguments entities that I call modal objects, entities of the sort of needs, obligations, and permissions. Modal objects may be produced by an illocutionary act (of demanding, promising, or permitting) and thus have the status of (abstract) artifacts (in the sense of Thomasson 1999), for example as laws or rules. But they need not be the product of an illocutionary act. What is important about modal objects is that they come with satisfaction conditions; a need may be satisfied; a promise fulfilled, a permission of offer taken up. (21a) and (22a) will then have the logical forms in (21b) and (22b) respectively:

(17) a. John needs to leave.

b. ∃d(need(d) & [*John to leave*](d))

(18) a. John is permitted to leave.

b. ∃d(permission(d) & [*John to leave*](d))

The possible-worlds-based property in (16) could apply only to modal objects of necessity, not possibility. For applying to modal objects of possibility, a clause S should denote the property below:

(19) [S] = λd[∃w(w ∈ f(d) & S is true in w)]

But then clauses as complements of modal predicates as in (17a) and (18a) would not have a single meaning, but be ambiguous, depending on the lexical meaning of the embedding predicates. This of course violates compositionality. The very same compositionality problem arises for complements speech act verbs associated with necessity and with possibility. In addition to the problem for compositionality, of course, the possible-worlds account is just not applicable to explicit permissions and obligations (and explicit propositional attitudes).

**3. A different approach: clauses expressing truthmaker-based properties**

Possible-worlds semantics thus faces serious difficulties with complements of verbs describing explicit attitudes and speech acts, content-bearing objects described by underived nouns, with explicit obligations and permissions. Furthermore it is unable to provide a single meaning of clauses applicable to embedding predicates (or nouns) associated with different modalities.

In what follows, I will sketch an alternative to the possible worlds, using situations or actions instead and making use of the exact truthmaking relation of Fine’s recent truthmaker semantics. The advantages of that proposal will be first that it accounts for explicit permissions as well as explicit attitudes and second that it allows for a single meaning of clauses applicable to embedding predicates associated with necessity and with possibility

First, a very brief outline of Fine’s (2012, 2014, to appear a, b) truthmaker semantics, for the purpose of showing that a unified semantics of clauses embedded under different predicates attitudinal and modal predicates can be formulated. Truthmaker semantics involves a domain of situations or actions containing actual, possible as well as impossible situations and actions. This domain is ordered by a part relation and is closed under fusion. The following standard conditions on the truthmaking of sentences with conjunctions, disjunctions, and existential quantification then hold:[[9]](#footnote-9)

(20) a. s ╟ S *and* S’ iff for some s’ and s’’, s = sum(s’, s’’) and s’ ╟ S and s’’ ╟ S’.

b. s ╟ S *or* S’ iff s ╟ S or s ╟ S’

c. For a one-place property P, s ╟ ∃x S iff s ╟ S[x/d] for some individual d.

Truthmaker semantics assigns sentences not only truthmakers or verifiers, but also falsifiers. This allows a straightforward formulation of the truthmaking conditions of negative sentences: a truthmaker for ¬ S is a falsifier for S. With ╢ as the relation of (exact) falsification, the condition is given below:

(21) s ╟ *not* S iff s ╢ S

Also complex sentences are assigned both truthmaking and falsemaking conditions. For conjunctions and disjunctions the false-making conditions are those below:

(22) a. s ╢ S *and* S’ iff s ╢ S or s ╢ S’

b. s ╢ S *or* S’ iff for some s’ and s’’, s = sum(s’, s’’) and s’ ╢ S and s’’ ╢ S’

A sentence S is then has as its meaning a pair <pos(s), neg(S)> consisting of a *positive denotation*, the set pos(S) of verifiers of S, and a *negative denotation*, the set neg(S) of falsifiers of S. In what follows, I will make not make use of the positive and negative denotation of a sentence, but just of the meaning of a sentence S as a property of content-bearing object, namely [S].

We can now turn to formulating the meaning of sentence as a property of content-bearing objects. First of all, let us note that sentences may under specify the truth conditions of a modal or attitudinal object. Complement clauses may underspecify the attitudinal object, with respect to its satisfaction conditions as well as in other respects. One case of such underspecification has recently been discussed by Graff Fara (2013), namely desire reports in which the clausal complement underspecifies the satisfaction conditions of the reported desire, as below:

(23) Fiona wants to PRO catch a fish.

The desire described by (27a) is not just satisfied in case Fiona catches a fish. It is satisfied only when she catches a fish suitable for eating, let’s say. If a desire report reports the conditions under which the desire is satisfied, the clausal complement of the desire verb may give only necessary, not sufficient conditions on the satisfaction of the reported desire. This is captured by the property of attitudinal objects below, where ╟ is the relation of exact truthmaking now holding between situations or actions a and attitudinal or modal objects d, and ╠ is the relation of inexact truthmaking:

(24) [S] = λd[∀s(s ╟ d 🡪 i ╠ S)]

The relation ╟ comprises different satisfaction relations reflected in the use of different satisfaction predicates in natural language that are applicable to attitudinal and modal objects. They include the truthmaking, fulfillment, acceptance, and compliance relation. In particular, the relation ╟ covers both world-to-word/mind directions of fit as well as word/mind-to world direction of fit. For independent sentences, these correspond to the two different sentence types of declaratives and imperatives: declarative sentences are made true by situations, imperatives are fulfilled by actions.

(24) cannot yet be adequate, though, since it would not allow distinguishing necessity and possibility semantically. Given (24), a permission (for Mary to enter the house) could be a modal object with the very same satisfaction conditions as an obligation (for Mary to enter the house). But the permission for Mary to enter the house is not an obligation for Mary to enter the house.

What distinguishes a permission from an obligation? Permissions allow certain actions, those they permit. Obligations allow for certain actions, those that comply with them, but they also exclude certain actions, those that violate them. The permission for Mary to enter the house allows for actions of Mary entering the house, but does not exclude any other actions. By contrast, the obligation for Mary to enter the house allows for actions of Mary entering the house and excludes actions of Mary’s not doing so. This means that permissions have only satisfiers, whereas obligations have both satisfiers and violators. Also illocutionary products can be distinguished in terms of having violators or not. An offer or an invitation has only satisfiers, but no violators; a request or an order has both satisfiers and violators.

The notion of violation as a relation between actions and modal or attitudinal objects matches Fine’s (2012, 2014, to appear a) notion of exact falsemaking, as a relation between a situation or action and a sentence. The relation ╢ corresponds to the notion of violation as a relation between sentences and modal or attitudinal objects. With this notion, the meaning of sentences can now be reformulated as below, where ╣ is the relation of (inexact) falsemaking:

(25) [S] = λd[∀s(s ╟ d → s╠ S) & ∀s(s ╢ d → s ╣S)]

That is, a sentence *S* expresses the property that holds of a modal or attitudinal object *d* just in case every exact satisfier of *d* is a (possibly inexact) truthmaker of *S* and every exact violator of *d* is a (possibly inexact) falsifier of *S*. In the case of permissions, of course the second condition is vacuously fulfilled.

On this account, modals of necessity and modals of possibility lead to exactly the same logical form, but they involve different sorts of modal objects with different satisfaction and violation conditions. Thus, (26a) and (26b) will have the logical forms in (27a) and (27b) respectively, involving the very same meaning of the complement clause in (28):

(26) a. John asked Mary to come to his house.

b. John allowed Mary to come to his house.

(27) a. ∃e(ask(e, John, Mary) & [*Mary come to his house*](product(e)))

b. ∃e(allow(e, John, Mary) & [*Mary come to his house*](product(e)))

(28) [*Mary come*] = λd[∀s(s ╟ d → s╠ *Mary com to his house* & ∀s(s ╢ d →

s ╣ *Mary come to his house*))]

Unlike the possible-worlds semantic account of attitude verbs and modals, this account is applicable to explicit permissions and obligations. If the object *d* to which the clause applies is a permission, the clause will specify which sorts of actions will be exact satisfiers of the permission, it will not just say what is true in some world in which the permission is satisfied. If *d* is an obligation, the clause will specify what sorts of actions fulfill it and what sorts of actions violate it. It will not just say what is true in all worlds in in which the obligation is fulfilled (what that may not content-wise relate to the fulfillment of the obligation). The account is thus tailored to explicit (strong or heavy) permissions and obligations. Would it also account for implicit (weak or light) permissions and obligations? The answer is yes, since they would simply involve different modal objects, modal objects that are not products of illocutionary acts, but states that come with a greater range of satisfiers and violators.

**4. Another application: ‘harmonic‘ modals**

Kratzer (2016) proposes an account of harmonic modals based on a possible-worlds-based property-meaning of clauses. She focuses an modals of necessity as in (33a) and proposes that the ‘harmonic’ modal in the embedded clause spells out universal quantification over possible worlds that make up the content *f(d)* of the content-bearing object *d*, as in (33b):

(29) a. John requested that Mary should leave.

b. λd[∀w(w ∈ f(d) → [*Mary leave*]w = true)]

The harmonic modal, she suggests, is linked to a syntactic position modality position above the

One major problem for this account is that it is inapplicable to modals of possibility, as in (6a-c), repeated below:

(30) a. John offered Mary that she *could* use the house.

b. The document indicates that Bill *might* be guilty.

c. John suggested that Bill *might* be at home.

Thus, (31) does not make sense as the meaning of the clauses in (30a-c), with the existential quantifier spelling out the contribution of *could* or *might*:

(31) λd[∃w(w ∈ f (d) & [*S*]w = true)]

In (30a), the *that*-clause does not just specify what is the case in some world in which John’s offer is taken up; it specifies (at least) what is the case in all the worlds in which the offer is taken up. Similarly in (30b),the *that-*clause does not say what is is the case in some world compatible with what document says, but in all worlds. The reason for the inappropriateness of (31) is that the possible worlds-based analysis of modals of possibility is just unsuited for specific content-bearing objects (explicit permissions, obligations, documents etc).

The truthmaker-based semantics of clauses as predicates allows for a straightforward account of harmonic modals. This account will consider harmonic modals as performative use of a modal in embedded contexts.[[10]](#footnote-10) The semantics will be parallel to that of sentences with a performative use of an illocutionary verb. Sentences with a performative use of an illocutionary verb such as (32a) and (32a) can be taken to express properties of illocutionary products as in (33a) and (33b):

(32) a. I ask you to leave.

b. I allow you to leave.

(33) a. λd[∃e(ask(e, speaker) & d = product(e) & [(addressee)  *leave*](d))]

b. λd[∃e(allow(e, speaker) & d = product(e) & [(addressee) *leave*](product(d))]

That is, a performative use of an illocutionary verb leads to the sentence expressing a property of illocutionary products meant to characterize the product produced by uttering the sentence (and thereby performing an illocutionary act).

Similarly, sentences with a performative use of a modal such as (34b) and (34b) will express the properties of modal products meant to be produced by uttering the sentence, in (35a, b):

(34) a. You must leave!

b. You may leave!

(35) a. λd[must(d) & [(addressee) *leave*](d)]

b. λd[may(d) & [(addressee) *leave*](d)]

A modal product, so the view, can be produced by the very same illocutionary act as an illocutionary product, and it will have the very same satisfaction conditions as the illocutionary product (Moltmann 2017a).

With a harmonic modal acting as a performative use of a modal in an embedded context, (36a) will simply have the analysis in (36c) based on the clause meaning in (36b), and (37a) the one in (37c), based on the clause meaning in (37b):

(36) a. John requested that Mary should leave.

b. [*that Mary should leave*] = λd[should(d) & [*Mary leave*](d)]

c. ∃e(request(e, John) & [*that Mary should leave*](modal-product(e)))

(37) a. The document indicates that Bill might be guilty.

b. [*that Bill might be guilty*] = λd[might(d) & [*Bill be guilty*](d)]

c. ∃e(indicate(e, the document) & [*that Bill might be guilty*](modal-product(e))))

Thus, the truthmaker-based accounts for harmonic modals based on a single truthmaker-based meaning of sentences.

**4. Summary**

There are a range of semantic and syntactic reasons to consider clauses semantic predicates of content-bearing objects. However, possible-worlds semantics turns out to be unsuited for developing that view. Instead a particular version of truthmaker semantics allows assigning sentences a single meaning as a property of content-bearing objects of different sorts. In addition it provides a straightforward analysis of harmonic modals.

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1. I chose the verb *assume*, rather than *think* or *believe* because I consider think a verb of (internal) saying, involving a different semantics than what I propose later (Moltmann2017b). Moreover, *believe* arguably involves a different semantics as well (Section). [↑](#footnote-ref-1)
2. See Moltmann (2003, 2013 chap 4, 2014) and reference therein. [↑](#footnote-ref-2)
3. Kayne (2008, 2010) in fact takes the view that all complement clauses are relative clauses. [↑](#footnote-ref-3)
4. In fact even some relative clauses, unrestrictive ones, have been analysed not as semantic predicates. But as (E-type) pronouns, see Cinque (2008) for discussion and references. [↑](#footnote-ref-4)
5. Some attitude verbs have been considered imposing an ordering of preference along worlds such as *want, wish, be happy* (e.g. in Heim 1992). [↑](#footnote-ref-5)
6. See von Wright (1963) and more recently Fine (to appear b) for the distinction between heavy and light permissions, which I will call ‘explicit’ and ‘implicit’ permissions. [↑](#footnote-ref-6)
7. Another way may be by specifying its structured content content or even form, namely with indirect and direct quotes as complements ( Moltmann 2017b). [↑](#footnote-ref-7)
8. Kratzer (2016) also proposes such an account for *believe*, which, she argues, behaves syntactically different from verbs like *think* and *assume* regarding its clausal complement. [↑](#footnote-ref-8)
9. The truthmaking condition for sentences with universal quantification and conditionals are less obvious and would require a lot more discussion. [↑](#footnote-ref-9)
10. With the performative use of a modal a speaker puts forward a modal states of a affairs described by the sentence. For the notion of a performative use of a modal see Portner (2007). [↑](#footnote-ref-10)