

DIP Colloquium

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Clauses as Predicates of Modal and Attitudinal Objects

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1. Modals as quantifiers and modals as predicates

The standard quantificational account of modals

Modal logic: Modals represent quantifiers ranging over (accessible) possible worlds

Kratzer (1977): contextually given modal base (set of worlds) and ordering source (set of ideal worlds inducing ordering among worlds)

(1) a. John may leave.

b. $\exists w (w \in f(w_o) \ \& \ [John \ leave]^w = \text{true})$

(2) a. John must leave.

b. $\forall w (w \in f(w_o) \rightarrow [John \ leave]^w = \text{true})$

Kinds of modal predicates

(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)

Two semantic issues regarding modal predicates:

[1] What do nominalizations of modal predicates describe?

[2] What if any is the Davidsonian (event) argument of modal predicates?

The present approach:

Answers to 1 and 2 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.

The semantic proposal:

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

How can clauses act predicates of modal objects?

They specify the satisfiers and violators of the modal object (in roughly the sense Kit Fine's truthmaker semantics)

Difference between modals of necessity and of possibility:

Modal objects of necessity: have satisfiers and violators

Modal objects of possibility: have only satisfiers

No difference in terms of quantification

Modal objects may share satisfiers with attitudinal objects:

Need, obligation – request

Permission – permission (on the part of..., as an illocutionary product)

Modal objects not tied to modal predicates (in English): laws, duties, rules, options

2. Nominalizations of modal predicates

2.1. Modal predicates with nominalizations

Neutral modal nominalizations

- (6) a. John's need to learn more
 b. the possibility that John will return (epistemic)
 c. the possibility that John can lift the table (circumstantial)

Modal objects related to directive illocutionary and mental acts

- (7) a. the permission to leave
 b. the obligation to return
 c. the offer to use the house

d. the invitation to stay in the house during summer

Ability modals:

(8) the ability / capability to do X

Other terms for modal objects:

(9) a. the duty to clean up

b. the rule, law, principle

c. the option to live in the country

2.2. The Davidsonian argument of modal predicates

The original motivations for the Davidsonian semantics of action sentences:

The semantics of (VP -) adverbials

(10) a. John played in the garden with a toy yesterday.

b. $\exists e(\text{play}(e, \text{John}) \ \& \ \text{in the garden}(e) \ \& \ \text{with a toy}(e) \ \& \ \text{yesterday}(e))$

Hacquard's (2010):

Modals are event-dependent: take modal base f and event e as arguments,

f maps e onto a set of worlds: those compatible with the content of e (epistemic modals) or those compatible with the circumstances of e (root modal)

Event specifies what agent the modality relates to and may be modified by tense.

Epistemic modals take speech event or reported propositional attitude as argument;

root modals take VP event as argument:

(11) a. It must be raining.

a' $\lambda e[\text{assert}(e) \ \& \ \text{must}(f, e) \ \& \ \forall w \in f(e) \ \text{rain}(x, w)]$

b. John had to leave.

b' $\exists e(\text{had to}(f, e) \ \& \ \forall w \in f(e) \ \text{leave}(\text{John}, e, w))$

Problems for Hacquard's proposal:

Adverbial modifiers for modals do not behave as predicted:

Epistemic modals:

(12) ??? John hesitatingly / quickly might be at home.

Root modals:

(13) a. John must stay in the room quietly.

b. ??? Quietly John must stay in the room.

What sorts of adverbials can apply to modal verbs?

Temporal adverbials, causal adverbials, degree adverbials (predicates of strength of force)
(*completely impossible, highly able, somewhat necessary*)

Application of the same sorts of modifiers to nominalizations:

- (14) a. the need today to leave early, the obligation last year to help Mary
b. the complete impossibility, the slight possibility / ability

Modal objects as the implicit Davidsonian arguments of modal predicates.

Complement of the modal acts as a predicate of the modal object:

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

Connection to agent: John's obligation / permission can be fulfilled only by John's actions

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

e: speech event, R: 'close connection'

epistemic modals as quasi-performative

3. A semantics of modals based on modal objects

3.1. Modal objects

How do clauses act as predicates of modal objects?

Specify satisfaction conditions -- satisfiers or violators -- of modal objects

Modal objects have satisfaction conditions

- (17) a. John's need was fulfilled by having X be done.
b. The obligation was met by doing X.
c. The offer was taken up / was accepted.

3.2. Fine's (2012, to appear) truthmaker semantics

(Exact) truthmaking

A situation is an exact truthmaker of a sentence S iff s is wholly relevant for the truth of S .

The meaning of a declarative sentence S :

the set of its verifiers ($\text{pos}(S)$) and the set of its falsifiers ($\text{neg}(S)$)

(Exact) satisfaction for the semantics of imperatives:

Exact satisfaction as relation between an action and an imperative

The meaning of an imperative:

the set of its satisfiers (actions complying with the imperative) and the set of its violators (actions contravening the imperative)

Standard truthmaking conditions:

(18) a. $s \Vdash P \text{ and } Q$ iff for some s' and s'' , $s = \text{sum}(s', s'')$ and $s' \Vdash P$ and $s'' \Vdash Q$.

b. $s \Vdash P \text{ or } Q$ iff $s \Vdash P$ or $s \Vdash Q$

c. $s \Vdash \exists x S$ iff $s \Vdash S [x/t]$ for some term / object t

(Exact) falsemaking for the truthmaking condition on negative sentences:

$s \Vdash S$: S is false in virtue of s

(18) d. $s \Vdash \text{not } S$ iff $s \Vdash S$.

Motivations for truthmaker semantics from imperatives and permission sentences (Fine 2014)

Get inferential relations among imperatives and deontic modals right (Ross' paradox):

(19) a. Take an apple!

b. Take an apple or the gold!

(20) a. You may take an apple.

b. You may take an apple or the gold.

Consequence in terms of partial content:

Imperative B is a consequence of imperative A iff every satisfier of A contains a satisfier of B and every satisfier of B is contained in a satisfier of A .

3.3. Another motivation for truthmaking/satisfaction: Searle's 1983 view of intentionality

Mental states and acts and illocutionary acts (generally) come with intrinsic satisfaction conditions and corresponding satisfiers.

Intentions, decisions, requests, promises (world-to-mind/word direction of fit):

have actions as satisfiers

beliefs, thoughts, hopes, fears (mind/word-to-world direction of fit):

have ‘states of affairs’ as satisfiers

Special case:

Intention, decision, requests: satisfiers are not just actions, but actions ‘by way of satisfying the intention, decision, or request’

Actions vs situations:

Actions: acts with the intention of performing an action type, possibly with the intention of fulfilling the mental state or directive act requiring that action type as for its satisfaction

(21) Sentence Meanings as Properties of Attitudinal and Modal Objects (First Version)

$$[S_{emb}] = \lambda d[\forall s(s \Vdash d \rightarrow s \in \text{pos}(S))]$$

\Vdash : exact satisfaction relation between a situation or action and an attitudinal or modal object

3.4. Truthmaker semantics for attitude reports based on attitudinal objects

The action-product distinction (Moltmann 2014):

Only products, not actions have truth or satisfaction conditions and thus truthmakers or satisfiers.

Truth-directed products:

(22) a. John’s claim is true / correct.

b. John claiming / John speech act is ??? true / ? correct.

John’s claim: the product resulting from John’s act of claiming

Directive products:

(23) a. John’s decision was executed / implemented.

b. ?? John’s act of deciding was executed / implemented.

(24) a. John’s request was fulfilled / was followed

b. ?? John’s act of requesting was fulfilled / was followed.

(25) a. John’s offer was taken up / was accepted.

b. ?? John’s act of offering was taken up / was accepted.

John’s decision, offer: the (non-physical) product resulting from the act of deciding, offering

Doubt:

John’s doubt that S has as its satisfiers the falsifiers of S

Distinction between Davidsonian event and its product:

Clausal complement may specify truthmakers /satisfiers of the product of the Davidsonian event argument.

Desires, intentions, and beliefs also have satisfaction or truth conditions, but need not be viewed as products of acts.

Object-based truthmaker semantics:

Attitudinal objects as bearers of truthmakers / satisfiers

- (26) a. John decided to leave
 b. John wants to win.
 c. $\exists e(\text{decide}(e) \ \& \ [John \ to \ leave] \ (\text{product}(e)))$
 d. $[S_{emb}] = \lambda d[\forall s(s \Vdash d \rightarrow s \in \text{pos}(S))]$

3.5. Modal objects and their satisfaction and violation conditions

Modal objects as entities with satisfaction conditions and satisfiers and violators:

John's obligation to help:

satisfiers: actions fulfilling the obligation,

violators: actions incompatible with the fulfillment of the obligation

John's offer to help:

has only satisfiers actions of John's helping

- (27) a. John must help.
 b. $\exists e(\text{must}(e) \ \& \ [John \ help](e))$
- (28) a. John may leave.
 b. $\exists e(\text{may}(e) \ \& \ [John \ leave](e))$

Difference between deontic modals of obligation and permission:

Obligations have satisfiers and violators, permissions have only satisfiers

(29) Sentence Meanings as Properties of Attitudinal and Modal Objects (Second Version):

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

Accounting for logical connection between modals of possibility and modals of necessity

must $\neg S \leftrightarrow \neg \text{may } S$

Roughly, there is a relevant modal product whose satisfiers make S false and whose violators make S true \leftrightarrow there is no relevant modal product whose satisfiers make S true and that does not have violators.

Illocutionary acts of obligation and permission:

(30) a. John asked Mary to come.

b. John invited Mary to come.

(31) 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. $[\text{Mary come}_{emb}] = \lambda d[\forall s(s \Vdash d \rightarrow s \in \text{pos}(\text{Mary come})) \ \& \ \forall s(s \Vdash d \rightarrow s \in \text{neg}(\text{Mary come}))]$

Application to other modalities:

Ability modals:

(32) John is able to walk

Satisfiers of an ability: its physical manifestations

Abilities have only satisfiers, not violators

Epistemic modals:

Evidence, accepted facts, ‘common ground’ ‘generate’ two sorts of modal objects:

- modal objects of possibility (whose satisfiers are situations supported by the evidence, facts, common ground) and
- modal objects of necessity (whose satisfiers are situations supported and whose violators are excluded by the evidence, facts, common ground)

4. Connections between modals and propositional attitudes

Inferences with modal auxiliaries:

(33) a. John asked Mary to leave

b. Mary must leave.

(34) a. John offered Mary an apple.

b. Mary may take an apple.

- (35) a. John plans to leave.
 b. John must leave.

Inferences with terms for modal objects

- (36) a. Yesterday John permitted Mary to leave
 b. Today, Mary still has the permission to leave.
 (37) a. Yesterday John offered Mary to use the car.
 b. Today Mary still has the offer to use the car.
 (38) a. John promised to help.
 b. John has the obligation to help.
 (39) a. John invited Mary to come to his house.
 b. Mary has the invitation to come to John's house.

- (40) a. John asked Mary to come.
 b. John invited Mary to come.

- (41) a. $\exists e(\text{ask}(e, \text{John}) \ \& \ [\text{Mary come}](\text{product}(e)))$
 b. $\exists e(\text{invite}(e, \text{John}) \ \& \ [\text{Mary come}](\text{product}(e)))$
 c. $[\text{Mary come}] = \lambda d[\forall s(s \Vdash d \rightarrow s \in \text{pos}(S)) \ \& \ \forall s(s \Vdash d \rightarrow s \in \text{neg}(S))]$

Explaining the valid inferences:

The illocutionary act produces both a (non-enduring) illocutionary product and an (enduring) modal object.

The illocutionary product and the modal object share exactly the same satisfiers (and possibly violators).

Two interpretations of (36a):

Involving the non-enduring illocutionary product:

- (36) c. $\exists e(\text{permit}(e, \text{John}, \text{Mary}) \ \& \ [\text{Mary to leave}] (\text{product}(e)))$

Involving the enduring modal product:

- (36) d. $\exists e(\text{permit}(e, \text{John}, \text{Mary}) \ \& \ [\text{Mary to leave}] (\text{modal-product}(e)))$

5. Modal Concord

- (42) 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.

Modal adverbs as predicates of modal objects:

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

Constraint: modal has to be of the same sort:

(44) a. ??? John must possibly have missed the plane.

b. ??? John may obligatorily fill out the form.

An alternative within standard account of modals:

Modal verb and modal adverb apply to the same modal base (Anand / Brasoveanu 2010):

(45) $\text{must}(w, f, p) \ \& \ \text{obligatorily}(w, f, p)$

Problem for Anand / Brasoveanu (2010): How to rule out modal concord with modals of necessity and possibility? (A/B propose pragmatic account)

6. Performative uses of modals

(45) a. I hereby ask that you leave.

b. You must leave.

c. Leave!

(46) a. I hereby offer you to take an apple.

b. You may take an apple.

c. Take an apple!

Independent sentences as predicates of illocutionary products or modal products produced by illocutionary acts

Semantics of performative uses of independent sentences:

(47) a. $\lambda e[\text{ask}(e, \text{speaker}) \ \& \ [(\text{addressee}) \ \textit{leave}](\text{product}(e))]$

b. $\lambda d[\text{must}(d) \ \& \ [(\text{addressee}) \ \textit{leave}](d)]$

c. $\lambda d[[\textit{leave!}](d)]$

(48) a. $\lambda e[\text{offer}(e, s) \ \& \ [(\text{addressee}) \ \textit{take an apple}](\text{product}(e))]$

b. $\lambda d[\text{may}(d) \ \& \ [(\text{addressee}) \ \textit{take an apple}](d)]$

c. $\lambda d[[\textit{leave!}](d)]$

(49) $[S \ !] = \lambda d[\forall a(a \Vdash d \rightarrow a \in \text{pos}(S)) \ \& \ \forall a(a \Vdash d \rightarrow a \in \text{neg}(S))]$

Performative uses of modals in embedded contexts

(also considered cases of ‘modal concord’ or ‘harmonic modal’):

Deontic modals:

Directive illocutionary verbs

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

Directive mental act verbs:

- (51) John decided that he *should* help.

Epistemic modals:

- (52) a. John proved / showed that Bill *must* be guilty.
 b. The document shows / proves that Bill *must* be guilty.
 (53) a. The document indicates that Bill *might* be guilty.
 b. The evidence shows that Bill *might* be guilty.
 c. John suggested that Bill *might* be at home.

Restriction: no ‘modal concord’ with ordinary (truth-directed) attitude verbs:

- (54) a. John knows that Bill *must* be guilty.
 b. John believes / claims / thought Bill *must* be guilty.

Analysis:

Occurrence of modal is a performative use of a modal in an embedded context:

- (55) a. [*that Mary should leave*] = $\lambda d[\text{should}(d) \ \& \ [\text{Mary leave}](d)]$
 b. $\exists e(\text{request}(e, \text{John}) \ \& \ [\text{that Mary should leave}](\text{product}(e)))$
 (56) a. [*that Bill might be guilty*] = $\lambda d[\text{might}(d) \ \& \ [\text{Bill be guilty}](d)]$
 b. $\exists e(\text{indicate}(e, \text{the document}) \ \& \ [\text{that Bill might be guilty}](\text{modal-product}(e)))$

Other performative uses of modals in embedded contexts:

- (57) a. It is possible that Bill *might* be guilty.
 b. $\exists e(\text{possible}(e) \ \& \ \lambda d[\text{might}(d) \ \& \ [\text{Bill be guilty}](d)](e))$

Nominal constructions:

- (58) a. the possibility that Bill *might* be guilty.
 b. $\iota e[\text{possibility}(e) \ \& \ \lambda d[\text{might}(d) \ \& \ [\text{Bill be guilty}](d)](e)]$

The more standard account (Kratzer, recent talks):

‘Harmonic’ modal in the embedded clause spells out universal quantification over possible worlds characterizing the content of an object of the sort of a belief, a claim, an offer.

(58) a. the offer [for John to visit]

b. $f_{\text{norm}}(\text{offer}) =$ the set of worlds w s.t. the offer is accepted in w

c. $\lambda x[\forall w(w \in f_{\text{norm}}(x) \rightarrow [\textit{John to visit}]^w = \text{true})]$

d. the offer that John may / * should / * must visit

e. $\lambda x[\exists w(w \in f_{\text{norm}}(x) \ \& \ [\textit{John to visit}]^w = \text{true})]$

(58e) does not make sense.

Problems:

- Difficulty accounting for ‘harmonic’ modals of possibility
- Overgenerates: predicts epistemic modals of necessity to be possible with all truth-directed attitude verbs

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