

CLASS 4: EPISTEMIC MODALS & ATTITUDE VERBS

Restrictions on distribution of epistemic modals:

- Epistemic interpretations are tied to a high modal position within its clause.
 - Epistemics cannot appear in any old embedded context. In particular, attitude verbs:
- (1) a. John thinks/claimed/argued that Mary must be the murderer.
 b. #John hopes/wishes/demanded that Mary must be the murderer.

Epistemics can only appear in the complement of *representational* attitudes.

Hypotheses:

- *Epistemic modals* are not necessarily knowledge-based. Instead they are anaphoric to the content of an embedding attitude (Hacquard 2006, 2010, Yalcin 2007).
- *Attitudes* do not share a uniform semantics: 2 classes of attitudes, *representational* (*think*) vs. *non representational* (*want*), which correlate with mood selection in Romance:
 - *Representational attitudes*: traditional Hintikka semantics. They have ‘content’, i.e., a set of consistent propositions, which determines a set of accessible worlds (e.g., *a set of belief worlds*), in which the complement proposition has to be true.
 - *Non representational attitudes* lack such a content: no consistent set of propositions that correspond to a ‘desire state’. They embed propositions via contextual comparison (Villalta 2000, 2008) of the complement proposition to contextual alternatives, given a scale of comparison (e.g., a scale of desires).
- The combination of these two proposals can explain distribution of epistemics (Anand&Hacquard 2009).

Last time: Event-relative framework, according to which modals are relative to an event: high modals relative to speech event in matrix contexts (a), and to attitude events in embedded contexts (b), low modals relative to VP event (c).

- a. [**Speech(e₀)** Mod(e₀) T Asp₁ VP(e₁)]
- b. [Speech(e₀) **Asp₂ Att(e₂)** [_{CP} Mod(e₂) T Asp₁ VP(e₁)]]
- c. [Speech(e₀) T **Asp₁ Mod(e₁) VP(e₁)**]

The plan

- Revisit epistemic modality.
- Show why epistemics are associated with the ‘high’ position.
- Rep. vs. non rep. attitudes. Show why epistemics only appear in complement of rep.
- Wrap up and acquisition issues.

1. Epistemic modality

Traditionally, epistemic modals (from Greek *episteme*, knowledge) express possibilities and necessities given ‘*what is known*’.

- (2) John might be the murderer.
In some world w' compatible with what is known in w , John is the murderer in w' .

1.1. Is epistemic modality knowledge?

- (3) Mary believes that John might be the murderer.
In all worlds w' compatible with Mary's beliefs in w , there is a world w'' compatible with what she knows in w' in which John is the murderer.

Can Mary really tell apart her what she knows from what she merely believes?

Intuitively, (3) makes the more modest claim that John being the murderer is compatible with Mary's *beliefs*:

- (4) In some world w' compatible with Mary's beliefs in w , John is the murderer in w' .

Yalcin's (2007): epistemic modality \neq knowledge

- (5) #Suppose that John is not the murderer but that he might be the murderer.

This feels contradictory. But it shouldn't, based on our semantics for epistemics and attitudes.

- (6) *In all worlds w' compatible with your suppositions in w :
 John is not the murderer in w'
 There is a world w'' compatible with what is known in w' s.t. J is the murderer in w''*

These shouldn't be contradictory: one can suppose that John is not the murderer but that it is nevertheless compatible with the available evidence that he is:

- (7) Suppose that John is not the murderer but that it is nevertheless compatible with what is known that he is the murderer.

Yalcin (2007): The contradiction arises because ‘epistemic’ modals talk about compatibility with the supposition state directly!

- (8) Suppose that John might be the murderer.
*It is compatible with your suppositions that John **is** the murderer*
- (9) Suppose that John is not the murderer.
*It is consistent with your suppositions that John is **not** the murderer*

(8) and (9) = **contradiction**

Upshot:

- Epistemic modals are not necessarily knowledge-based: They express compatibility with an *information state*: the very information state provided by the attitude verbs that embed them (e.g., a set of suppositions), unmediated by a state of knowledge.
- This will be the key to solving the modal meaning/modal syntax problem:
 - Epistemics require an embedding attitude: either an attitude verb, or the attitude associated with declarative speech events (assertions).

1.2. Epistemic modal base**1.2.1. Event-based semantics for attitude verbs**

- Reformulate the epistemic modal base to capture this anaphoricity.
- To do so, in an event-relative framework, we need to be able to talk about the information state associated with each attitude in event terms.

First, reformulate our attitudes, by invoking the notion of *content of an attitude event*:

CONTENT(e) = the set of propositions that make up the attitude
 When e is a believing event: CONTENT(e) is a set of beliefs (a belief state)
 When e is a supposing event: CONTENT(e) is a set of suppositions...

Example: believe

- Recall Hintikka denotation:

$$(10) \quad [[\text{believe}]]^w = \lambda p_{\langle st \rangle}. \lambda x. \forall w' \text{ compatible with } x\text{'s beliefs in } w: q(w') = 1$$

- Event-based denotation:

$$(11) \quad [[\text{believe}]]^w = \lambda p_{\langle st \rangle}. \lambda x. \text{Exp}(e, x) \ \& \ \text{belief}^o(e, w) \ \& \ \forall w' \text{ comp. } w / \text{CONT}(e): p(w') = 1 \\ \text{where } \text{CONTENT}(e) = x\text{'s beliefs in } w$$

- (12) Mary believes that John is the murderer.
 $\exists e[\text{exp}(e, M) \ \& \ \text{belief}^o(e, w) \ \& \ \forall w' \text{ comp } w / \text{CONTENT}(e): J \text{ is murderer in } w']$
where CONTENT(e) = Mary's beliefs
In all worlds w' compatible with Mary's beliefs, J. is the murderer in w'

1.2.2. New epistemic modal base

We can now reformulate our **epistemic modal base**:

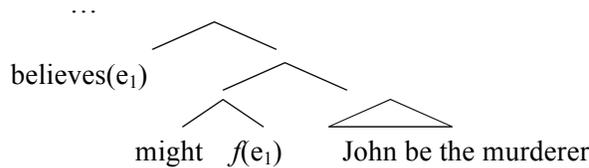
$$(13) \quad \cap f_{\text{epis}}(e) = \lambda w'. w' \text{ is compatible with } \text{CONTENT}(e)$$

What is the event e , whose content determines the set of accessible worlds?

⇒ The event that anchors the modal.

The modal quantifies *directly* into the information state that makes up the attitude.

1.3. Epistemics in attitude contexts:



- *might* is anchored to the *believing* event.
- *believe* and *might* quantify over the same set of worlds, i.e., those compatible with $\text{CONTENT}(e_1) = \text{Mary's beliefs}$.

- (14) a. Mary believes that John might be the murderer.
 b. $\forall w'$ comp. w/ $\text{CONTENT}(e_1)$: $\exists w''$ comp. w/ $\text{CONTENT}(e_1)$: J is the murderer in w''
 ≡ c. $\exists w''$ comp. w/ $\text{CONTENT}(e_1)$: John is the murderer in w''
In some world w' compatible with Mary's beliefs, J. is the murderer in w'

(b) and (c) equivalent because of vacuous layer of quantification. The modal quantifies over Marys' belief state directly.

1.4. Epistemics in matrix contexts (a sketch)

- Intuitively, epistemics make claims about the state of knowledge/beliefs of the speaker.
- (15) John might be the murderer.
In some world compatible with my beliefs, John is the murderer.
- ...So do assertions: Assertion = expressing a belief
- (16) John is the murderer.
(I believe that) John is the murderer
In all worlds compatible with my beliefs: John is the murderer.

We'll assume *assertions* are implicitly modalized by an ASSERT operator (cf. Kratzer & Shimoyama 2002, Alonso-Ovalle & Menendez-Benito 2003), quantifying over speaker's beliefs, for which we give an event-relative semantics ($\text{CONTENT}(e_0) = \text{beliefs of the speaker}$).

- (17) John is the murderer.
 Assert'(e₀) & $\forall w'$ comp. w/ $\text{CONTENT}(e_0)$: John is the murderer in w'
In all worlds compatible with the beliefs of the speaker, John is the murderer.

Summing up: solving the modal height/modal flavor problem

We started out with two conflicting cross-linguistic generalizations:

- The same words express various flavors of modality
- Flavors of modality correlate with different syntactic positions

Event-relative account of modality:

- Maintain a single lexical entry per modal (a la Kratzer)
- Which can merge either at TP or VP level.
- Association between modal's position and flavor derived independently.

Epistemic modality:

- Epistemics express compatibility with info state given by local attitude.
- Epistemic modal base picks worlds compatible with *content* of its anchoring event.
- Only speech/attitude events are contentful \Rightarrow Only *high* modals (modals relative to speech/attitude events) can receive epistemic interpretations.

3. On the limited distribution of epistemic modals in attitude contexts

Epistemics can appear in the complement of some **attitude verbs**, but not others:

- (20) Mary {thinks, claims, argued, assumed...} that John must be the murderer.
 (21) *Mary {commanded, wished, hoped...} that John must be the murderer.

Anand & Hacquard (2009): epistemics only in complements of 'attitudes of acceptance' (those said to be correct if the complement clause is true, Stalnaker 1984) \approx representational attitudes.

Hypothesis:

- Epistemics are anaphoric to the *content* of the embedding attitude event.
- Non representational events lack *content*.

3.1. Representational vs. non representational events

3.1.1. Attitudes and mood selection in 'Romance' (= Spanish, French)

Attitudes differ in mood selection (partial list from Villalta 2008):

Subjunctive: desideratives (*want*), modals (*it is possible that*), predicates of doubt, directives (*order*), emotive factives (*be glad, regret*).

Indicative: doxastics (*believe*), speech (*say*), certainty (*be sure*), fiction (*dream, imagine*), mental judgment (*guess, conclude, realize*), perception (*see, notice*).

Intuitive meaning differences between the two classes:

- One can have incompatible desires, but not incompatible beliefs (Farkas 1985)
- One can *want p* to different extents; one either *believes p* or not.

Villalta's proposal: a verb selects for subjunctive mood in its embedded proposition if the proposition is compared to its contextual alternatives on a scale introduced by the predicate.

Subjunctive-selecting attitudes involve a comparative semantics.

- (22) Mary wants to teach on Tuesdays.
Teaching on Tuesday is more desirable to Mary than any other contextual alternatives (teaching on Monday, teaching on Wednesday, ...)

3.1.2. Comparative semantics

3.1.2.1. A predecessor: Stalnaker (1984), Heim (1992)

Standard Hintikka semantics:

- (23) Mary wants to teach on Tuesdays.
In all of Mary's desire worlds, Mary teaches on Tuesdays.

Problem: Mary would rather not teach at all! In all of her desire worlds, she doesn't teach. Intuitively, (23) says that if Mary has to teach at all, she would rather teach on Tuesdays.

Heim (1992) proposes a conditional comparative semantics for *want*, which incorporates a doxastic element, in the spirit of Stalnaker (1984).

For Heim, the comparison is between *p* worlds and non *p* worlds¹:

- (24) 'a wants p' is true in *w* iff : for every $w' \in \text{Dox}_a(w)$;
 Every *p*-world max similar to *w'* is more desirable to *a* in *w* than any non-*p* world max similar to *w'*
- (25) Mary wants to teach on Tuesdays.
*In all of Mary's belief worlds *w'*, every world as similar to *w* where I teach on Tuesdays is more desirable than any worlds in which I don't teach on Tuesdays*

Mary's desire not to teach at all doesn't interfere, since we're only considering worlds compatible with what Mary believes, and in all of these worlds, Mary does teach.

 Note that the same issue arose with root modals (e.g., *deontics*), which led to Kratzer's double relative semantics (circumstantial modal base + deontic ordering source):

¹ This is Villalta's non dynamic version of Heim's lexical entry in the original paper.

- (26) John committed a crime. He must go to jail.
Amongst all the worlds compatible with the circumstances (including the fact that John committed a crime), in all the most ideal ones, given the law, John goes to jail.

The same can be done for *want*: doxastic MB + bouletic OS (Fintel 1999, Giorgi&Pianesi 1997):

- (27) Mary wants to teach on Tuesdays.
Amongst all the worlds compatible with Mary's beliefs (including the fact that she has to teach), in all the most ideal ones, given her desires, she teaches on Tuesdays.
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3.1.2.2. Villalta (2009)

Villalta (2009) adopts a comparative-style account from Heim for *want*, BUT, with comparison of embedded proposition p with contextually available alternatives, rather than *not p*.

Evidence: context with more than two alternatives.

Context: Sofia has promised to bring dessert to a picnic. 3 possibilities: cake, ice cream, pie.

Scale of likelihood: (ice cream < pie < cake) (-/+ departure from Victoria's beliefs)

Scale of desirability: (ice cream > pie > cake) (-/+ departure desirable for Victoria)

In this scenario, (28) is judged false:

- (28) Victoria wants Sofia to bring pie.

Heim predicts (28) should be true: Sofia bringing pie is more desirable than Sofia not bringing pie (in worlds where she doesn't bring pie, she brings ice cream).

Villalta: comparison of contextually-provided alternatives, based on a desirability scale:

- (29) $[[\text{want}_C]]^g(p)(a)(w)$ defined iff $\forall q \in g(C): \text{Dox}_a(w) \cap q \neq \emptyset$
 if defined = 1 iff $\forall q \in g(C): p <_{a,w} q$,
 where $<_{x,w}$ is defined as follows:
 (i) for any $w, w', w'', w' <_{x,w} w''$ iff w' is more desirable to x in w than w''
 (ii) for any $p \subseteq W, q \subseteq W, p <_{x,w} q$ iff for $\forall w'' \in q, \exists w' \in p$ s.t. $w' <_{x,w} w''$, and it is not the case that for all $w' \in p, \exists w'' \in q$ s.t. $w'' <_{x,w} w'$.

- (30) Victoria wants Sofia to bring pie.
Sofia bringing pie is more desirable to Victoria than any other contextual alternatives (S brings ice cream, S brings cake).

Villalta extends her proposal to all subjunctive-taking verbs: all have a comparative semantics, where what changes from one attitude to the next is the dimension of the ordering relation.

To sum up:

- Mood selection reflects two kinds of attitudes, with different semantics:
 - Indicative-selecting attitudes have a standard Hintikka semantics: they introduce an information state, w.r.t. which the embedded proposition has to be consistent.
 - Subjunctive-selecting attitudes introduce a scale of comparison against which *contextually provided* alternatives are compared.
- Indicative-selecting (representational) attitudes have *content* (a consistent information state), while subjunctive-selecting (non representational) attitudes do not.
- Epistemics cannot appear in non representational attitudes because they lack the content epistemics are anaphoric to.

4. Wrapping up

- We have looked at similarities and interactions between attitudes, modals and evidentials.
- We asked whether these similarities were an artifact of using a limited set of formal tools (e.g., quantification over possible worlds), or whether they reflected something deeper: identity or dependency. We saw that for:

Root and epistemic modals: share a semantic core and differ in accessibility relations. The availability of accessibility relations is however partly constrained by grammatical environment, making sense of their complementary distribution.

Epistemic modals vs. evidentials: We saw arguments that these two may actually be part of the same category (Matthewson 2010). Alternatively, they could be viewed as two different systems, which stand in some dependency. For instance, evidentials may impose an *ordering source* on an epistemic modal (Portner 2007).

Epistemic modals and attitude verbs:

- Problems with uniform Hintikka semantics for all attitudes. Instead, two kinds of attitudes: representational vs. non representational, with different semantic template.
- Epistemics are anaphoric to the information state of an embedding attitude. They can only appear in complements of representational attitudes, because only they provide such an information state.

The view from acquisition (tentative speculations...)

Timeline of acquisition

Age 2	root modality (<i>ability/deontic</i>)	Non rep. attitude (<i>want</i>)
Age 2;5	Rep. attitude (<i>think</i>): <i>formulaic/parenthetical uses only</i>	
Age 3;5	epistemic modality	Rep. attitude (<i>think</i>)
Age 5+	Full distinction between epistemic modals (strength) and evidentials	

One plausible story: Timeline of acquisition tracks *conceptual* development.

Regardless of what the adult-state lexical entries for *think* and *want* are, children won't acquire them until they acquire the relevant concepts.

- *desire* conceptually more primary than *belief*.
- Acquisition of *think* (and *epistemic* modals) awaits development of **theory of mind** (ability to attribute false beliefs to others), supposed to emerge between age 3 and 4 (Papafragou 1998)

Potential nags for the simple story:

- Evidence that *infants* attribute false beliefs to others, cf. Onishi&Baillargeon (2005).
- Chicken and the egg problem of theory of mind. De Villiers and colleagues propose that mastering mental verbs like *think* opens the door to understanding false beliefs (enable the representation of a false belief).
 - Children won't understand false beliefs (and hence false belief tasks) *until* they have the ability to represent false beliefs, which comes from mastering mental attitudes and their complements.
 - If this is true, we have a bit of a paradox: children's delay in acquisition of *think/epistemics* has to await ToM development, but ToM doesn't fully develop until mastery of attitudes like *think*.

Where semantics may matter

Even if acquisition of attitudes/modals merely track conceptual development, the question arises of what lexical representations children have at various stages.

A potential issue:

- Under the Hintikkan view that all attitudes share a semantic template, and only differ in accessibility relations, it may be surprising that they wouldn't be acquired at the same time.
- This is even more puzzling under the view that *desire* predicates are more complex, and in fact incorporate *believe*. Recall that in the Stalnaker/Heim/von Stechow accounts, *want* picks out the most desirable of the subject's *belief worlds*:

- (31) Mary wants to teach on Tuesdays.
Amongst all the worlds compatible with Mary's beliefs, in all the most ideal ones, given her desires, She teaches on Tuesdays.

If *want* builds on *think*, it is at the very least surprising that *want* would be acquired *earlier*.

The picture we have presented here is at least consistent with the developmental timeline (and is compatible with a de Villiers's approach):

- If the semantics of desire and belief predicates is substantially different, as in the Villalta account, there is no reason to expect that they should come at the same time.
- It may furthermore be expected that if there should be an asymmetry in acquisition, *desire* predicates should be acquired earlier.
 - Arguably, comparing alternative propositions may be 'easier' than checking whether a proposition is consistent with an information state.
- Now, why should epistemics be acquired late? If epistemics are anaphoric to representational attitudes, it may again not be surprising that they wouldn't be acquired until representational attitudes are.

The acquisition of attitudes and modals, and its connection with theory of mind is a complex matter, which we can't hope to solve here. We can't know for sure what children's lexical semantics are at various stages, or how they reach the adult state. However, the story we just told is at least consistent with it.