

Chapter 2

Modals: Meaning Categories?

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1 Introduction

In many languages, the same modal word can be used to express various flavors of modality (Bybee et al. 1994; Palmer 2001; among others).¹ English *must*, for instance, can express various kinds of necessities (epistemic, deontic, or teleological), as illustrated in (1).

- | | | | |
|-----|----|---|---------------------|
| (1) | a. | John is not in his office. He <i>must</i> be home. | <i>epistemic</i> |
| | b. | John parked illegally. He <i>must</i> pay a fine. | <i>deontic</i> |
| | c. | John wants to get a PhD. He <i>must</i> write a thesis. | <i>teleological</i> |

Given the pervasiveness of this multiplicity of meanings across unrelated languages, a Kratzerian semantics—in which modals are not multiply ambiguous, but where they come in single lexical entries, with flavors determined by context—seems particularly appealing.

Let us briefly review this system. Kratzer (1981, 1991) proposes that modals are quantifiers over possible worlds, whose restriction is contextually provided via ‘conversational backgrounds,’ responsible for the various flavors. Specifically, modals combine with a *modal base f*, which determines an initial set of worlds, and an *ordering source g*, which provides an ordering given certain ideals (such as deontic and bouletic).

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¹ About half of the 200+ languages van der Auwera and Ammann (2005) examined across the world show overlap of form for either possibility or necessity modality, or both.

Modals quantify over some (possibility modals) or all (necessity modals) of the ‘best’ worlds (best in terms of the ordering source) among the worlds provided by the modal base:²

- (2) a. $[[\text{must}]]^w = \lambda f_{\langle s, st \rangle} \lambda g_{\langle s, st \rangle} \lambda q_{\langle st \rangle} . \forall w' \in \text{Best}_{g(w)}(f(w)) : q(w') = 1$
 b. $[[\text{can}]]^w = \lambda f_{\langle s, st \rangle} \lambda g_{\langle s, st \rangle} \lambda q_{\langle st \rangle} . \exists w' \in \text{Best}_{g(w)}(f(w)) : q(w') = 1$

Kratzer identifies two broad classes of modals: **epistemic modals** (which take an *epistemic* modal base), and **root modals** (which take a *circumstantial* modal base). Root modals are further differentiated by combining with various ordering sources (deontic, bouletic, teleological). From this point on, I will ignore the ordering source and consider root modals as a group.

- (3) a. $f_{\text{epistemic}}(w) = \lambda w' . w' \text{ is compatible with what is known in } w$
 b. $f_{\text{circumstantial}}(w) = \lambda w' . w' \text{ is compatible with the circumstances in } w$

The same modal *must* is involved in (1a)–(1c), but it combines with different conversational backgrounds to yield different flavors.

- (4) a. (John is not in his office.) He *must*_{f-epis} be home. *epistemic*
In all worlds w' compatible with what is known in w (e.g., the fact that he's not in his office), John is home in w' .
 b. (John parked illegally.) He *must*_{f-circ,g-deon} pay a fine. *deontic*
In all most ideal worlds w' , given the law in w , among those compatible with the circumstances in w (e.g., the fact that he parked illegally), John pays a fine in w' .
 c. John wants to get a PhD. He *must*_{f-circ,g-boul} write a thesis. *teleological*
In all most ideal worlds w' in which John gets a PhD, among those compatible with the circumstances in w , John writes a thesis in w' .

Beyond a difference in modal bases, epistemics and roots pattern differently in their interaction with tense and aspect.³ First, modal flavors differ in **temporal** orientation. The time of evaluation of a **root** modal has to be the time of the embedded event—that is, the time provided by **tense**. I use the semi-modal *have to*, which can carry tense morphology, to illustrate the point.

- (5) John wanted to get a PhD... He *had* to write a thesis.
Given John's situation and goals then, it was necessary that he write a thesis then.
**Given John's current situation and goals, it is necessary that he wrote a thesis previously.*

When *have to* receives an epistemic meaning, however, its time of evaluation cannot be back-shifted: in matrix contexts, the modal's time of evaluation has to be the speech time.⁴ The past tense of *have to* is interpreted in the modal's prejacent:

² I assume that modal base and ordering source are explicit arguments of the modal, rather than parameters of the interpretation function. The function Best picks (Portner 2009) the most ideal worlds of the modal base given the ordering source.

³ They also differ in related ways in their interactions with negation and quantifiers. See Hacquard (2011) for a survey and further references.

⁴ Epistemic modals can be interpreted relative to a past with an *overt* restriction, as in the gloss in (6) (cf. section 3).

- (6) (??Two days ago), John **had** to be in his office at the time of the crime.
*Given what we know **now**, it is necessary that he was in his office then.*
Given what we knew **then, it was necessary that he was in his office then.*

Consider the following scenario from Hacquard (2010): Last week, John had a solid alibi. Mary said that they were meeting in his office at the time of the crime. But yesterday several eyewitnesses claimed they saw Mary at the library at the time of the crime, destroying John's alibi. Here (6) is false: it cannot refer to the time when John's alibi was solid (e.g., two days ago).

Modal flavors also differ in their interactions with **aspect**. With perfective, a root modal triggers an 'actuality entailment' (Bhatt 1999), an uncancelable inference that the complement was actualized. This can be seen in languages that have an overt morphological distinction between perfective and imperfective aspect, such as French:

- (7) a. Jean pouvait s'enfuir, mais il est resté.
Jean could_{root}-**ipfv** escape, but he stayed.
b. Jean **a pu** s'enfuir, #mais il est resté.
Jean could_{root}-**pfv** escape, but he stayed.
Jean was able to escape, (#)but he stayed.

The same modals with an epistemic interpretation are, however, immune to this effect; they do not force the realization of their complement with perfective aspect (Hacquard 2006, 2009):

- (8) (A ce que je sache) Jean **a** (bien) **pu** s'enfuir, mais il est possible qu'il ne l'ait pas fait.
(As far as I know) Jean could_{epis}-**pfv** escape, but it's possible he didn't.
(As far as I know) Jean may (well) have escaped, but it's possible he didn't.

To sum up, the same words can be used to express root and epistemic modality in many different languages, suggesting that epistemic *must* and deontic *must* are one and the same. Yet we need to explain why they systematically differ in their interactions with tense and aspect, as a function of the flavor they express.

Is there something about the *meaning* of each flavor that can explain these interactions? If the link between modal flavor and its interactions with tense and aspect were principled, we could make sense of the fact that we never find the opposite patterns cross-linguistically, diachronically, or in language acquisition. If there were something inherent about the meaning of, say, epistemic, as opposed to root, modality, to make it outscope tense, we would expect it to do so across languages. Children would never hypothesize epistemic meanings for modals that appear in the scope of tense, and the pattern would repeat itself among speakers and hold up diachronically. What kind of inherent connections could we find between modal meanings and tense and aspect? Could it be, for instance, that by virtue of being epistemic, a modal somehow expresses atemporal possibilities and necessities,⁵ and thus cannot have a back- or forward-shifted evaluation time? Or could it be that by virtue of having a root meaning a modal is susceptible to actuality entailments? If circumstantial modality expresses potentials for events to happen, constraining such potentials to a very

⁵ This is, for instance, expected of so-called alethic (or logical) modality. See von Stechow (2006) for skepticism that alethic modality is ever attested in natural language.

short time interval via the perfective might trigger a strong implication that the event must have been realized (cf. Enfeld 2003; Mari and Martin 2007; and Homer 2010 for such a take on actuality entailments with ability modals).

There are reasons to believe that these interactions cannot be purely meaning-based. The modals we have been examining so far are all (semi-)auxiliaries. However, the meanings these modals express can also be expressed by verbs or adjectives, which do not seem to obey the same constraints. Adjectives (*possible, likely*) and verbs (*seem, know, think*) express *epistemic* meanings, and yet are easily interpreted in the scope of a past tense:

- (9) a. It **seemed** to John that Mary was home.
b. John **thought/knew** that Mary was home.
c. It was **possible/likely** that Mary was home.

Nouns (like *means* or *permission*) and verbs (like *want*) express root meanings, and yet they do not yield actuality entailments with perfective:

- (10) a. Jean **a voulu** s'enfuir, mais il n'est pas parti.
Jean wanted-*pfv* to escape, but he didn't leave.
b. Jean **a eu les moyens** de s'enfuir, mais il n'est pas parti.
Jean had-*pfv* the means to escape, but he didn't leave.
c. Jean **a eu la permission** de partir, mais il n'est pas parti.
Jean had-*pfv* permission to leave, but he didn't leave.

It thus appears that the constraints on modal flavors and their interactions with tense and aspect are limited to 'grammatical modality' (i.e., expressed by grammatical modal words), but not 'lexical modality' (i.e., expressed by lexical words such as adjectives or verbs; Traugott 2011). Adjectives and verbs that express similar meanings do not show the same patterns. Why should this be? Why should modals behave the way they do in the first place? And what differentiates grammatical modals from other elements with similar meanings? These are the questions that this chapter addresses. In section 2, I review the proposal I made in Hacquard (2006, 2010) about (grammatical) modals and their interactions with tense and aspect. Section 3 asks how robust the constraints between modal flavor and tense and aspect are, and discusses counterexamples. Section 4 takes a closer look at verbs and adjectives on the one hand, and modals fully specified for flavor on the other, and discusses what might differentiate 'grammatical' from 'lexical' modality.

2 Event-Relativity of Modality

In Hacquard (2006, 2010), I proposed an account of modals with the goal of maintaining a Kratzerian semantics where modals come in single lexical entries, while providing scope-based constraints on the interpretations it can receive in order to derive the right patterns with tense and aspect.

2.1 Epistemics and Roots Differ in Structural Position

The first step in the account is to reduce the differing interactions of root and epistemic modals with tense and aspect to *scope*, with epistemics scoping above tense and aspect, and roots below, in line with a simplified Cinquean (Cinque 1999) organization of functional projections:

- (11) Cinque's Universal Hierarchy of Functional Projections
 ... MOD_{epis} > T > Aspect > MOD_{root} > VP

Assuming that epistemics scope above tense explains why their time of evaluation cannot be shifted (Groenendijk and Stockhof 1975; Picallo 1990; Stowell 2004; Hacquard 2006; Borgonovo and Cummins 2007; Demirdache and Uribe-Etxebarria 2008; Laca 2008; among others): they must be interpreted relative to the local time of evaluation. Similarly, assuming that root modals scope below tense explains why their time of evaluation has to be the time provided by tense.

In Hacquard (2006, 2009), I proposed a way to explain why *root*, but not *epistemic* modals yield actuality entailments also in terms of scope. I argued that actuality entailments result from having perfective aspect take scope over a modal, which happens with roots, but crucially not with epistemics. Aspects are quantifiers over events that relate the running time of the VP event to a time of reference (provided by tense). *Perfective* aspect existentially quantifies over the VP event and places its running time within a reference time interval (cf. Kratzer's 1998 formalization of Klein 1994), and, I argue, in a world of evaluation.

- (12) $[[\text{Mary took-pfv the train}]]^w = \text{true iff } \exists e[\tau(e) < t^* \ \& \ e \text{ in } w \ \& \ \text{Mary took the train}(e)]$

When perfective takes scope *under* a modal (as happens with epistemics), its world of evaluation is provided by the modal, locating the event in the modal worlds. However, when perfective takes scope *over* the modal (as happens with roots), its world of evaluation has to be the matrix one, thereby forcing the event to occur in the actual world. This is sketched in (13) and (14):

- (13) a. Mary a pu prendre le train. *epistemic > perfective*
 'Mary may have taken the train.'
 b. $[\text{ModP can } [\text{TP past } [\text{AspP pfv}_1 [\text{VP Mary take the train } e_1]]]]$
 c. 'There is a world w compatible with what is known in the actual world, such that there is a past event in w which is a train-taking by Mary.'
- (14) a. Mary a pu prendre le train. *perfective > root*
 'Mary was able to take the train.'
 b. $[\text{TP past } [\text{AspP pfv}_1 [\text{ModP can } [\text{VP Mary take the train } e_1]]]]$
 c. 'There is a past event e_1 in the **actual world**, which in some world compatible with the circumstances in the actual world is a train-taking by Mary.'

Example (14) is true if there is an actual event that in some circumstantial world is a train-taking by Mary. With a further default assumption that the event keeps its description across worlds, we obtain that this actual event is a train-taking by Mary. Following Bhatt (1999), I take the lack of actuality entailments with imperfective to be due to an additional layer of modality associated with the imperfective itself. In sum, I argue that epistemics and roots differ in actuality entailments based on the way they interact with aspect. What shields

epistemics from actuality entailments is the fact that, unlike roots, they are interpreted above aspect.

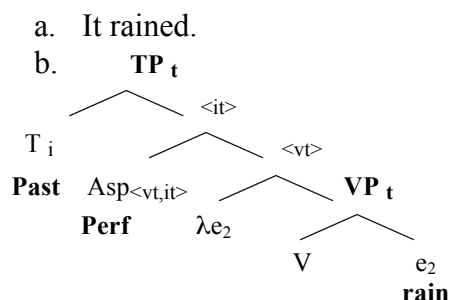
Assuming that modals' peculiar interactions with tense and aspect can be derived in terms of scope, the puzzle to be explained is why modals with epistemic meanings scope above, but modals with root meanings scope below tense and aspect. In other words, why should Cinque's hierarchy hold? Is it because epistemics and roots occupy dedicated positions by *fiat* (by having separate lexical entries that specify both position and flavor), or can we get Kratzerian modals that are unspecified for flavor to occupy different positions based on meaning?

2.2 Event-Relativity

Assuming that a modal can appear in two positions, but without having any flavor specified (in Kratzerian fashion), the question that we need to explain is why a high modal is associated only with epistemic flavors, and a low modal with root flavors.

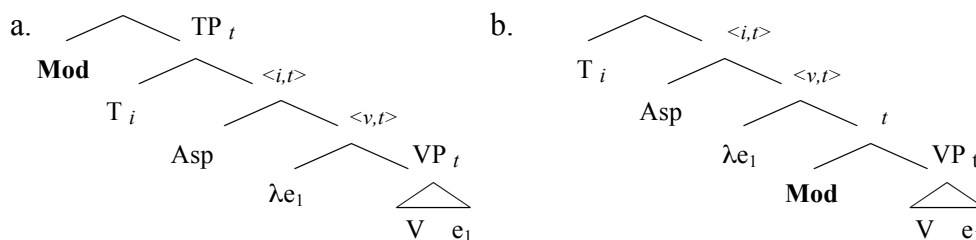
First, we need to let the same modal appear in two positions. In Hacquard (2006, 2010), I derived two positions for modals by adopting a particular view of Aspect. Traditionally, Aspect is base-generated between Tense and VP. I adopted instead von Stechow's (2001) suggestion that Aspect starts as an argument of the verb. Being a quantifier, it needs to move out for type reasons, leaving a trace (type v , for events) inside the VP. The trace of Aspect allows the VP to have its event argument saturated. This crucially yields two nodes of type t : TP and VP, as shown in Figure 2.1 (I assume a referential analysis of Tense, with tenses as pronouns of type i ; Partee 1973; Kratzer 1998; among others):

Figure 1: Aspect Movement



This allows a modal, which needs to combine with a proposition (after it combines with its modal base and ordering source), to appear either right above TP (a) or right above VP, with Aspect moving right above the modal (b), as shown in Figure 2.2.

Figure 2: High and Low Modals



Modals keep their Kratzerian lexical entries: they take a modal base f , an ordering source g , and a proposition q , and quantify over the best worlds of the modal base, given the ordering source. The only change from the Kratzerian view is that the conversational backgrounds are relative to an *event*, rather than a world of evaluation. As we will see in the next sections, different syntactic positions make available different events, which in turn make different modal bases available.

- (15) a. $[[\mathbf{must}]]^w = \lambda f_{\langle v, st \rangle} \lambda g_{\langle v, st \rangle} \lambda e_v \lambda q_{\langle st \rangle} \forall w' \in \text{BEST}_{g(e)}(\cap f(e)): q(w') = 1$
 b. $[[\mathbf{can}]]^w = \lambda f_{\langle v, st \rangle} \lambda g_{\langle v, st \rangle} \lambda e_v \lambda q_{\langle st \rangle} \exists w' \in \text{BEST}_{g(e)}(\cap f(e)): q(w') = 1$

The event variable in the modal's restriction needs to be bound locally by the nearest event binder.⁶ There are two possible event binders: Aspects (as quantifiers over events), and a default topmost event binder, associated with a speech act projection (cf. Ross 1970; Rizzi 1997; Krifka 2001; among others).

When a modal appears *low* within a clause (i.e., between Aspect and VP), the closest event binder is the Aspect quantifying over the VP event. The modal's event variable gets bound by Aspect, and thus the modal gets anchored to the VP event:

- (16) John had to escape.
 $[\text{CP speech } e_0 \lambda e_0 [\text{TP T } [\text{AspP Asp}_1 \lambda e_1 [\text{ModP Mod } f e_1 [\text{VP escape } e_1]]]]]$

When a modal appears *high* in a matrix clause (i.e., above TP), the only event binder is the topmost event binder; the modal gets anchored to the speech event.

- (17) John had to have escaped.
 $[\text{CP speech } e_0 \lambda e_0 [\text{ModP Mod } f e_0 [\text{TP T } [\text{AspP Asp}_1 \lambda e_1 [\text{VP escape } e_1]]]]]$

What happens in embedded contexts? If the modal is in the low position of the embedded clause, it will be anchored to the embedded VP event. However, if the modal is in the high position in the embedded clause, the closest event binder is no longer the speech event, but the Aspect quantifying over the matrix event. The modal gets anchored to the matrix (*think*) event:

- (18) Mary thought that John had to have escaped.
 $[\text{CP speech } e_0 \lambda e_0 \text{ T Asp}_2 \lambda e_2 \mathbf{think } e_2 [\text{CP Mod } f e_2 [\text{TP T Asp}_1 \lambda e_1 [\text{VP escape } e_1]]]]$

⁶ The modal's event argument is occupied by an event pronoun that must be bound locally. Syntactic considerations prevent aspect from appearing here, as it could not move out of a modal's restriction, an island for movement (cf. Hacquard 2006).

There are thus three possible events that a modal can be anchored to: the *VP event* (this happens when the modal appears in the low position and is bound by the Aspect of its own clause); the *speech event* (this happens when the modal appears in the high position of a matrix clause); an *attitude event* (this happens when the modal appears in the high position of a clause embedded under an attitude verb).

A first advantage of this system is that it explains why modals seem to be anchored to time and individual pairs, but why not all possible combinations of times and individuals are attested. Indeed, we find that when a modal is anchored to the speaker, it has to be anchored to the speech time (19a) vs. (19b, c); when it is anchored to the subject, it has to be anchored to the VP time (19d) vs. (19e, f); when it is anchored to the attitude holder, it has to be anchored to the attitude time (20a) vs. (20b, c). These constraints are unexpected in a system where modals are anchored to a world. They, however, follow from an event-relative system: if a modal is anchored to an event, it will naturally be anchored to time and individual pairs, namely the running time of that event and its participants. A second advantage of this system is that it will allow us to derive correlations between modal meaning and modal height, as we will see in the next section.

- (19) John had to be the murderer.
- a. *Given what I know now, it is necessary that John was the murderer.*
 - b. **Given what I knew then, it was necessary that John was the murderer.*
 - c. **Given what John knows now, it is necessary that John was the murderer.*
 - d. *Given John's obligations then, it was necessary that John be the murderer.*
 - e. **Given my obligations then, it was necessary that John be the murderer.*
 - f. **Given John's obligations now, it was necessary that John be the murderer.*
- (20) Yesterday, Mary thought that John had to be the murderer.
- a. *Given what Mary knew yesterday, it was necessary that John was the murderer.*
 - b. **Given what Mary knows now, it is necessary that John was the murderer.*
 - c. **Given what I knew yesterday, it is necessary that John was the murderer.*

To sum up, a modal can appear in *high* (above TP) or *low* (above VP) position. When *high*, it is either anchored to the *speech event* (in matrix contexts) or an *attitude event* (in embedded contexts). When the modal is *low*, it is anchored to the *VP event* in its clause. What remains to be explained is why modals anchored to speech and attitude events ('high' modals) are associated with epistemic modal bases, and modals anchored to VP events ('low' modals) are associated with circumstantial ones. What sets speech and attitude events apart from regular events?

2.3 Epistemic Modality

Attitude predicates (*think*), unlike regular ones (*escape*), describe an *information state* (e.g., a state of belief for *think*; i.e., a set of beliefs that an individual holds). *Speech* acts can also be viewed as a kind of attitude. *Assertions* in particular are made relative to an information state, namely, the set of beliefs or commitments of the speaker. We can encode this relativity by assuming assertion operators tied to the speech act projection, which quantify over the speaker's beliefs (cf. Krifka 1995; Kratzer and Shimoyama 2002; Menendez-Benito and Alonso-Ovalle 2008). In this view, speech and attitude predicates share the property of

describing information states. This information state, I argue, is responsible for their special connection with epistemic modality.

In a traditional view of epistemic modality, epistemics quantify over a state of knowledge, as in (21). An alternative view, however, argues that the quantificational domain of epistemics is determined by anaphoric reference to an embedding attitude (Veltman 1996; Hacquard 2006, 2010; Yalcin 2007), as shown in (22), where *might* quantifies directly over Mary's belief worlds.

- (21) Mary **thinks** that John **might** be the murderer.
...in some world compatible with what M. knows in her belief worlds, J. is the murderer
- (22) Mary **thinks** that John **might** be the murderer.
...in some world compatible with M.'s beliefs, J. is the murderer

Evidence for this view comes from the contrast between (23) and Yalcin (2007). In the traditional view, the contradictoriness of (23b) is unexpected. Example (23b) should simply ask you to imagine a state of affairs where it is raining, but where your state of knowledge does not rule out the possibility of rain (just as for (23a)). Under the anaphoric domain view, however, the contrast is expected: given that the modal quantifies directly over the supposition state, we run into a contradiction, with rain in all supposition worlds, but no rain in some supposition world.

- (23) a. Suppose that [it is raining but you don't {know/believe} that it is raining].
 b. #Suppose that [it is raining but that it **might** not be raining].

In an event-relative framework, the anaphoricity of 'epistemic' modals is encoded by making the epistemic modal base anaphoric to the information state of an attitude event:

- (24) $f_{\text{epistemic}}(e) = \lambda w'. w'$ is compatible with INFO STATE(e)⁷
 where INFO STATE(e) is the information state quantified over by an attitude

Modals have to be relative to the nearest event.⁸ If this event (or state) is an information state, an epistemic modal base makes the modal quantify over that information state. This happens when the modal is embedded under an attitude verb, as in (25), or when the modal is in the high position of a matrix clause, right under a speech event, as in (26). If the event that the modal is relative to is not an information state (as happens when the modal is anchored to a regular VP event), the epistemic modal base is not available.

⁷ In Hacquard (2006, 2010), I use the term *content*(e). I use *info state* here to avoid confusion with the term *content*, sometimes used to refer to the object of belief rather than the set of beliefs against which a belief claim is evaluated.

⁸ This is not a conceptual constraint, but rather has to be some kind of grammatical principle (cf. Percus 2000 and Hacquard 2006 for locality of binding in world/situation/event arguments).

- (25) Mary **thinks** that John **might** be the murderer.⁹
*There is a thinking e by Mary, and in some world w' compatible with **the info state of e** [i.e., Mary's beliefs in w], John is the murderer in w' .*
- (26) John **might** be the murderer.
*There is an assertion e by me, and in some world w' compatible with **the info state of e** [i.e., my beliefs in w], John is the murderer in w' .*
- (27) John **had to** escape.
*There is an event e , and in some world w' compatible with **the info state of e** [#undefined!], e is an escape by John in w' .*

Thus, the epistemic modal base is anaphoric to the information state that the modal is relative to. Only speech and attitude events involve an information state. This predicts that only speech and attitude events can license an epistemic modal base.

Anastasia Giannakidou (pers. comm.) suggests that there are other ways to account for Yalcin's puzzle. In particular, she proposes that (23b) is odd because it is anchored to the speaker's model (see Giannakidou 1998) and it posits conflicting requirements on that model—to be *veridical* by the first conjunct (because “speakers present themselves as conveying a veridical state”), and *non veridical* in the second conjunct, (because “modals do not convey commitment to truth”): this is pragmatically impossible, hence the oddity. It is not clear to me why the imperative ‘suppose’ should trigger anchoring to the *speaker's* model (Yalcin's puzzle still stands when the speaker commits herself to a lack of rain: *It's not raining, but #suppose that that it is raining, but that it might not be.*) However, we might be able to carry this proposal over to a conflict in the addressee's model. This is possible. I am certainly not arguing that event anaphoricity is the only solution to Yalcin's puzzle. Rather, my point here is that this puzzle follows straightforwardly from the event-relativity account I proposed to derive the correlations between a modal's interpretation and its interactions with tense and aspect. As discussed in section 2.2, the motivation behind anchoring a modal to an event, as opposed to an individual and her epistemic state (or “model” Giannakidou 1998), is that modals seem to be anchored to something more fine-grained. Take the sentence ‘*John said that Mary must be the murderer, but he knows that his brother did it.*’ In this sentence, epistemic *must* is anchored to John's speaking event, not his epistemic state—hence the lack of contradiction with the following sentence. Event-relativity aims to explain why modals are relative only to certain time and individual pairs but not to others. Anchoring modals to an individual (or to an individual and a time independent of each other) does not suffice to derive the paradigms in (19) and (20).

2.4 Modal Height/Modal Flavor Correlations

A modal can appear in two positions within a clause, either right above VP or right above TP. A modal has an event variable in its restriction, which needs to be bound locally. When low, the modal has to be bound by the aspect quantifying over the VP event. When high, the modal is bound either by the aspect quantifying over a matrix attitude event (in embedded contexts) or by the speech event (in matrix contexts).

⁹ An anonymous reviewer asks whether the event is still available if the attitude is under negation. It should be and yields the following: *There is no e such that e is a thinking event by Mary and such that in some world w' compatible with **the info state of e** [i.e., Mary's beliefs in w], John is the murderer in w' .*

High modals (i.e., modals anchored to speech or attitude events) are associated with epistemic modal bases; low modals (i.e., modals anchored to VP events) are associated with circumstantial modal bases for the following reason: Epistemic modal bases are anaphoric; they require events that involve information states, which only speech and attitude events do. Low modals—that is, modals anchored to regular VP events, which typically do not involve information states¹⁰—cannot take an epistemic modal base. Instead, they take a circumstantial one.

(28) $f_{\text{circumstantial}}(e) = \lambda w'. w'$ is compatible with the circumstances of e

(29) John **had to** escape.

There is an e which in all w' compatible with the **circumstances of e** is an escape by John.

In sum, an event-relative account keeps a Kratzerian semantics where modals are not lexically specified for flavor. The correlation between modal flavor and modal height arises from the event-dependence of modals and from properties of the event that the modals are anchored to. This derives a Cinquean ordering of modals with respect to other functional projections (tense and aspect) without having to hard-code dedicated positions for specific flavors.

3 Robustness of the Constraints on Modal Flavor and Tense and Aspect Interactions

3.1 Temporal Interpretation of Epistemics

In the previous section, I assumed that epistemic modals scope above tense (or rather that modals that scope above tense receive epistemic interpretations). But is it truly the case that the time of evaluation of an epistemic modal can never be shifted?

First, with an overt restriction, it is possible to evaluate the modal at a past time:

(30) Given what we knew two days ago, John **had** to be in his office at the time of the crime.

Furthermore, some have argued that even in the absence of an overt restriction, epistemics are sometimes evaluated at a past time. Two kinds of contexts seem to lend themselves to such back-shifted epistemics. The first are justifications for a past action. In example (31), for instance, von Stechow and Gillies (2007) argue that *might* expresses a past epistemic possibility, which held at the time that I looked in the drawer, but no longer at utterance time:

(31) A: Why did you look in the drawer?
B: Because my keys might be in there.

The second kind of context is a narration, as illustrated by in example (32), from Rullman and Matthewson (2012), where *had to* describes an epistemic necessity given the facts as they stood this morning, but no longer at utterance time:

¹⁰ See Hacquard (2006, 2010) for a discussion of cases where the VP event is an attitude itself.

- (32) This morning, I opened my phone bill and was shocked when I saw that I owed \$10,000. This **had to** be a mistake! Unfortunately, it turned out to be correct. My husband had used my phone on his latest trip to Papua New Guinea, forgetting about the roaming charges.

In both types of scenarios, the shifting of the epistemic's time of evaluation can be pinned on a particular operator, which can independently be argued to perform point-of-view shifting: 'because' for the former (see Stephenson 2007), and a free indirect discourse operator for the latter. Boogart (2007) argues that the past involved in examples similar to (32) is not a true past (i.e., back-shifted), but a kind of narrative past, where the viewpoint of the speaker is set back to 'this morning'. The sentence describes a *current* possibility from that perspective, rather than a back-shifted possibility from the present. In support of this, it seems that adding a 'now' at the beginning of the modal claim (*Now, this had to be a mistake!*) is possible, where 'now' does not refer to the utterance time, but is shifted to 'this morning'.

Absent such shifting operators, Kratzer (2009) points out that epistemics may not even need to be anchored to the speaker (or local attitude holder), when the context makes a particular source of information extremely salient:

- (33) Nobody among us has had access to the information in this filing cabinet, but we know that it contains the complete evidence (including possibly forged evidence) about the murder of Philip Boyes and narrows down the set of suspects. We are betting on who might have killed Boyes according to the information in the filing cabinet. Harriet, who is innocent, says:
'I **might** have killed him.'
According to the information in the filing cabinet, it's possible I killed him.

Event-relativity does not preclude such cases. In the absence of an overt restriction, it explains why epistemics are anchored to the local attitude bearer and the attitude 'now' (speaker/speech time in matrix contexts; attitude holder and attitude 'now' in attitude contexts). However, it allows the binding of the modal's event variable by overt or contextually salient events (so long as they involve an information state). An *overt restriction* (a) anchors the epistemic to the information state provided by the content of the restriction ('what I knew then' in (a)); a *because*-clause anchors the epistemic to the agent's viewpoint at the time of the caused action; *free indirect discourse* (c) anchors the epistemic to the 'now' of the narrative; a *contextually salient body of information* or *individual* anchors the modal to its content/knowledge state (d):

- (34) a. Given what Mary knew then, John *had* to be the killer.
b. I ran off because John might be the killer.
c. John had to be the killer! I was now convinced of that.
d. 'I might be the killer' (according to John/the info in the filing cabinet).

The event-relative LFs in (35) provide a schematic illustration:

- (35) a. [**speech e : assertion**] John **had_e** to be the killer.
In all w compatible with info state of e [my doxastic state], J. is the killer.
b. [assertion] **given what Mary knew <e> then**, John **had_e** to be the killer.
In all w compatible with info state of e [M.'s past knowledge state], J. is the killer.
c. [assertion] **according to the content <e> of the cabinet**, John **had_e** to be the killer.
In all w compatible with info state of e [the content of the cabinet], J. is the killer.

3.2 (Lack of) Actuality Entailments with Root Modals

An appealing alternative approach to the scope account I proposed for actuality entailments argues that they arise from interpretive considerations and aspectual coercion (e.g., Mari and Martin 2007; Homer 2010).¹¹ The very rough idea is that perfective limits temporally the *ability to φ* to the runtime of the φ -event. The most natural way to make sense of such an ephemeral ability is to assume that it was realized (yielding an actuality ‘entailment’). Such a line predicts that actuality entailments should be cancelable. And indeed, in examples (36) and (37), the ability need not have been realized:

- (36) Notre nouveau robot a même pu repasser les chemises à un stade bien précis de son développement. Mari and Martin (2007)
Our new robot could-pfv even iron shirts at a precise stage of its development.
- (37) A plusieurs reprises, Olga a pu soulever un frigo, mais ne l’a pas fait. Homer (2010)
On several occasions, Olga could-pfv lift a fridge, but didn’t do it.

Deriving actuality entailments through purely interpretive terms provides a natural explanation for why actuality entailments systematically distinguish epistemic from root modals. However, such an account also predicts that actuality entailments should not be idiosyncratic to modals. But as mentioned in the introduction, adjectives and verbs that express root meanings (such as ‘have the means’ or ‘have permission’) do not yield actuality entailments. Now, an interpretive account does not necessarily trigger actuality entailments in such cases: one can conceive of short-lasting permission, without suggesting that that permission was actualized. But why should a deontic possibility modal differ from the periphrastic ‘have permission’ on purely interpretive grounds, such that the former yields actuality entailments, but the latter does not? In section 4.2, I present a similar contrast between French and Italian ‘want’ which suggests that actuality entailments must involve structural factors.

In response to the counterexamples presented here, I have proposed that the lack of actuality entailments with root modals is symptomatic of an additional layer of modality (as with imperfective), which may go undetected for morphological reasons (Hacquard 2009). Examples (36) and (37) use the *passé composé*, which spells out either a past perfective or a perfect. A perfect does not necessarily force perfective aspect, however, and is compatible with the additional presence of a generic (or other modal) operator, obscured in the morphology. Further support for this account over aspectual coercion comes from Hindi and Bulgarian, which overtly differentiate perfective and perfect aspects. In these languages, perfective (unlike a mere perfect) always forces an actuality entailment, even with sentences like those in (38) and (39), suggesting that the perfect is responsible for the lack of actuality entailments in (38) and (39) (cf. Hacquard 2014).

¹¹ Giannakidou and Staraki (2013) show that ability modals in Greek are always implicative when they appear in a causative coordinate structure, irrespective of the aspect that appears on the modal. Given that this structure also yields implicative readings with verbs like *try*, we can assume that the causative component is responsible for the actuality entailment in such constructions, above and beyond the contribution of modality and aspect. I thus focus here on actuality entailments that occur outside of this type of construction.

4 Event-Dependence and Grammatical Modality

Grammatical modals (e.g., verbs or adjectives) express meanings that other words express. However, these other words are not subject to the same constraints. As we saw, while *epistemic* modals seem to scope above tense, ‘epistemic’ attitude verbs scope below:

- (38) a. It **seemed** to John that Mary was home.
b. John **thought/knew** that Mary was home.
c. It was **possible/likely** that Mary was home.

Furthermore, unlike *root* modals, verbs and adjectives that have root meanings do not force actuality entailments when combined with perfective, in a language like French:

- (39) a. Jean **a voulu** s’enfuir, mais il n’est pas parti.
Jean wanted-*pfv* to escape, but he didn’t leave.
b. Jean **a eu les moyens** de s’enfuir, mais il n’est pas parti.
Jean had-*pfv* the means to escape, but he didn’t leave.
c. Jean **a eu la permission** de partir, mais il n’est pas parti.
Jean had-*pfv* permission to leave, but he didn’t leave.

Why do *modals* tend to be subject to these constraints? Why do *verbs* and *adjectives* tend not to?

According to the event-relative account, the constraints on a modal’s interpretation arise from their event-dependence to complete their meaning. Lexical words are fully specified for meaning and are not event-dependent. In this view then, event-dependence is what differentiates *grammatical* from *lexical* modality. In this section, we test the generality of this claim and probe the lexical/grammatical distinction by turning to grammatical modals that are fully specified for meaning and to verbs that seem underspecified for meaning.

4.1 Cinque’s Hierarchy

One advantage of an event-relative account of modality is that it derives a Cinquean ordering of modals without hard-coding Cinque’s hierarchy. The positions of the functional elements under consideration are derived on purely semantic grounds. Epistemics scope high because they are speech-event-relative, roots low because they are VP-event-relative. There is no hard-coding of dedicated positions for flavor. Semantically, modals come in single lexical entries and end up with different meanings in different positions owing to their event-dependence.

What about modals that are fully specified for meaning? Do they obey scoping restrictions similar to those of their underspecified counterparts? Given the proposed account, modals show scope restrictions by virtue of having flexible meanings. But if a modal does not have meaning flexibility, can an event-relative system derive meaning-based scope relations, without encoding dedicated structural positions for modal meanings?

4.1.1 Ordering of Fully Specified Modals

While modals in many of the world's languages are reported to be underspecified for meaning, modals in many other languages are fully specified (van der Auwera and Ammann 2005). How do such modals pattern in their interactions with tense and aspect? Do they behave more like underspecified modals or like verbs and adjectives? A full answer to this question would take us well beyond the scope of this chapter, as we would need to look individually at each language carefully. One immediate challenge is to figure out whether such modals are 'grammatical' or 'lexical,' and what we take such a distinction to be, in a way that is not circular. Traugott (2011) provides the following distinctions, noting that they are "poles on a continuum as opposed to absolute contrasts" (p. 382): lexical categories are members of major word classes (noun, verb, adjective); they express referential meaning and can be used as predicates. We can assume further that lexical categories scope below tense and show characteristics of bi-clausality when they take a sentential complement. (Of course, such a classification gets murky once we consider elements that share properties with both, such as restructuring predicates; see section 4.2).

Take Japanese *kamosirenai* and *nitigainai*, for instance, which are fully specified for meaning and express epistemic possibility and necessity, respectively.¹² Unlike their French and English counterparts, they can scope under tense, as example (40) shows.

- (40) (Sensyu no jiten de wa) John-ga hannin-de aru {**kamosirenakat-ta/nitigainakat-ta**}
 (at an earlier point last week) John-Nom culprit-Pred be **might-past/must-past**
 (at an earlier point last week) John could/had to be the murderer.

However, these modals are arguably lexical, based on their adjectival morphology and the relative temporal independence of their complement:

- (41) Kinou John-wa zenjitu-ni hon-o yon-da (no) kamosirenakat/nitigainakat-ta.
 Yesterday J-Top the.day.before-at book-Acc read-past (C) possible/necessary-past
Yesterday, it was possible that John had read a book the day before.

Thus, while fully specified modals (like those in Japanese) may seem not to obey meaning-based temporal constraints, their morphological and syntactic properties may show that they are more lexical than functional in nature.

Putting this worry aside, and assuming that there are still many languages with fully specified grammatical modals, do we have any evidence that they display the same constraints as their underspecified homologues? Investigating the interaction of fully specified modals with tense and aspect presents further challenges from the tense and aspect systems of the languages under investigation. Modals in Lilloet Salish, for instance, are fully specified for meaning (Rullman et al. 2008), but it is difficult to investigate their interactions with tense, given the lack of overt tense in that language.

Beyond their interactions with tense and aspect, however, there may be one aspect in which fully specified modals obey structural constraints similar to those of their underspecified counterparts, namely the way they scope relative to one another. Nauze (2008) argues that modals from diverse language families show the same Cinquean ordering (epistemic > deontic > ability), *regardless* of whether they are under- or fully specified for meaning. The epistemic enclitic *-kał*, and the circumstantial circumfix *ka...a* in Lilloet, for

¹² Thanks to Y. Izumi, Y. Ito, K. Funakoshi, and especially S. Funakoshi for judgments and helpful discussion.

instance, are fully specified for flavor and only allow the epistemic to scope over the circumstantial:

- (42) Ka-sək-s-as-á -kəl ti sq'úm'c-a ti twéw'w'ət-a <exs>Demirdache (1997)
 Ka-hit-TR-(3SG-)3SG-a -kəl DET ball-DET DET boy-DET
 'The boy will/might be able to hit the ball.'

It could be that ability and deontic modals do not scope over epistemic modals generally owing to meaning incompatibilities: it is strange to talk about an ability or obligation to bring about an epistemic possibility or necessity. Von Stechow and Iatridou (2004), however, argue against conceptual impossibility with the following example. Imagine a scenario in which an insurance company will only pay for an expensive test if there is a possibility that the patient may have Alzheimer's. This state of affairs can be reported with the sentence in (43):

- (43) For the test costs to be reimbursed, it has to (DEONTIC) be possible (EPISTEMIC) that the patient has Alzheimer's.

Example (43) shows that a *lexical* epistemic can scope under a deontic modal, suggesting that this ordering cannot be ruled out on purely interpretive grounds. Note, however, that this embedding possibility does not seem available with modal *auxiliaries*, at least in English: (44) does not seem to have an interpretation where 'may' is read deontically and 'have to' epistemically.¹³

- (44) The patient may have to have Alzheimer's.

Thus the ordering of (grammatical) modals with respect to one other may be rigidly fixed universally, though the matter is not entirely settled. But let us assume that it is, for the sake of argument. Can we derive this ordering without hard-coding dedicated positions, even in those languages with modals fully specified for meaning?

4.1.2 Deriving Cinque's Hierarchy

If modals are fully specified for meaning, they technically do not *need* to depend on an event to complete their meaning: their lexical entry could specify that they quantify over epistemically or circumstantially accessible worlds without being event-relative:

- (45) $[[\mathbf{must}_{\text{epis}}]] = \lambda q_{\langle \text{st} \rangle} \forall w'$ compatible with what is known in w : $q(w') = 1$

But if that is the case, why should epistemic modals appear high, and root modals low? Do we need to hard-wire a particular position for these fully specified modals in order to prevent unattested scope readings (e.g., where an epistemic would scope below a root modal)?

¹³ Kratzer (1976) argues that in the following German example the embedded modal auxiliary *können* can be interpreted epistemically while the modal *müssen* is interpreted deontically. Nauze (2008), however, argues that the embedded modal cannot be interpreted epistemically. Similarly, it is not entirely obvious that 'possible' in (43) describes an epistemic rather than a circumstantial possibility.

- (i) Und auch in Zukunft muss diese Schnecke...Saugfüsse haben können.
 And also in future must this snail suction.feet have might
 And even in the future, this snail must possibly have suction feet. (Translation from Nauze (2008))

Event-relativity can derive different positions for fully specified modals without any hard-coding of structural position. An alternative to the option given in (45) for fully specified modals lexically specifies a particular modal base, but specifies it in *event* terms, as in (46):

$$(46) \quad [[\mathbf{must}_{\text{epis}}]]^w = \lambda e_v. \lambda q_{\langle st \rangle} \forall w' \text{ compatible with INFO STATE } (e): q(w') = 1$$

Assuming that the event variable in a modal's restriction still has to be bound by the nearest event binder, such a denotation will force an epistemic modal to appear above Aspect, so that it can be relative to an event that describes an information state—that is, a speech or attitude event. We would thus still predict that epistemics (which are speech/attitude event-relative) scope higher than roots (which are VP event-relative).

4.2 Lexical vs. Grammatical Modality

Modals are subject to particular interactions with one another and with tense and aspect, based on the meaning they receive, a circumstance that verbs or adjectives expressing the same meanings are not subject to. We have argued that the particular behavior of modals can be blamed on their event-dependence for full meaning specification. But what about verbs and adjectives? Do they always behave uniformly with respect to their interactions with tense and aspect? Are they always fully specified for meaning? The answer to both questions seems to be no.

As for the first question, I showed earlier that, unlike bouletic modals, French 'want' (*vouloir*) does not yield actuality entailments. Italian *volere* does, however. A continuation that denies the truth of the complement comes out as a contradiction in Italian but not in French:

- (47) a. Jean a voulu parler à Marie, mais il ne l'a pas fait. *French*
 b. Gianni ha voluto parlare a Maria, #ma non lo ha fatto. *Italian*
 '*John wanted to talk to Mary, (#)but he didn't do it.*'

Why should Italian and French 'want' differ in this way? In Hacquard (2006, 2008), I argued that the crucial difference is that Italian *volere* is a restructuring predicate, unlike French *vouloir*. Assuming that restructuring verbs form a single clause with their complement (Wurmbrand 2001), I argued that *volere* sentences involve just one Aspect, which quantifies over the VP event across *volere*, as with a root modal, yielding a *single* event that necessarily occurs in the actual world (as well as in the desire worlds):

$$(48) \quad [[(48b)]]^w = \text{true iff in there is an event } e \text{ in } w, \text{ which all worlds } w' \text{ compatible with Gianni's desires, is an event of Gianni talking to Maria.}$$

That the ultimate cause for actuality entailments is structural and not merely meaning-based is further supported by the fact that Italian *desiderare* ('desire'), which is not a restructuring predicate, does not yield actuality entailments.

- (49) Gianni ha desiderato parlare a Maria, ma non lo ha fatto. *Italian*
 '*John desired to talk to Mary, (#)but he didn't do it.*'

Hence, while *volere* seems verbal in taking an individual argument (though see Grano 2012 for a proposal that *want*'s subject is not even selected by *want* itself, but raises from its complement), it behaves like a functional element in not requiring its own layer of aspectual quantification. This fundamental property that it shares with modal auxiliaries is responsible for its similar behavior with respect to actuality entailments.

As for the second question, there appear to be verbs whose meaning also is flexible, though they are not as common as modals. Mandarin *xiang* ('want'), for instance, sometimes expresses belief ('think') (Tardiff and Wellman 2000; Nguyen 2013):

- (50) Zhangsan *xiang* Lisi zai Shanghai.
Zhangsan {wants/thinks} *Lisi* to be in Shanghai.

The meaning that *xiang* receives is constrained by its syntactic environment. Is *xiang* genuinely ambiguous or should it receive a Kratzerian semantics? First, *xiang* seems verbal: it takes an individual argument and shows characteristics of bi-clausality, such as temporal independence (at least under its 'think' interpretation). Furthermore, the subcategorization constraints for its different interpretations are in line with those of unambiguous verbs that express similar meanings. It is thus not entirely clear that a verb like *xiang* is truly underspecified, with the full determination of its meaning dependent on its syntactic environment (as I proposed for modals). Verbs with flexible meanings (like *xiang*) may make a better case for ambiguity or polysemy than modals, given their relative cross-linguistic infrequency. Such verbs would be associated with multiple lexical entries, with their own subcategorization specification, which would match that of their unambiguous synonyms. I leave an investigation of this question for future research.

It is interesting to note that, cross-linguistically, 'want' seems to be particularly prone to modal behavior: it is often a core restructuring predicate (Wurmbrand 2001; Cinque 2004; Grano 2012), which makes it behave like a root modal (*volere*); it can be involved in polysemy (*xiang*), and it is often the source of grammaticalization (Heine 1993; Remberger 2010; among others). Looking at such predicates, which share syntactic and semantic properties with both regular verbs and modals, seems like fertile ground for an investigation of what distinguishes lexical from grammatical modality, and how a verb might turn into a modal.

Given my proposal that event-dependence is what distinguishes grammatical from lexical modality, a process of grammaticalization might go as follows. What the verb 'want' and the modal 'must' have in common is their quantification over worlds. They differ in two respects: 'want' is an event sortal, implying participants; 'must' is not. The domain of quantification for 'want' is lexically provided and anchored to its experiencer, while for 'must' it is provided anaphorically via the event variable inside the modal's restriction. If a verb turned into a modal, it would no longer be an event sortal and would lose its participants. It would, however, keep an event variable in its restriction that would need to be bound locally. This loss would result in a gain in both structural and meaning flexibility. A modal would be able to move freely to two positions, but the meaning that it could receive in these positions would depend on constraints imposed by the event binders that are locally available. If a modal still had a lexically specified modal base, it might be banned in certain positions. If it did not, it would be able to appear in either position and display the kind of meaning-based constraints with tense and aspect we have seen in this chapter. I take up some of these ideas in Hacquard (2013).

5 Conclusion

In many (unrelated) languages, the same modals can express various flavors of modality but show distributional constraints based on flavor (modal flavor/modal position correlations). I argue that these constraints are not solely due to the meaning they express. There is nothing inherent in epistemicity that requires atemporality, or in abilities or deontic permissions or obligations that requires actualizations. Instead, I argue that we can blame the correlations between modal flavor and modal position on the event-dependence of modals, without hard-coding particular syntactic positions dedicated to particular meanings. I hypothesize that this event-dependence is what ultimately differentiates grammatical from lexical modality.

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