

Modals, Contextual Parameters, and the Modal Uniformity

Hypothesis

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Abstract

There is a common assumption in the semantics of modal auxiliaries in natural language; in utterances of $\lceil \text{MOD } \phi \rceil$, where MOD is a modal and ϕ is the prejacent, context determines the particular flavor of modality expressed by the modal. Such is the standard contextualist semantics of Kratzer and related proposals. This winds up being a problem, because there is a significant class of modals which have constraints on the admissible modal flavor that are not traceable to context. For example, in $\lceil \text{MUST } \phi \rceil$, subsentential properties of ϕ , like the aspectual class of the predicate in the prejacent, can affect the flavor of MUST. By encoding the above assumption into the semantics, such contextualist accounts fail to be able to explain, much less to predict, this pattern. Worse yet, attempts to exploit the resources of the theory in service of an explanation run afoul of important commitments of the view, like the hypothesis that modals have a uniform semantics. Given these circumstances, these data might seem like a justification for dispensing with the uniformity hypothesis. The present paper lays out the above problem in detail. Against the pessimistic view, I argue that the contextualist account can in fact explain and predict these patterns while preserving the uniformity hypothesis. This requires adopting an amendment to the semantics of modals based on the work of Valentine Hacquard. Aside from maintaining the contextualist paradigm and preserving uniformity, the proposal also clarifies the role of context in the interpretation of modals. As it will turn out, the role of context ought to be circumscribed in its flavor-determining role for modals.

1 Introduction

The dominant position in natural language semantics and philosophy of language models the semantics of modal auxiliaries after the semantics of necessity and possibility operators of modal logic. However, unlike their formal-logical counterparts, the meanings of natural language modals exhibit significant contextual variation. A natural way of accommodating the variety of modal meanings in natural language is to treat modal terms as context sensitive expressions. This is captured by the following paradigm: $\lceil \text{MUST } \phi \rceil$ is a universal quantifier over a contextually determined set of worlds, where ϕ is to hold in each of these.¹ This paradigm allows for an elegant and uniform treatment of modals in natural language. The work of Angelika Kratzer² is the touchstone of this approach, and employs contextual parameters to restrict the modal's domain of quantification. Even many challenges to Kratzer's semantics follow her in treating modals in roughly this way.

The fact that Kratzer's semantics for modals allow a uniform treatment of modal expressions is thought by many to count strongly in favor of the approach, and the need for a uniform treatment amounts to a working hypothesis in much of the literature. The alternative would apparently treat modal expressions as ambiguous and, contra Grice's modified Occam's razor (Cf. his 1989), multiply the senses of modals intolerably.³ Though advocates of a uniform semantics for modals are in the majority (at least in formal semantics, and in much of philosophy of language), uniformity does have its detractors. By way of recent example, Viebahn and Vetter [2016] present arguments in favor of modal polysemy. Most of their arguments invoke typological and historical-linguistic data which

¹I adopt the following convention in the paper: mentions of natural language words are in italics, and object language operators are rendered in capital letters, which I will set in bold face when they appear in derivations.

²Cf. Kratzer [1977], Kratzer [1981], Kratzer [1991], Kratzer [2012]

³Cf. Kratzer [1977] for an early discussion of this point, and Hacquard [2011] for a more contemporary discussion.

they argue favor a polysemy hypothesis concerning modals. In the present paper, I will concern myself with the uniformity hypothesis as well, discussing some more directly semantic data that threatens to undermine it. I will show how these data are very hard to accommodate in a satisfactory way on the orthodox Kratzerian semantics and thus might seem to call for something like a polysemy approach to modals. Nonetheless, I will defend both the Kratzerian paradigm and the uniformity hypothesis by suggesting that the data can in fact be accommodated by a Kratzer-style contextualist semantics. I give such a semantics, based on a modification of Kratzer’s semantics along the lines suggested by Hacquard [2010]. Doing so will reveal some fundamental properties pertaining to the type of context sensitivity exhibited by modals.

To give an idea of the kind of problem I will be pressing, consider the following. On the Kratzerian contextualist view, while the quantificational force of the modal is lexically encoded (whether the modal expresses necessity or possibility), the meaning component typically referred to in the literature as the ‘flavor’ is contextually determined.⁴ This means that for a sentence like (1), context determines whether the flavor of *must* is deontic or epistemic.

(1) John must go to the store.

I will argue that this is not the case. There are constraints on the flavors *must* can have in (1) that are not traceable to context, and allowing context to determine its modal flavor leads to over-generation. So, if our theory is that context alone is responsible for setting the values of the parameters relative to which modals are semantically evaluated, we lack the resources to account for some commonplace regularities in the interpretations of modal auxiliaries. It will turn out that if we want to maintain this broad role for context, we are

⁴The ‘hard-wiring’ of the quantificational force of modals may not be universal. Cf. Rullman et al. [2008] for a discussion of how modals in St’át’imcets show contextually variable quantificational force. Cf. Kratzer [2012] for additional discussion. I set this possibility aside, since it would not affect the main arguments of this paper.

forced to give up the uniformity hypothesis.

Sentences like (1) exhibit a pattern; the predicates of the prejacent are all non-stative, as though the aspectual class of the prejacent's predicate mattered to the interpretation of modals. If it does, the account lacks a satisfactory way of maintaining the broad value-setting role of context while somehow making this feature relevant to the interpretation of the modal. The lesson of this, I will argue, is that the value setting role of context proposed by Kratzer semantics is in tension with its commitment to uniformity. I will argue that an explanation of this pattern ultimately does not require that we give up a uniform semantics for modals, though it does require paying attention to the roles of tense and aspect in the interpretation of modals. In many ways, the received view I will detail is an idealization that abstracts away from these features. Such idealization is unobjectionable, as far as it goes. But I aim to show that a failure to appreciate at least some of the ways tense and aspect interact with modals results in a distorted view about the role context plays in modal interpretation.

The paper will proceed as follows. In section 2, I first describe some of the key meaning components a theory of modals ought to capture. I then rehearse the Kratzerian account of the semantics of modals and point out some key features and commitments of the view. In section 3, I show how exactly how we can see that the epistemic readings available to sentences like (1) are not traceable to context. I then diagnose why the orthodox Kratzerian view is unable to capture the appropriate generalization and dispense with some non-solutions. Section 4 develops a semantics which can explain this pattern but preserves uniformity. My semantics yields an easy explanation of why epistemic interpretations of (1) are so constrained, and reveals some surprising features of of root interpretations of (1).

2 The Meaning Components of Modals

Rather than expressing possibility or necessity absolutely, natural language modals express these with respect to a circumscribed domain. The routine way of describing this dimension of meaning is to say that modals admit of different flavors.

- (2)
- a. Smith must be the murderer.
 - b. The students must finish their assignments by Friday.
 - c. You absolutely must try the fabulous dessert.

Many natural language modals are polyfunctional; they express multiple flavors of modality. In (2), *must* has an epistemic, a deontic, and a bouletic flavor, respectively. Epistemic modals describe the ways things could be, given some body of knowledge or evidence. Deontic modals express possibility or necessity given a certain body of laws or rules; bouletic modals express them with respect to a set of desires.⁵ The categories designating modal flavor are themselves subject to finer-grained distinctions in meaning. Even within flavors of modality, there are subtle differences in meaning a given modal can have. Consider deontic *must*.

- (3)
- a. The convict must serve time in prison for the crime.
 - b. Mary must do the dishes after dinner.
 - c. John must hand in his term paper by the due date.

If deontic *must* expresses an obligation, it is clear that the type of laws or ideals from whence the obligation issues is different in each of (3).⁶ A little reflection suggests that

⁵Other flavors of modality include abilitive and teleological modality, expressing possibility/ necessity relative to a set of physical abilities and set of particular goals, respectively.

⁶To fill out the example a little bit, a natural context on which (3a) is intuitively true is one where, according to the laws of a country or state, the convict must serve time in prison, (3b) is one according to which the rules of the household are such that Mary must do the dishes after dinner, and (3c) is one according to which the norms of higher education are such that John must hand in his term paper by the due date.

all the flavors of modals admit of this kind of stratification of meaning within the flavor dimension. To fix some vocabulary, call the difference in meaning exhibited by (2) **inter-flavor**, and the kind of differences in meaning exhibited by (3) **intra-flavor**, since they concern differences in meaning within a particular flavor.

While modal flavor is but one feature of modals, any theory of modal semantics must account for differences among inter-flavor and intra-flavor distinctions in some way.⁷ The prevailing view is contextualist; the interpretation of a modal is secured by context’s supplying values to parameters introduced by the expression into the semantic representation of the sentence. On this view, inter- and intra-flavor distinctions share a source: the value context assigns to the contextual parameters relative to which the expression is interpreted. The parameters posited determine modal meaning on both inter- and intra-flavor axes, in virtue of the values context assigns to them.⁸ It is this feature of the view that comes into conflict with the uniformity hypothesis, and which I wish to advocate an alternative for.

Before scrutinizing the semantic account, I want to highlight one further distinction amongst modals that will be relevant. It is common in the generative linguistics tradition to distinguish between ‘root’ and ‘non-root’, or epistemic, modals, since the latter exhibit different syntactic behavior than their root counterparts.⁹ This is more of a grammatical distinction than is the classification of modals into flavors based on their interpretations. However, it is generally accepted that root modals correspond to the non-epistemic fla-

⁷An invariantist account, like that of Bach [2009] or Braun [2012], claims that the semantic content of a modal is invariant across different contexts, and account for inter- and intra-flavor differences by appeals to pragmatic reasoning. (Cf. also Sackris [2015].) My interest, however, is with those views that integrate this dimension of meaning into the contextually determined content of the modal. However, since my argument is that certain interpretations of modals are systematically excluded for reasons having nothing to do with context, I am suspicious of the ability of invariantist views to account for these data.

⁸Swanson [2008] puts the point as follows. “The striking ease with which a single modal can target different modalities is sometimes taken to suggest that context alone determines which modality is targeted – that there is no lexical difference between epistemic and deontic *must*, for example, but only a difference in some parameter or parameters supplied by context.”

⁹Cf. especially Jackendoff [1972] and predecessors.

vors.¹⁰ I make use of this distinction in what follows, though I sometimes use these terms to refer to the grammatical type of modal word, and sometimes to the cluster of flavors aligned with the grammatical type, letting context disambiguate.

In what follows, I use *must* to illustrate my main points, since it can be used to express a wide range of flavors. My interest is in conditions under which *must* takes a root interpretation (so, a non-epistemic interpretation) as opposed to an epistemic interpretation. I will typically invoke a deontic reading since such a reading suggests itself rather easily with this modal, but all the points can equally be made with any of the root flavors available to *must*. I leave a more thorough investigation of how other modals compare with these distributional features of *must* to future work. Nonetheless, the behavior generalizes to other polyfunctional modals, and I will flag the extent to which it does so when appropriate.

2.1 The Semantics of the Standard Account

What I will henceforth call the Standard Account is due a series of seminal papers by Kratzer.¹¹ Harking back to the paradigm described in the introduction, the Standard Account construes modal sentences as having the the following underlying form: $\lceil \text{MOD}(\text{R})(\phi) \rceil$.¹² The modal operator, MOD, takes two arguments; R, the restrictor, which determines the domain the modal quantifies over, and ϕ , the nuclear scope, which is the sentence the modal scopes over (commonly known as the prejacent). The sentence *John must be the murderer* then has the form:

$$(4) \text{ MUST}(\text{R})(\text{John be the murderer})$$

According to Kratzer [1981], two “conversational backgrounds” comprise R and thereby jointly affect the restriction on the domain of possible worlds: the modal base, f , and the

¹⁰Cf. Portner [2009] for a discussion of how the root/ non-root distinction applies to the flavor categories.

¹¹Cf. Kratzer [1977], Kratzer [1981], Kratzer [1991], Kratzer [2012]

¹²Cf. Fintel and Gillies [2011] for a similar presentation of what they call “the canon”. Cf. also Dowell [2011].

ordering source, g . Here is how these two features work. The modal base and the ordering source are both functions from worlds to sets of propositions. To accommodate the distinction between *epistemic* and *root* modals, Kratzer allows two modal bases, f_{ep} and f_{circ} , an epistemic and a circumstantial one, with the circumstantial modal base corresponding to the class of root modals.¹³ The nature of the set of propositions delivered by each modal base is commensurate with its role in the interpretation of the modal. Epistemic modals have to do with possibility or necessity given states of information, so f_{ep} will yield a set of propositions characterizing some information state. Root modals have to do with possibilities or necessities given the obtaining of certain facts, so f_{circ} will yield a set of propositions characterizing some circumstances. Ultimately, we will want to the modal to quantify over a set of possible worlds, and since propositions are themselves sets of possible worlds, these functions give us a way to accomplish this. Intersecting the propositions given by the modal base gives us a single set of possible worlds, which we can call the modal domain. Then it makes sense to talk of a circumstantial domain or an epistemic domain, depending on whether the modal base is circumstantial or epistemic. The definitions of circumstantial and epistemic domains are given in (5).

- (5) a. $\bigcap f_{ep}(w) = \{w' \mid w' \text{ is compatible with what is known by the relevant agent(s) in } w\}$ ¹⁴
- b. $\bigcap f_{circ}(w) = \{w' \mid w' \text{ is compatible with certain circumstances relevant in } c \text{ in } w\}$

The ordering source, g , also picks out a set of propositions, and the relation \leq_g imposes

¹³Recall from section (2) that root modals are traditionally considered to encompass all those flavors of modality that are non-epistemic.

¹⁴Part of the debate in the philosophical literature over epistemic modals concerns whose information state is the relevant one to determine f_{ep} . I skirt that issue here, and assume there is a way the context provides for the relevant agent(s), even though this issue is a big part of what separates so-called contextualists from relativists.

a preorder on the worlds in $\bigcap f(w)$ according to which propositions in $g(w)$ hold at each world. Since this has the effect of restricting the set of worlds to those deemed “best” according to g , we can think of g as further restricting the domain as follows. BEST_g is a function that picks out the best worlds (according to g) in its domain. We are now in a position to see how the Standard Account implements the intuitive paradigm formally.¹⁵

$$(6) \quad \llbracket \text{MUST } \phi \rrbracket^{w,f,g} = \forall w' \in \text{BEST}_{g(w)}(\bigcap f(w)): \phi(w') = 1^{16}$$

Less formally: $\lceil \text{MUST } \phi \rceil$ is true iff ϕ is true in all of the most highly ranked worlds (according to the standards of $g(w)$) compatible with $f(w)$. The contextual parameters f and g allow us to stay quite close indeed to the intuitive paradigm glossed in the introduction.

2.2 Key Features of the Standard Account

There are two key features of the Standard Account I wish to draw attention to. These features are perhaps more properly understood as ways the Standard Account makes good on some antecedent theoretical commitments, as opposed to entailments of the semantic theory. These are: the implementation of the uniformity hypothesis and a strong understanding of the role of context in determining modal flavor (both inter and intra).

2.2.1 Uniformity

On the Standard Account, both the inter- and intra-flavor differences in meaning are accounted for via the conversational backgrounds f and g . Accounting for them so allows the Standard Account to explain the differences in modal interpretations without thinking of modals as ambiguous. The uniformity hypothesis is a principled constraint, with the aim

¹⁵Here I adopt the formulation from Portner [2009], which makes the Limit Assumption, though Kratzer [1981] does not. I adopt it here for ease of formalization, but this formulation is now standard.

¹⁶I’ve suppressed other parameters of the interpretation function besides those relevant to this presentation.

of avoiding a proliferation of modal senses for polyfunctional modals. Since (translations of) modal expressions apparently have a strikingly similar flavor profile across multiple languages, this makes it highly unlikely that polyfunctional modals like *must* are homophonous realizations of different words. The Standard Account can give content to this constraint, through something like:

UNIFORMITY: Modal words in natural language have uniform lexical entries, in spite of their ability to be used to express different flavors of modality.

In spite of the fact that a given modal expression may be polyfunctional, what that expression introduces into the logical form of the sentence containing it is nonetheless univocal. By appealing to the lexical entry of the modal expression, UNIFORMITY makes good on Kratzer [1977]’s contention that modals intuitively have a “common kernel” of meaning across flavors. In every sentence where *must* (for example) occurs, regardless of the flavor, it has the following lexical entry.

$$(7) \quad \llbracket \text{must} \rrbracket^{w,f,g} = \lambda P \lambda f \lambda g \lambda w [\forall w' \in \text{BEST}_{g(w)}(\bigcap f(w')): P(w') = 1]$$

The denotation of *must* combines with the denotation of a prejacent, P , and, given a modal base and an ordering source, the resulting proposition is true relative to a world according to which f and g get the appropriate values. The flavor of the resulting modal sentence admits of is the result of the assignment of values to the parameters. On this picture, this is entirely a pragmatic affair, and requires no flavor-induced change in the lexical entry for the modal.

2.2.2 Pragmatic Resolution

The value-setting role of context on the Standard Account is rather powerful. Our motivating paradigm includes the insight that modals are quantifiers over contextually determined sets of worlds. As we saw in sections 2.1 and 2.2.1, the restriction is accomplished via

parameters whose values are assigned via context. If this is right, then absent idiosyncratic lexical features, the values of the parameters are resolved pragmatically. Short of such hard-wired restrictions, nothing in principle constrains context in its setting the value of the parameter. The model we have for this is essentially that of NP anaphora.^{17,18} This feature is captured by PRAGMATIC RESOLUTION.

PRAGMATIC RESOLUTION: The contextual parameters introduced by modals exhaustively determine the meaning of the modal along the flavor dimension through the pragmatic assignment of values to the parameters.

PRAGMATIC RESOLUTION encodes the intuition that modal expressions are context sensitive. The next section will show that this feature of the account quickly comes to grief if we're serious about UNIFORMITY.

3 Driving a Wedge Between Context and Modal Interpretation

Given the recipe for determining modal meaning, the dual commitment to UNIFORMITY and PRAGMATIC RESOLUTION quickly comes to grief. Consider (1), reproduced as (8).

(8) John must go to the store.

(8) is a simple, unembedded modal sentence, with nothing distinguishing the prejacent except for the fact that its predicate, *go to the store* is eventive (that is, non-stative).

¹⁷Cf. Stanley [2000] and Stanley and Szabó [2000].

¹⁸An example of such an idiosyncratic feature is that *might* is often thought to only have an epistemic reading (though cf. Condoravdi [2002] on a type of non-root interpretation of *might* she calls 'metaphysical'). If this is true, context could not conspire to yield a deontic reading for *might*. The advocate of the Standard Account allows this feature to be hard-wired into the lexical entry for *might*, limiting its possible interpretations. However, since *might* then admits of no readings besides the epistemic ones, this does not result in having to postulate a separate lexical entry for *might* with other modal flavors, and so does not impugn UNIFORMITY.

Predicates fall into one of at least four aspectual classes based the temporal structure of the eventualities the predicates denote; states, activities, accomplishments, and achievements. Of these four, the latter three are known as the ‘eventive’ classes.^{19,20} Though the predicates that fall in the eventive classes differ with respect to the temporal structure of the events they denote in ways I won’t discuss presently, they all share the feature of being dynamic. Events are thought to *happen* and to take time to do so.²¹ States, by contrast, are said to *hold* rather than happen.²² They lack eventives’ dynamism. To the extent that they hold over a particular interval, they do so in an undifferentiated, homogenous manner.

The most obvious interpretation of the modal in (8), I submit, is a teleological (and therefore, a root) one: John’s going to the store is required to satisfy his aims of, say, having food in the house. Now, according to PRAGMATIC RESOLUTION, context should settle both the inter- and intra-flavor meaning for *must* in (8). If this were the case, we should be able to evoke epistemic readings of (8) merely by manipulating features of the context. However, (8) and similar sentences (those with eventive predicates) have systematic constraints on how they can have an epistemic reading. My contention is that attention to the conditions under which the epistemic reading is available show that context is not the factor responsible for determining the flavor. It will turn out that the

¹⁹The classic classification of the aspectual classes (also called *Aktionsarten*) are due to Vendler [1957], Dowty [1979], and Mourelatos [1978], with important precursors in Kenny [1963] and Ryle [1949], though these distinctions trace back to Aristotle. Some authors add additional classifications, like semelfactives (Cf. Smith [1991]), but others (e.g. Rothstein [2004]) find this addition unnecessary.

²⁰Two tendencies for variation in the literature are worth flagging. First, about what to call the class that encompasses all four aspectual classes. I follow Bach [1986] in referring to them as ‘eventualities’. This avoids confusion the other oft-used term, ‘situations,’ (e.g., as in Smith [1991]) can cause with respect to situation semantics. Second, some authors, like Mourelatos and Bach, classify activities as ‘processes’ and distinguish these from bona-fide events like achievements and accomplishments. I follow Vender, Dowty, and Rothstein in calling them events. While distinguishing between processes and events might make a difference in the mereology of events, for our purposes, the issue is merely terminological. Cf. Smith [1999] for a compelling case assimilating activities to the class of events.

²¹Achievements, like *die* or *win the race* are conceptualized as change of state predicates, so the interval over which this type of event elapses can be small indeed. But nonetheless, achievements occur over an interval long enough for the change to take place, so they satisfy this minimal characterization.

²²Cf. Parsons [1990] for discussion.

constraints are traceable to differences in the logical form of the prejacent. Therefore, despite appearances, meeting them exceeds mere manipulation of the context.

3.1 First Constraint: Habituality

Though the default interpretation the modal in (8) is perhaps teleological, not an insignificant number of informants are able to access an epistemic interpretation of (8) when the predicate *go to the store* receives a habitual reading. The habitual reading is most easily evoked with the help of a bit of contextual background and a frequency adverbial. (Think: *John must go to the store (Mondays/ often/ every day after work)*. Or, even more evocatively; *Even though John's refrigerator is always empty over the weekends, it is invariably stocked full when I stop by his apartment Tuesday mornings. John must go to the store Mondays.*) In saying that the predicate is interpreted habitually, the contrast here is to the episodic reading of the predicate. To make this contrast vivid, we may first note that sentences can describe information about particular events, as in (9).

(9) John went to the store.

Abstracting away from features like tense, what makes a sentence like (9) true is the occurrence of a particular kind of episode or event, namely a going-to-the-store by John.²³ On the other hand, sentences such as (10) don't describe particular events, but rather regularities in the world which amount to generalizations over events.

(10) John goes to the store (Mondays/ often/ every day after work).

(10) has a habitual interpretation, and its truth isn't dependent on any particular event so much as a pattern of event-types (goings-to-the-store by John) that are asserted to hold

²³To be sure, (9) *also* has a habitual reading, as in the following exchange. A: Throughout the past year, John had a relentlessly routine schedule. He dedicated each of his weeknights to a different chore. Mondays he did his laundry. Tuesdays he vacuumed his apartment. B: What did he do on Wednesdays? A: He went to the store.

sufficiently regularly.²⁴

Two facts are important to the present discussion. First, habituais are a species of generic. More specifically, they are a variety of what Krifka et al. [1995] call *characterizing sentences*, one of the two basic varieties of genericity in natural language. Secondly, as the previous gloss on the truth conditions of episodic vs. habitual sentences makes clear, the distinction between habitual and episodic sentences reflects a semantic difference. That a robust semantic difference in the prejacent underlies the difference in the root and epistemic readings of (8) is easy to overlook due to the fact that, in English, habituality has the same linguistic form as the simple present. Linguists like Dahl [1995] point out that many languages opt to express habituality through the least marked tense-aspect choice available in the language. In other languages, it just so happens that this distinction is grammaticalized.

That said, it is no more a matter of context whether the prejacent of (8) is habitual than it is whether (10) is. The difference between a habitual and episodic interpretation of the prejacent in (8) is reflected in the semantic representation of (8) at a suitable level of abstraction. While the precise truth-conditions of generic sentences are a thorny matter, semanticists generally agree that genericity is represented in logical form by means of a phonologically null variable binding operator, GEN.²⁵ The epistemic interpretation of (8) all but vanishes on an episodic interpretation of the predicate. The lesson here is that this way of getting an epistemic interpretation of (8) requires that (10) be the prejacent. According to standard proposals concerning generics, GEN is a dyadic operator, so generic sentences are also partitioned into a restrictor and a scope. The logical form of (10) is something like the following:

²⁴Cf. Carlson [2005] for discussion.

²⁵Cf. Krifka et al. [1995]. Also cf. Leslie [2008] and Leslie [2013] for discussion. The operator was originally proposed by Heim [1982].

(11) GEN(x, e)[$x = \text{John} \ \& \ e \text{ involves } x$] [Going(e, John) & To($e, \text{the store}$)]

If this is so, this means that the difference between the non-epistemic interpretation of (8) and this particular epistemic interpretation of (8) hinges on a difference in the prejacent. Holding fixed the event semantics employed in my gloss on the truth conditions of characterizing sentences, the difference between this epistemic and the teleological interpretation of (8) is made visible in (12).

(12) a. EPISTEMIC: MUST(R)(GEN(x, e)[$x = \text{John} \ \& \ e \text{ involves } x$][Going(e, John) & To($e, \text{the store}$)])

b. ROOT/ TELEOLOGICAL: MUST(R)($\exists e$ (Going(e, John) & To($e, \text{the store}$)))

All of this suggests that the epistemic interpretation of *must* will covary with the habitual reading of the predicate in the prejacent. When the predicate gets a habitual reading, the epistemic reading of *must* is available. On the episodic reading, a root reading is mandatory. Aside from forcing a root reading, there seems to be no further constraint on which of the root flavors are allowed when the predicate has an episodic reading. So, while I glossed the most likely reading of episodic (8) as teleological, an appropriate context may yield a deontic reading of (8) as well. A final point to note. There is an aspectual difference between the episodic and the habitual readings of the predicates. Work on Aktionsart and lexical aspect makes clear that habitual sentences have a stative semantics.²⁶ Since the episodic interpretation of *go to the store* is eventive, the binding of the event variable by GEN seems to make the prejacent stative.

3.2 Second Constraint: Futurates

The emerging generalization is that prejacentes with eventive predicates are subject to systematic constraints if they are they are to admit of epistemic readings under modals like

²⁶Cf., e.g., Smith [1991], Carlson [2005]

must. The first such constraint was a habitual reading of the prejacent. There is a second way an eventive prejacent could get an epistemic reading; if the prejacent has a futurate reading. Futurates are sentences without future-referring verbal morphology that nonetheless refer to future events. So, while *John will leave tomorrow* is interpreted as concerning a future event of John's leaving in virtue of the auxiliary *will*, simple futurates (*John leaves tomorrow*) and present progressive futurates (*John is leaving tomorrow*) ostensibly talk about a future event without any verbal marking signaling future reference. However, as a condition on their assertability, they require a reading of the predicate such that the event it describes is planned or scheduled in advance.^{27,28}

A futurate reading is not immediately apparent for the prejacent in (8), but this comports well with the assertibility conditions of futurates. Had the prejacent contained an eventive predicate more easily construed as scheduled, then an epistemic reading of *must* would have been easy to come by, particularly if a temporal adverbial made a future reference time salient. Consider this next example in the following context. I have hosted John for a few days, see his packed luggage standing by the front door that evening, and surmise that his departure is imminent. I utter (13).

(13) John must leave tomorrow.

With (13), the available readings include not only the deontic reading, according to which (roughly) the speaker claims that John is under an obligation to leave tomorrow, but also an epistemic reading, which was made salient by the envisioned context, in spite of the

²⁷Compare sentences like i. *My plane takes off this afternoon*, ii. *The Yankees play the Red Sox on Wednesday*, and iii. *I go to the doctor tomorrow* with i'. #*My plane crashes tomorrow*, ii'. #*The Yankees defeat the Red Sox on Wednesday*, and iii'. #*I accidentally meet the doctor tomorrow*. Cf. Copley [2008b] and [2009] for discussion of the literature surrounding this kind of construction.

²⁸Most, of the time, this requires a plan to have been made by some salient agent, where knowledge of the plan is contextually available. But there are futurates that cannot plausibly be the result of a plan by any agent, e.g. *The sun rises tomorrow at 6:34 AM*. These types of futurates only seem to be available when it is contextually agreed upon that the event in question comes about through some expected, law-like process. Copley [2009] suggests that for such constructions, we can understand the law-like process as standing in for the plan, and the world as taking the role of the director of the plan.

eventive predicate in the prejacent. The epistemic reading of (13) contains a futurate prejacent.

One would need to strain to trigger an analogous “scheduled” reading of (8). The relevant difference between (8) and (13) is that leavings are easily thought of as scheduled (since they often are scheduled), so we don’t require conversational machinations to accommodate this prerequisite. The difficulty in getting a non-habitual epistemic interpretation of (8) to gain traction is due to the difficulty in interpreting *go to the store* as plausibly scheduled. But suitable cooperation by the context can over-ride this tendency, as evidenced in (14).

CONTEXT: You and I are discussing an upcoming party John is hosting the day after tomorrow. We know that John intends on buying a lot of supplies for the party. We see that his cupboards are still bare, so we attempt to determine when John will go to the store for supplies. You note that John has to work late today and wonder aloud what his plans are for tomorrow. I retort:

(14) John must go to the store (tomorrow).²⁹

Once the context allows for an interpretation of the predicate as a description of a planned event, we can have an epistemic reading of *must* with a non-habitual, eventive prejacent. Moreover, it is clear that the eventive predicates that more readily admit of epistemic readings under *must* are precisely those that admit of scheduled readings rather easily. So, the evidence suggests that in those epistemic interpretations of *must* with non-habitual eventive prejacent, the prejacent are in fact futurates.³⁰ We see no evidence of a similar constraint for the types of predicates that can embed under root *must*; they do not need to be scheduled or planned. The significance of this asymmetry harks back to our

²⁹Many speakers, myself included, would probably be more likely to utter a progressive futurate in the envisaged context: *John must be going to the store tomorrow*. But (14) is still acceptable as an epistemic modal sentence, which is what matters to the present discussion.

³⁰This suggestion is also pressed by Klecha [2016] and Ramchand [2014].

discussion of habituais in the following two ways. First, the most prominent account of the semantics of simple futurates posits a special kind of futurate operator in logical form responsible for triggering the appropriate reading.³¹ Assuming a non-habitual, epistemic reading of (8), we would then be justified in suspecting a difference in the logical form between the epistemic and the root sentences. Rendering this futurate operator as FUT, the logical form of the root reading would be as above in (12b), whereas the logical form of the epistemic reading under discussion would be something like (15).³²

(15) MUST(R)(FUT (John go to the store))

Second, the construction resulting from the application of FUT is a derived stative.³³ So, as with habituais, the most worked out account of futurates treats futurate sentences as semantically different from their non-futurate counterparts.

3.3 General Remarks on the Constraints

The motivation behind explaining the above constraints on an epistemic interpretation of the likes of (8) was to show that, to the extent that an epistemic reading was possible, the availability of the reading conformed to a predictable pattern. These epistemic interpretations were admittedly not nearly as prominent as the root readings, and needed either considerable help from the context or the addition of certain kinds of temporal adverbials to make them accessible. The above discussion was not intended as a recipe for yielding an epistemic interpretation for every *must*-sentence with an eventive prejacent. Instead, it

³¹Cf. Copley [2009] for a modal construal of FUT. Also, Kaufmann [2005] argues for a similar modal element. Copley [2009] suggests that FUT in simple futurates is actually a species of GEN. If this is so, the present discussion could in principle be assimilated to the previous section. Cf. Copley [2014] for a non-modal, “causal-chain” analysis of FUT. This analysis will become important later on in the paper.

³²In this rendering of logical form, I abstract away from the event semantics employed in (12). In future sections, we’ll have the occasion to look at the logical forms in more detail. For now, I’m interested in representations at a rather coarse level of granularity, insofar as these are suggested by the apparent asymmetries in root and epistemic interpretations of *must*.

³³For a collection of evidence of this fact, cf. Copley [2008a] and Copley [2014].

was intended to show that, to the extent that an epistemic interpretation was even available, it was only where the prejacent was an instance of a habitual or a futurate. Tying an epistemic interpretation of (8) to the habituality or futurity of its prejacent has the following consequence. The epistemic reading of *must* is predicted to only be as prominent as the respective habitual or futurate readings of the prejacent. In contexts where these futurate readings are hard to get, the epistemic reading is correspondingly predicted to be hard to get as well, which is exactly what we see when we reflect on the data.

It also has further significant consequences. If context alone were responsible for the epistemic interpretation of the modal in (8), then we ought to be able to evoke this epistemic reading merely by manipulating features of the context. Yet, evoking an epistemic reading for (8), as with all *must*-sentences whose prejacent has eventive predicates, seems to require interpreting the prejacent as habituals or futurates, and is difficult in precisely those contexts that don't lend themselves to habitual or futurate interpretations of the prejacent. Moreover, these two constraints exhaust the options for epistemic readings of (8). Admittedly, obtaining a futurate or habitual interpretation of a predicate seems to require a good degree of cooperation by the context of utterance, as evidenced from the contextual gerrymandering I employed to evoke these readings. But this should not obscure the fact that, if our current accounts of habituals and futurates are on the right track, the habitual/ futurate interpretations of (8) trace to differences in the logical form from their episodic and non-futurate counterparts. Simply put, in spite of the fact that the string of words exemplified in (8) can have an epistemic reading, the nuclear scope of the modal is in fact different when the modal is interpreted epistemically. To the extent that context plays a role in securing these interpretations, it does so largely in a disambiguating role with respect to the prejacent, to use the terminology of Stanley and Szabó [2000]. The evidence we would need to attribute the epistemic reading of (8) to contextual factors is

a case where the nuclear scope is unchanged with respect to its logical form for both the root as for the epistemic readings, and the only difference is some feature of the discourse context. So far, we haven't seen such evidence.

Since the habitual and futurate prejacentes are stative and their episodic counterparts are eventive, it would appear that epistemic *must* does not tolerate eventive predicates in the nuclear scope of the modal. Whatever the cause of this restriction, it also persists under various embeddings, as exhibited in (16) where the salient reading throughout is a deontic/ root reading.

- (16) a. Attitude verbs: Mary thinks John must go to the store.
b. Indirect discourse: Mary said that John must go to the store.
c. Antecedents of conditionals: If John must go to the store, then...
d. Consequents of conditionals: If we are out of milk, then John must go to the store.

In light of the persistence of this effect, the null hypothesis is that the eventuality-type of the predicate in the prejacent has something to do with this restriction. Let's call eventive predicates where we see no evidence for a stativizing operator like GEN or FUT, "bare eventive predicates". Further, let's call prejacentes with bare eventive predicates, "bare eventive prejacentes." The following generalization is strongly suggested by the foregoing discussion.

EVENTIVITY CONSTRAINT: a modal auxiliary is bound by the eventivity constraint if it has an obligatory root interpretation with a bare eventive prejacent

Though I will continue to focus on *must*, it is worth noting that *must* is not unique in conforming to the EVENTIVITY CONSTRAINT (henceforth "EC"). *Ought* and *should*, to the extent that they admit of epistemic readings, seem to conform to the EC as well.³⁴ *May*

³⁴Cf. Yalcin [2016] for arguments that these modals do not in fact have epistemic readings. For Yalcin,

and *might* seem, at first blush, not to conform to it. The important point is that we have something of a robust generalization applying to a range of modals. The most immediate concern is that the Standard Account fails to predict this pattern in the interpretation of these modals. In the next section, I will discuss why this is.³⁵

3.4 Diagnosing the Problem

The EC spells trouble for the Standard Account, since the latter predicts that context can conspire to produce values for f and g such that $\llbracket(8)\rrbracket^{w,f,g}$ is epistemic on an episodic reading of *go to the store*. Once we set aside habitual and futurate prejacent, the epistemic reading of (8) is simply not attested. We lack an explanation of this apparent restriction on the interpretation of the modal.

Recalling the motivating paradigm, if we analyze modals as quantifiers over sets of possible worlds, we need some kind of restriction on the domain of quantification. To that end, the Standard Account posits a contextual parameter that restricts the modal’s domain of quantification. One of these parameters, the modal base f , is responsible for determining whether the modal has an epistemic or a root flavor. So a good place to look for an explanation of the EC is f . The story is that context contrives to secure values for f , yet there is no *prima facie* reason to suppose context is prevented from assigning a value for an epistemic modal base to it. After all, f is just a function that takes a world argument, and there is nothing in the recipe provided by the Standard Account that indicates when the value of the function should yield an epistemic as opposed to a circumstantial domain,

these are pseudo-epistemic readings; he proposes a semantics where a normality ordering is imposed over a set of worlds characterizing an information state. I don’t wish to quibble over whether, if this is an apt characterization, “normality” modals form a natural class with properly epistemic ones. Suffice it to say, that such an account is not inconsistent with anything I’ve said.

³⁵The behavior the EC describes is gestured at in Hacquard [2011]. EC behavior is noted by Lekakou and Nilsen [2008] in Greek, and Drubig [2001] discusses a related pattern, but to my knowledge the only extended semantic treatment of the EC is in Ramchand [2014]. The earliest explicit acknowledgement of the pattern described by the EC seems to be Steedman [1977].

aside from the needs of the conversational context. The EC makes it seem like the choice for the value of f is systematically restricted given certain sub-sentential properties of the prejacent in the scope of the modal. It would be as if in $\lceil \text{MUST } \phi \rceil$, the internal complexity of ϕ impacts the interpretation of MUST.

To see why this is a problem for the Standard Account, consider what it takes for f to get a particular value. As Kratzer’s formulation invites, let’s think of f_{ep} and f_{circ} as two different function-types, the definitions for which are given in (5a) and (5b). On the basis of the EC, we want to say that bare eventive prejacent somehow only allow the parameter f in (7) to get a value of the type f_{circ} . The reason this is so difficult to accommodate on the Standard Account comes into relief in considering what would determine whether the modal base of a modal is f_{circ} or f_{ep} in a given context.

Exactly how this would work is partly a reflex of the details of the semantics’ implementation. For completeness’s sake, let’s consider both implementations. On the first implementation, the one I adopted for the exposition of Kratzer’s semantics, f and g were simply parameters of the interpretation function, $[[\cdot]]$. That is to say, the interpretation of modal sentences is relative to these parameters (in non-modal sentences, they are vacuous); an interpretation is possible once values have been assigned to these parameters. However, the idea is just that they are given a value pragmatically; this is the significance of Kratzer’s calling them “conversational backgrounds.” Consequently, according to this implementation, whether the modal base is f_{circ} or f_{ep} is a matter of context. Of course, the EC shows us precisely that does not hold in full generality.

On the second implementation, f is treated as an object language variable in the level of syntactic representation of the sentence that serves as the input to semantic interpretation.³⁶ Like any free variable (think of unbound readings of pronouns, like deictic readings

³⁶This is in fact the preferred approach in much of the current linguistics literature. Cf. Fintel and Heim [2002].

of *he* or *she*), it needs to be given a value in order for the modal sentence to be interpreted. This is done by the assignment function, a .³⁷ The assignment function determines whether f is assigned a value of type f_{circ} or f_{ep} . Treating f as an object language variable may then seem like an advance insofar as its value assignment is mediated by a , but this doesn't help with the EC. The appropriateness of a given assignment is determined by the context of utterance.³⁸ Absent a special condition on the appropriateness of variable assignments that manages to rule out assignments according to which f gets an f_{ep} -type value, this would again incorrectly predict that there are epistemic readings of EC modals with bare eventive prejacent. Of course there is no such reading. Moreover, what would such a special condition be, short of a mere specification of the prohibition? And what justification would we claim for the special condition, aside from a desire to render the theory empirically adequate? This maneuver really just recapitulates the data by building an ad hoc condition into the appropriateness conditions for assignment functions. Such a restriction has no explanatory value.

3.5 Whither Uniformity?

I submit that the Standard Account over-generates; the EC shows how the Standard Account does so in a rather systematic way. I've shown that this is attributable to the mechanism in the semantics which yields the modal domain; the modal base parameter. I've also shown how the most apparent ways of remedying this over-generation problem are either unsatisfactory, or they contravene UNIFORMITY.

³⁷The assignment function is one of the coordinates of the interpretation function, $[[\cdot]]$. So, the interpretation is defined relative to those coordinates. It is typically rendered ' g ', but I've rendered it ' a ' to avoid confusion with the ordering source.

³⁸Cf. Heim and Kratzer [1998] (pp. 243 – 244), who place the following appropriateness condition on LFs with free pronouns:

A context c is *appropriate* for an LF ϕ only if c determines a variable assignment $[a_c]$ whose domain includes every index which has a free occurrence in ϕ .

In response to this problem, one might think, “So much the worse for UNIFORMITY! The EC gives us a semantic reason to think modal auxiliaries do not have a uniform semantics, at least along the root/ epistemic dimension. Let’s not hinder theorizing with such a commitment.” It is not my goal to give a full-throated defense of UNIFORMITY in this paper. But while the EC does pose complications for UNIFORMITY, this pessimistic attitude is premature. It would be more appropriate if we were not able to vindicate UNIFORMITY after all. In the next part of the paper, I will show that there is a way to salvage UNIFORMITY and maintain the spirit (if not the letter) of the Standard Account in the face of this constraint, by outlining a semantics that can predict and explain the EC.

One might think, by way of a second response, that my claim that the EC poses a problem for the Standard Account is overblown. In fact, such an argument would go, the Standard Account can have a perfectly good response to the data posed by the EC, one which, moreover, would predict the data. This putative response is simply to build the restriction into the lexical entry of the modal, as it were. The idea here is similar to the one floated in the last section, where a condition is placed on acceptable variable assignments. Here, the idea is that a condition of this type is recommended by the lexical meaning of the word. The discussion thus far suggests the following kind of restriction.

(17) $\llbracket \text{MUST } \phi \rrbracket^{w,f,g}$ is only defined if f is circumstantial or if ϕ is stative

This suggestion is reasonable, but I think ultimately unsatisfying. For one thing, it buys us the ability to predict the EC at the cost of what appears to be another *ad hoc* stipulation. It appears *ad hoc* because it simply integrates the EC as a condition on the interpretation of the modal. Moreover, it does nothing to explain the EC. In response to my complaint, my interlocutor may object that semantics just needs to model the truth conditions of the target expressions in the fragment of natural language the semantic account is concerned with; demanding it *explain* the derivation of those truth conditions is misplaced. After all,

there may not be an explanation, properly speaking, for why an expression has the truth conditions it has. And building the restriction into the interpretation in the manner above signals that the meaning of the expression is messy and idiosyncratic.

As above, I think this theoretical posture is premature. To start with, the notion of explanation I'm invoking is not particularly deep. It would suffice for the semantic account to give some indication as to why the relevant property stipulated in the restriction is at all relevant to the interpretation of the modal, perhaps by appealing to the semantic or syntactic properties that figure in accounts of aspectual class or *Aktionsart*. A restriction of the kind in (17) falls short of that. Now, it might turn out that there is nothing more to be said about the aspectual class of the prejacents and its relation to the modal. But that would be strange, considering that the behavior captured by the EC turns out to be unexceptional as opposed to idiosyncratic, and moreover the putative restriction appeals to a lexical semantic property of modals that seems to apply to various modal expressions. Moreover, it turns out that EC behavior is not a mere quirk of English. Though I won't be pursuing a rigorous cross-linguistic comparison of modals in service of this point, I can note some suggestive comparisons to other languages. Lekakou and Nilsen [2008] note a similar pattern with the Greek modal *prepi*. The German modal *müssen* exhibits similar behavior (though see the discussion in section (4.3) for an important qualification). There is also a similar pattern in Russian. The Russian necessity modal *dolžen* is a copula+participle construction roughly glossable as “obliged is”; effectively the translational equivalent of *must*. In (18), with an eventive prejacents, the modal can only have a root interpretation.

- (18) Vanja dolžen pojti v magazin
 Vanja must.PRES go.pfv to store
 ‘Vanja must go to the store’

A large part of the case against ambiguity accounts of modals is that they model what is better represented as systematic behavior of expressions in a way better suited to lexical

accidents.³⁹ I think the same kind of methodological ambition ought to apply here. A cursory look at this data doesn't support the suspicion that the EC or EC-type behavior are idiosyncrasies of English, so the account of it ought not treat it as such. Building the restriction into the lexical entry for the modal as a condition on its interpretation suggests we are dealing with lexically idiosyncratic behavior when the hunch that we have systematic behavior of modals on our hands is more justified.

I propose, then, to give an account that preserves UNIFORMITY while respecting the apparent systemicity of the data underlying the EC. For an inquiry into the relation between modals and aspectual class, Condoravdi's [2002] deserves attention for making note of patterns of aspectual dependency in modal interpretation. Before presenting my own account, I will discuss how her theory might come to bear upon an explanation of the EC.

3.6 Condoravdi [2002] on the Modals' Sensitivity to Aspect

The fact that the interpretation of modals can be affected by the aspectual properties of the predicates of their complements was famously noted by Condoravdi [2002], so it's worth seeing to what extent Condoravdi's theory can explain the kind of patterns captured by the EC. She makes two distinctions that are essential to her account. The first one concerns the difference between epistemic and metaphysical readings of modals. According to Condoravdi, they are both non-root modals in the sense discussed above, with epistemic modals having an epistemic modal base, as in our previous discussion, and metaphysical modals having a metaphysical modal base, the value of which is an equivalence class of worlds consisting of the set of worlds that are identical in history through some time t . (Condoravdi uses the term 'modal base' for what I've been calling 'modal domain', but this kind of ambiguity is unproblematic, and common in the literature.) In matrix contexts, a

³⁹Cf. the work cited in fn. 3.

metaphysical modal base delivers the worlds which are historical alternatives to the world of utterance, at the time of utterance.^{40,41}

The second distinction is between the temporal perspective and temporal orientation of a modal. The temporal perspective of the modal is the time at which the modal base is determined. For an epistemic modal, it is the time that determines the information state relative to which the prejacent is evaluated. For a metaphysical modal, it is the time relative to which the historical alternatives are determined. The temporal orientation is the time at which the evaluation of the prejacent is to take place. Put differently, it is the interval probed for the truth of the prejacent.

Condoravdi is concerned to maintain a uniform account of the temporal semantics of non-root modals in light of the differing temporal behavior of certain constructions. To that extent, her concerns, though different in detail, are broadly in sympathy with the concerns of the present paper. Her thesis is that non-root modals uniformly have a present perspective and a future orientation. However, the temporal perspective of the modal can be shifted by operators of various sorts, changing the apparent orientation of the modal. For example, (19), the relevant reading of which is made especially prominent by the adverbial *still*.

(19) The team might (still) have won the game.

On an informal gloss, (19) is true on the relevant reading just in case, at some point in time prior to the time of utterance, it was still possible for the team to go on to win the game. As the game progresses, and the possible avenues for the team's victory were winnowed down, any historical alternative wherein they win was no longer open to them, and they consequently lost. This reading of *might* has a temporal orientation which is

⁴⁰Cf. the branching time framework of Thomason [1970].

⁴¹One might have doubts about whether metaphysical modals are really not a variety of root modal after all, but I put this concern aside.

backshifted with respect to the time of utterance (the perspective is some time in the past). Yet, Condoravdi maintains her uniformity thesis by arguing that the backshifted reading is attributed to a scope reversal between the modal and the operator contributed by the Perfect, PERF. On her analysis, PERF scopes over the modal, and while the modal still has a present perspective and future orientation, its present perspective is shifted by PERF (so it is a kind of present in the past, not an indexical present) and it is future oriented with respect to that perspective.

I mention this scope reversal, the first way in which the temporal behavior of modals can be affected by other elements of the clause, to put it aside as orthogonal to the present concerns. The second way that the temporal behavior of modals is affected by other elements in the clause is more central to my concerns. The precise nature of a modal's temporal orientation also depends on the aspectual type of its complement. Condoravdi specifies the translation of temporal operators in terms of the AT-relation, where this varies depending on the nature of its third argument (which, for our purposes, is the prejacent).

(20)

$$AT(t, w, P) = \begin{cases} \exists e [P(w, e) \ \& \ \tau(e, w) \subseteq t] & \text{if } P \text{ is eventive} \\ \exists e [P(w, e) \ \& \ \tau(e, w) \circ t] & \text{if } P \text{ is stative} \\ P(w)(t) & \text{if } P \text{ is temporal} \end{cases}$$

That is, if P is eventive, then P standing in the AT-relation to t and w is a matter of the interval of P 's holding in w to be included in t . If P is stative, it is a matter of P (in w)'s overlap with t . (P is temporal if it is a property of times.) We can then use the AT-relation to define the lexical entries for modals according to the following schema, where 'MB' stands for 'modal base' (or, what I've been calling the modal domain).

(21) a. Possibility modal: $\lambda P \lambda w \lambda t \exists w' [w' \in \text{MB}(w, t) \ \& \ AT([t, \infty), w', P)]$

- b. Necessity modal: $\lambda P \lambda w \lambda t \forall w' [w' \in MB(w, t) \rightarrow AT([t, \infty), w', P)]$

The present tense operator PRES identifies the free occurrences of t with the interval *now*, as in (22).

$$(22) \text{ PRES: } \lambda P \lambda w [AT(now, w, P)]$$

On Condoravdi's analysis, the arguments of modals are tenseless, with tense scoping over the modal, resulting in the following schema for modal sentences generally: $\lceil \text{PRES (MODAL(P))} \rceil$. Taking into account the different instantiations of the AT-relation for eventive and stative prejacent, modal sentences result in the following kinds of derivations. Following Krifka [1989], the function τ maps events (or events and their worlds of instantiation, as construed here) to their run-times. We use *be at the store* and *go to the store* as our paradigmatic eventive and stative predicates alike.

- (23) a. He might be at the store.
 b. he be at the store: $\lambda w \lambda e [\text{he be at the store}](w)(e)$
 c. $\text{MIGHT}_{MB}(\text{he be at the store})$:
 $\lambda w \lambda t \exists w' [w' \in MB(w, t) \ \& \ \exists e [[\text{he be at the store}]] (w')(e) \ \& \ \tau(e, w') \circ [t, \infty)]]$
 d. $\text{PRES (MIGHT}_{MB}(\text{he be at the store}))$:
 $\lambda w \exists w' [w' \in MB(w, now) \ \& \ \exists e [[\text{he be at the store}]] (w')(e) \ \& \ \tau(e, w') \circ [now, \infty)]]$
- (24) a. He might go to the store
 b. he go to the store: $\lambda w \lambda e [\text{he go to the store}](w)(e)$
 c. $\text{MIGHT}_{MB}(\text{he go to the store})$:
 $\lambda w \lambda t \exists w' [w' \in MB(w, t) \ \& \ \exists e [[\text{he go to the store}]] (w')(e) \ \& \ \tau(e, w') \subseteq [t, \infty)]]$
 d. $\text{PRES (MIGHT}_{MB}(\text{he go to the store}))$:
 $\lambda w \exists w' [w' \in MB(w, now) \ \& \ \exists e [[\text{he go to the store}]] (w')(e) \ \& \ \tau(e, w') \subseteq [now, \infty)]]$

$\infty))]$

(23) and (24) show how the truth conditions differ subtly for prejacent with stative and with eventive predicates. For stative prejacent, the temporal trace of the P -eventuality overlaps with the interval starting *now* and extending infinitely into the future. However, if the prejacent is eventive, it is included in that same interval. The stipulation that the temporal relation involved for events is one of inclusion rather than overlap has important consequences. For one thing, since events are temporally extended, the requirement that the event be included in the interval $[now, \infty)$ guarantees that the event be in the future of *now*. For it to be properly included in the interval, it must start, at the earliest, at *now* and extend to some point in the future. Since stative eventualities merely *overlap* with the evaluation interval, they can start at some point before the interval and persist into the future, and still satisfy the overlap requirement. This allows for stative eventualities to be contemporaneous with the time of utterance, where no such possibility exists for events. This feature of the semantics thereby accounts for the obligatory future-orientation of eventive predicates compared to the merely optional future-orientation of stative predicates.

So much for Condoravdi's semantics. The question is how the analysis would rule out epistemic readings of the likes of $\lceil \text{MUST } \phi \rceil$, where ϕ is eventive. Though her analysis is sensitive to the effects of the prejacent's aspectual class on the interpretation of modals, nothing in her analysis rules out the readings targeted by the EC, and Condoravdi does not discuss this pattern. At best, we could surmise how an explanation of the lack of these readings would go, given the resources of her theory. Since, by assumption, ϕ is eventive, the temporal requirement with respect to eventive prejacent has the ϕ -eventuality included in the interval starting at the utterance time and extending into the future. As discussed, this puts the ϕ -eventuality in the future with respect to the utterance time. The definition of necessity modals glossed above has it that all worlds in the modal base (i.e., all worlds

consistent with what is known by the relevant agent(s)) are worlds where the ϕ -eventuality holds at some point in the future.

What might rule out epistemic *must*, given these truth conditions? We could hazard an explanation on the assumption that *must* is veridical. If *must* is veridical, as von Fintel and Gillies [2010] would have it, $\lceil \text{MUST } \phi \rceil$ entails ϕ . But if the future is open, then the kind of knowledge that would satisfy such truth conditions is perhaps exceedingly rare, since it would require knowledge of the inevitability of the eventuality described by ϕ . In fact, the kind of circumstances that could underwrite such knowledge are circumstances where the ϕ -eventuality is treated as though its eventuating is settled (e.g. as though through a prior plan). But such circumstances are precisely those that support the felicity of futurate constructions, as outlined in section 3.2. So, this line of reasoning would go, the conditions under which an epistemic reading of $\lceil \text{MUST } \phi \rceil$ is true either simply does not exist for lack of appropriate foreknowledge, or else it cedes to the futurate construction. Absent acceptable truth conditions, $\lceil \text{MUST } \phi \rceil$ has an obligatory root reading, when ϕ is eventive.

Against such an explanation, we might note that the interpretation of *must* as veridical is controversial; in arguing against it von Fintel and Gillies position themselves as arguing against a “mantra”. Indeed Kratzer [1991] accepts the mantra of non-veridical *must*. Though I’m partial to veridical *must*, one might worry about an explanation for the EC that hinges on a controversial analysis. Secondly and more decisively, modals like *should* and *ought* seem be EC modals. However, unlike *must*, *should* and *ought* are nowise thought to be veridical, even on their epistemic reading. Yet, they $\lceil \text{SHOULD } \phi \rceil$ and $\lceil \text{OUGHT } \phi \rceil$ lack epistemic readings when ϕ is eventive. So this kind of story would not serve to explain the EC. I cannot think of another obvious way to leverage Condoravdi’s theory for an explanation of the EC.

There is another worry, which doesn't immediately bear on the explanation of the EC, but brings into question whether the way the aspectual dependencies are cast in Condoravdi's semantics captures the right truth-conditions. Specifically, the temporal relation that determines the nature of the temporal orientation for stative sentences under modals is too weak. The semantics allows the prejacent to be true at *any* point within an interval overlapping the time of utterance. That would mean, for a sentence like (23), *He might be at the store*, it would be true if there is a world in the modal base where the referent of *he* is at the store two weeks from now. The truth conditions are presumably set up in this way because we can easily evoke this meaning with the adverbial *two weeks from now*. Without such an adverbial, (23) is simply present-oriented; (23) would be false if *he* were not at the store at the time of utterance. So, for all its insights into the aspectual dependency of modals, I do not think Condoravdi [2002] will serve as a firm enough basis for an explanation of the EC.

4 The Event-relative Approach to Modals

So ends the critical portion of the paper. I will now argue that the lack of epistemic readings of *must* with eventive prejacentes in fact has quite a simple explanation, once we allow a small departure from the Standard Account. Seeing this involves taking a finer-grained look at the semantics of tense and aspect and their integration with modals. The result of this integration accounts for half of an explanation of the EC. The other half of the explanation, explaining why root *must* with eventive prejacentes is acceptable, becomes a more delicate matter on the account I will advocate. But first the easy part. The way forward involves taking note of apparent difference in syntactic position between root and epistemic modals, what Hacquard [2010] calls 'Cinque's Puzzle'. Following the work of Cinque [1999] on the relative positions of functional heads, it is largely thought that the

relative syntactic positions of modals is as follows (irrelevant projections omitted).⁴²

(25) MODAL_{epistemic}>TENSE>ASPECT>MODAL_{root}>vP.

These syntactic positions impose scope restrictions on modals. To illustrate a poignant example of this, epistemic modals are often said to scope higher than tense and aspect, whereas root modals scope below tense and aspect. Since *must* does not inflect for tense, this scope restriction is difficult to detect in *must*-sentences. It becomes apparent with the semi-modal *have to*, which does inflect for tense. (26) has both a root and an epistemic interpretation.

(26) Deborah had to be at the train station.

(Epistemic gloss) ‘It is necessary, given what is known now, that Deborah was at the train station.

(Root/ teleological gloss) ‘It was necessary, given Deborah’s circumstances then, that she be at the train station.

As the glosses on (26) make clear, the evaluation time of the modal is not modified by tense on the epistemic reading, whereas it is on the root reading. On the epistemic reading, the modal is evaluated with respect to the salient information state as it is *now*, at the time of speech, amounting to a present temporal perspective, to use Condoravdi’s terminology.⁴³ By contrast, on the root reading, the modal is evaluated with respect to the circumstances *then*, as though shifted by the past tense on the modal expression. This is consistent with the modal being in the scope of the past tense, as (25) puts it.

These syntactic differences are something of an embarrassment to the Standard Account, insofar as it aims at UNIFORMITY. The difference in syntactic location illustrated

⁴²Recall that Condoravdi takes non-root modals to scope under tense, so her account is at odds with Cinque’s hierarchy.

⁴³Discourse effects may make another perspective available, as can certain kinds of adverbials. I put these complications aside, since they do not affect present point.

in (25) suggest that there might be at least some lexical differences between root and epistemic modals, at least with regards to what licenses their different positions in the clausal architecture. To account for these data, Hacquard [2010] proposes a revision of the Standard Account, which I will adopt in what follows. Here the paradigm of treating modals as restricted quantifiers over sets of possible worlds is maintained, except that modals take an event argument as opposed to a world argument. Suggesting that modals take an event argument allows Hacquard to explain the two different syntactic positions for modals as follows. First, she assumes a Davidsonian event semantics where verbs are treated as predicates of events and introduce event variables into logical form.^{44,45} Second, she posits an operator representing illocutionary force in the logical form of the sentence.⁴⁶ Hacquard proposes that this illocutionary operator is a predicate of events much like in the verbal domain (in this case, though, a speech event or illocutionary event). This makes at least two event variables available in the logical form of the sentence; a high event variable associated with the speech or utterance act, and a low event variable introduced by the verb. In making modals take event arguments, she is able to correlate the height of the modal with the availability of an event variable for the modal to take as argument. Hacquard derives the different flavors from the event argument the modals take. ‘Low’ modals are anchored to the event variable introduced by the vP. On Hacquard’s picture, modal base projections from vP events yield a circumstantial domain, and correspond with root interpretations of the modal. ‘High’ modals are anchored to the speech event, and such

⁴⁴Cf. Davidson [1967]’s foundational arguments, and Higginbotham [1985] for the classic proposal to implement Davidson’s event semantics compositionally.

⁴⁵Although I made a commitment to using the cover term “eventuality” to talk about events and states (or, events, processes, and states, for those who make the further distinction), it is conventional to talk about “event semantics” and “event variables” even when it is understood that these may also stand for states. When following this convention would cause confusion, I will disambiguate.

⁴⁶Cf. Krifka [2001] for an example of this. Theorists like Krifka self-consciously distinguish their approach from the ‘explicit performative’ approach to mood as in Lewis [1970], which is widely thought to be inadequate. Representing the illocutionary act in the semantics is meant to account for certain noteworthy embedding facts such as left-dislocation, as opposed to a semantic representation of mood or clause-type.

modal base projections yield an epistemic domain.⁴⁷

So far I've only noted that modals can sit in two syntactic locations and that on Hacquard's approach, this is attributable two different event variables in the clausal structure that the modal base can take as arguments. These facts alone do not justify the claim that high modals yield an epistemic domain and low modals a circumstantial one. In fact, there is a reason for this distribution. Certain predicates of events (namely, those events associated with speech or utterance events, and those associated with propositional attitudes) are thought to be associated with content, whether the content of the illocution or the attitude. We use CON as a function that is defined when e has propositional content. Then $\text{CON}(e)$ denotes the content of e . This innovation allows us to reconstrue modal domains as follows.

- (27) a. $\bigcap f_{ep}(e) = \{w' \mid w' \text{ is compatible with } \text{CON}(e)\}$
b. $\bigcap f_{circ}(e) = \{w' \mid w' \text{ is compatible with certain circumstances of } e\}$

According to Hacquard, for f to be epistemic, its event argument needs to be a 'contentful' event; $\text{CON}(e)$ needs to be defined for f 's argument if f is to be of type f_{ep} .⁴⁸ This explains why there are no 'low' epistemic epistemics.⁴⁹

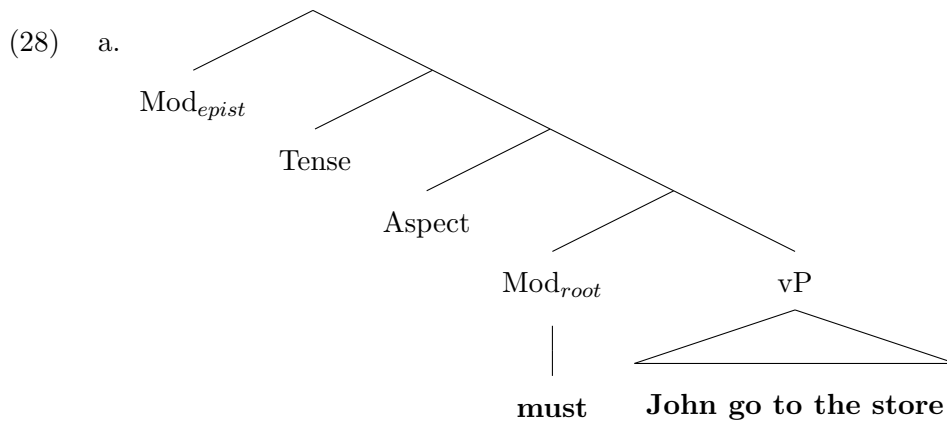
Hacquard's revision of the Standard Account allows us to keep the semantics of modals uniform. It requires no major revision of the lexical entry for modals, so it preserves

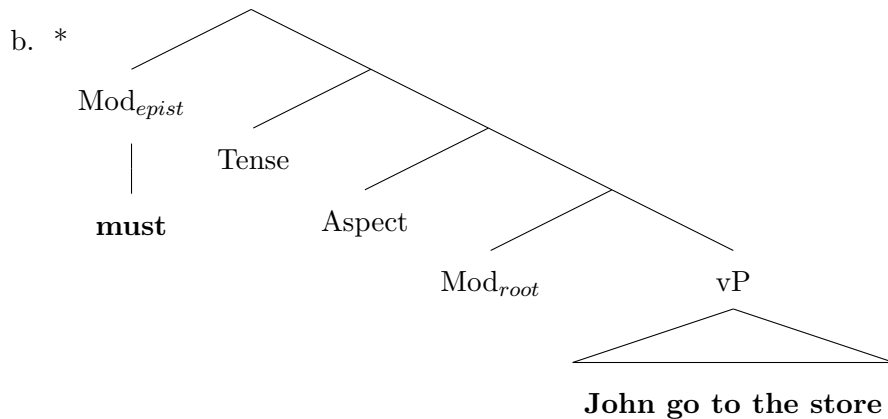
⁴⁷Speech act operators are not the only way to motivate the presence of a speech event in the logical form of the sentence. Proponents of "Austinian Propositions" make use of a situation or event variable at the clause level to represent the speech act (Cf. e.g., Recanati [2007], Kratzer [2008]). So, Hacquard's proposal to make modals take an event or situation argument is not married to the putative need for illocutionary operators in logical form. Indeed, Kratzer has adopted Hacquard's proposal on this count in more recent work (Cf. Kratzer [2013]). It is for this reason that I labeled the target view "the Standard Account". Kratzer herself is no longer committed to the view in precisely its original formulation.

⁴⁸Cf. Pietroski [2000] for independent arguments for such a function.

⁴⁹Even though they are not anchored to an utterance event, modals directly under attitude verbs can also have epistemic interpretations, because attitude verbs like *think* or *belief* themselves introduce an event variable, and the believing-event or thinking-event are "content-ful" events. I omit further discussion of attitude verbs to avoid the added degree of complexity.

UNIFORMITY. My contention is that it allows us to integrate the semantics of tense and aspect more seamlessly into the modal semantics and thereby makes explaining the EC more tractable. Recall that the problem was that f needed to yield a circumstantial modal base if the prejacent was eventive, but that we couldn't make the selection of a value for f appropriately sensitive to the Aktionsart of the prejacent, and appeals to context didn't do the trick. If f gets an event argument, there is another way forward. On Hacquard's event-relative approach, the choice between f_{ep} and f_{circ} is formally constrained by the type of event argument available in the logical form. In turn, the type of event argument available in logical form is a matter of clausal architecture. This allows us to recast the analytical question as follows: why should a bare eventive prejacent prevent *must* from occupying the 'high' position? That is, why is (28a) good and (28b) bad?





I will next show how recasting the question in this way gives us the means to explain the EC while preserving UNIFORMITY.

4.1 Explaining the EC

Our new way of putting the question essentially asks why (28b) is bad. Answering this requires saying more about what sits in the Tense and Aspect positions. Tense is fairly familiar; we can assume that (8) has present tense. The Aspect head is where grammatical aspect is realized in the clause.⁵⁰ Determining what sits in the Aspect slot of (28b) requires some more background.

Aspect plays a role in many theories of tense. vPs build up event descriptions through the saturation of a verb's arguments and a series of optional modifiers, adding more predicative material onto the event variable introduced by the verb. On a popular conception of tense, associated with Reichenbach [1980] and developed by Klein [1994], tense locates these events on a time-line with respect to some privileged point of reference called the *reference time* in Reichenbach's terminology, or the *topic time* in Klein's. Note that our use of event semantics runs us into trouble with logical types. Tense deals with predicates of times, whereas vPs build predicates of events. So construed, Tense takes an argument that

⁵⁰Not to be confused with "lexical" aspect or *Aktionsart*, which underwrites the distinction between the aspectual classes of eventive and stative predicates that the EC presumes.

has a different logical type than the event description built up by the vP. The solution is for Aspect to take a vP denotation and turn it into something appropriate for Tense to modify; so to take a property of events and turn it into a property of times. Another way of putting it: the event description built by the vP has its own temporal properties (events are temporal entities, after all, and occur at a particular time). This has been called the *event time* (for Reichenbach), or the *situation time* (Klein). Aspect relates the situation time to the topic time. Tense relates the topic time to the utterance time.

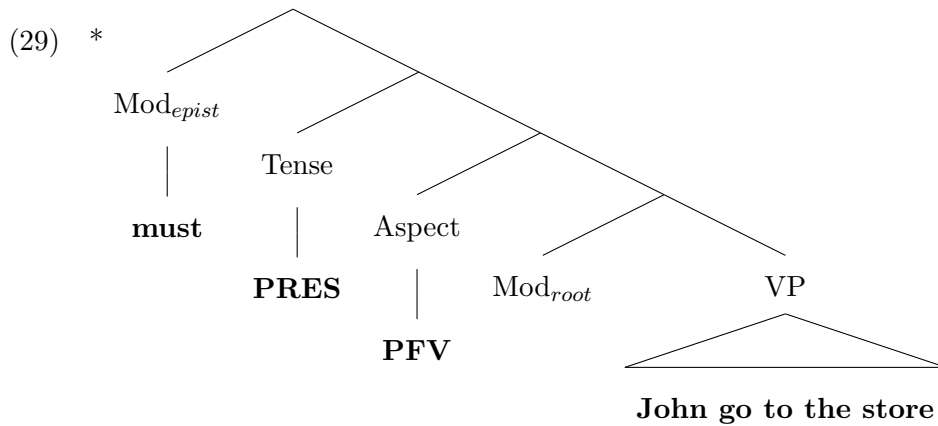
Semantically, grammatical aspect turns on the perfective/ imperfective contrast, and refers to the presentation of the structure of the eventuality described by the predicate. To draw on descriptive metaphors in currency since Comrie [1976], perfective aspect describes *complete* eventualities, without regard for their internal structure. Conceptually, perfective aspect packages the eventuality described by the predicate as a bounded whole, whereas imperfective aspect presents the eventuality as in some way incomplete or ongoing. To deploy some more of the standard metaphors, imperfective aspect describes eventualities *from the inside*, as it were, allowing language to account for the internal structure of the event.⁵¹ In English, the imperfective is often marked by progressive morphology on eventive verbs, but habitual interpretations of the predicate are also instances of imperfective meaning, occurring on unmarked forms of the verb. Perfective aspect occurs here in the unmarked case; the case where no imperfective marker is present, and habituality is ruled out.⁵²

Having ruled out habituality in our characterization of bare eventive prejacent, the

⁵¹For example, in a sentence like *While I was writing a letter, Esther walked in*, the dependent clause is marked for imperfective aspect by way of the progressive, allowing for an interpretation whereby the event of Esther’s walking in took place within the event of my writing a letter. That is to say, the writing of the letter was ongoing or incomplete at the point at which the walking in event occurred.

⁵²Cf. Bohnemeyer and Swift [2004] for discussion. So-called “telic” languages differ from English on this. For these languages, unmarked telic verbs (accomplishments and achievements) get a default perfective reading. More on this, and what it means for the EC, in section (4.3).

prejacent at issue in the EC have perfective aspect. A more complete representation of the structure of (8) would show that there is perfective aspect on the Aspect node, and the eventuality described by the vP is therefore represented as a completed event. (28b) is then more appropriately filled out as (29).⁵³



Upon adopting Hacquard’s account, the question that came into relief was why (8) cannot have the structure in (28b), now filled out as (29). The “bare” eventive prejacent that constrained *must* from having an epistemic interpretation are actually *perfective* eventive prejacent in the present tense.

We know, independently of the present discussion, that perfective eventive sentences in the present tense are unacceptable. Consider (30).

- (30) a. John goes to the store.
 b. Mike eats an apple.
 c. Mary pushes a cart up the hill.
 d. Tim wins the race.

The sentences in (30) have an attested habitual reading (in addition to a possible futurate

⁵³Here, as before, I include the syntactic positions (like Mod_{root}) that remain unoccupied. On some syntactic frameworks, such a representation is problematic, but I intend it as a harmless idealization to keep track of the relative positions of the projections we are interested in.

reading, on a scheduled interpretation of the predicate). There is an unattested reading of (30), which concerns our explanation, and which has the form $\lceil \text{PRES} [\text{PFV}(\phi)] \rceil$, where PRES is the present tense operator, and PFV is a perfective operator.

Were the sentences in (30) in the past tense, they would have had a fine perfective interpretation.

- (31) a. John went to the store.
b. Mike ate an apple.
c. Mary pushed a cart up the hill.
d. Tim won the race.

It is clear that the lack of an acceptable perfective reading is particular to the present tense. On the version of the Reichenbach/ Klein view of tense sketched above, tense locates the topic time in relation to utterance time. Present tense identifies the topic time with the utterance time. But perfective aspect constrains the situation time in such a way that it must be ‘completed’. According to Klein [1994], a more precise way of capturing this gloss is to think of the perfective as putting a constraint on the situation time such that it be included in the topic time. (Imperfective aspect, by contrast, issues the converse constraint; that the situation time be included in the topic time.) But then we have a conceptual problem. It is sometimes assumed, going back to Taylor [1977], that the utterance time is an instant. This means that the eventive predicates, which we’ve described as taking time to occur, are supposed to occur within the topic time, which is to be taken as an instant in virtue of its identification with the utterance time.⁵⁴

⁵⁴This is thought to hold as a conceptual fact, even though producing an utterance of any kind is in fact an event that takes time. The idea is that the speech event picks out an instant that is to serve as the utterance time, which in turn constrains the temporal properties of the intervals that can be identified with it, and therefore the events that can be contained in it. For example, Hallman [2009] holds the view that the utterance time is an instant (one that shares the denotation of *now*). Ogihara [2007] gives a similarly motivated view. Some authors endorse a variation of this idea, even if they don’t endorse the view that the utterance time is an instant. Bach [1981] and Parsons [1990] are examples of the view where the utterance

We now have the makings of a conceptual explanation for why (29) is bad. The constraint perfective aspect places on the event description built up by the vP is incompatible with the function of present tense. It remains to be seen how this looks semantically, to which I turn now. First, let's specify the semantics of perfective and imperfective aspect and the present tense. We want Aspect to play two roles. First, it should take a predicate of events and turn it into a predicate of times, and second, it should relate the situation time with the topic time. Following Klein, we need the perfective to place a constraint on the predicate of times such that the situation time is contained in the topic time. We can make use of Kratzer [1998]'s formalization of Klein's conception of tense and aspect as below. For present tense, we just take the topic time and identify it with the utterance time, schematized as t_u .⁵⁵

- (32) a. **PFV**: $\lambda P.\lambda t.\lambda w. \exists e[\tau(e) \subseteq t \ \& \ P(e)(w)=1]$
 b. **IMPF**: $\lambda P.\lambda t.\lambda w. \exists e[t \subseteq \tau(e) \ \& \ P(e)(w)=1]$
 c. **PRES**: $\lambda P.\lambda w. \exists e[t = t_u \ \& \ P(e)(w)=1]$

We see from the logical forms above that PRES requires some aspectual operator to relate the event time to the topic time, else PRES is otiose. For the representation of the vP, *John go to the store* will be rendered as 'John-go-to-the-store'(e)(w)'. We also need to specify where the Davidsonian event variable is existentially closed. Since we assume that Aspect performs the role of turning a predicate of events into a predicate of times, Aspect is a good candidate for performing this function. So, we also stipulate that the event

time is a constrained interval. Giorgi and Pianesi [1997] take the view that the interval characterizing the utterance time is homogenous, which places a mereo-typological constraint on the type of events that can be included in this interval—ruling out eventive verbs. I'll henceforth adopt the view that the utterance time is an instant. This may be a bit of an idealization, but if so it still comports with a body of literature on the subject.

⁵⁵It's not uncommon to have it be a presupposition of present tense that the topic time is the utterance time, and have the semantics be undefined if this condition is not met, as in Kratzer [1998]. Instead, I build this condition into the object language, but the other way would not change the diagnosis of the EC greatly.

variable introduced by the verb is existentially closed by Aspect. Finally, I'll make use of the assertion operator used by Hacquard. This operator is introduced high in the clause, in the CP layer, and rendered as a predicate of events, like verbs. It is defined as follows, which relates the assertive act to its content via CON.

$$(33) \quad \mathbf{ASSERT} e_0 = \lambda P. \lambda w [\mathbf{ASSERT}'(e_0, w) \ \& \ \forall w' \in \mathbf{CON}(e_0): P(w)=1]$$

Then our derivation proceeds as follows:

- $$(34) \quad \begin{aligned} \text{a. } & [{}_{vP} \text{ John go to the store }] = \lambda w. \lambda t. \lambda e \text{ John-go-to-the-store}'(e)(w) \\ \text{b. } & [{}_{AspP} \mathbf{PFV} [{}_{vP} \text{ John go to the store }]] \\ & = \lambda w. \lambda t. \exists(e_1) [\tau(e_1) \subseteq t \ \& \ \text{John-go-to-the-store}'(e_1)(w) = 1] \\ \text{c. } & [{}_{TP} \mathbf{PRES} [{}_{AspP} \mathbf{PFV} [{}_{vP} \text{ John go to the store }]]] \\ & = \lambda w. [t = t_u \ \& \ \exists(e_1) [\tau(e_1) \subseteq t \ \& \ \text{John-go-to-the-store}'(e_1)(w) = 1]] \\ \text{d. } & [{}_{Mod} \mathbf{MUST} [{}_{TP} \mathbf{PRES} [{}_{AspP} \mathbf{PFV} [{}_{vP} \text{ John go to the store }]]]] \\ & = \lambda w. \forall w' \in \mathbf{BEST}_{g(e_2)}(\bigcap f(e_2)): [t = t_u \ \& \ \exists(e_1) [\tau(e_1) \subseteq t \ \& \ \text{John-go-to-the-store}'(e_1)(w') = 1]] \\ \text{e. } & [{}_{CP} \mathbf{ASSERT}_{e_2} [{}_{Mod} \mathbf{MUST} [{}_{TP} \mathbf{PRES} [{}_{AspP} \mathbf{PFV} [{}_{vP} \text{ John go to the store }]]]]] \\ & = \lambda w. [\mathbf{ASSERT}'(e_2, w) \ \& \ \forall w' \in \mathbf{CON}(e_2): \forall w'' \in \mathbf{BEST}_{g(e_2)}(\bigcap f(e_2)): [t = t_u \ \& \ \exists(e_1) [\tau(e_1) \subseteq t \ \& \ \text{John-go-to-the-store}'(e_1)(w'') = 1]]] \\ \text{f. } & \text{“In all worlds } w' \text{ compatible with the content of the assertion } e_2 \text{ in } w, \text{ all of the best worlds } w'' \text{ according to } g \text{ in } f \text{ are such that a John-going-to-the-store event, } e_1, \text{ is included in the utterance time in } w'' \text{.”} \end{aligned}$$

The issue is the fact that the proposition which is the argument of the modal has impossible truth conditions.⁵⁶ If t_u is an instant and if e_1 is an eventive predicate, there is no way

⁵⁶As I've stressed before, this account is not beholden to the idea of illocutionary operators, though I have

for $\lceil \tau(e_1) \subseteq t_u \rceil$ to hold. We see why there is no interpretation of (8) where it has the structure in (29).

With this semantic analysis in hand, we might ask why epistemic modals with stative prejacent are acceptable. Recall our problematic sentences (30); they did not have perfective readings. By contrast, habitual interpretations of these sentences were fine. Moreover, if the predicates in these sentences were stative to begin with, they'd be fine as well. (Think: *John is at the store.*)

Do stative predicates, in virtue of their on-going readings in matrix contexts, therefore have default *imperfective* readings? This is the natural thing to say, especially given our notional characterization of the imperfective and the truth conditions I've assigned to perfective and imperfective aspect. This hypothesis has a good pedigree. Parsons [1990] suggests that stative sentences have a default 'Hold' predicate, which takes an eventuality and a time argument; $\lceil \text{Hold}(e,t) \rceil$ means that e holds at time t . Meanwhile, events have a default 'Cul' predicate, which similarly takes eventuality and time arguments; $\lceil \text{Cul}(e,t) \rceil$ means that e culminates at t .⁵⁷ In our framework, this amounts to saying that states have default imperfective readings (the 'Hold' predicate is one of the key ingredients to Parsons' account of the progressive) and events default perfective readings, since Cul encodes the intuition that the eventuality in question is completed. Keeping with our preferred semantics for imperfective aspect, a stative sentence like (35a) would then have the representation in (35b).

(35) a. John is at the store.

b. $[_{CP} \text{ASSERT}_{e2} [_{TP} \text{PRES} [_{AspP} \text{IMPF} [_{vP} \text{John be at the store}]]]]]$

no qualms with them. An alternative which would work just as well is common in situation semantics where the clause is related to the utterance situation by means of some kind of anchoring relation. This topmost anchoring relation might not make use of CON, but otherwise the derivation would proceed similarly.

⁵⁷States can't instantiate a Cul-relation because a culminating state would indicate a change of state, making it a dynamic eventuality, and thereby eventive.

= $\lambda w. [\text{ASSERT}'(e_2, w) \ \& \ \forall w' \in \text{CON}(e_2): [t = t_u \ \& \ \exists(e_1) [t \subseteq \tau(e_1) \ \& \ \text{John-be-at-the-store}'(e_1)(w') = 1]]]$

- c. “In all worlds w' compatible with the content of the assertion e_2 in w , the utterance time is included in a John-going-to-the-store event, e_1 in w' .”

That said, let’s assume that lexically stative predicates trigger default imperfective aspect.⁵⁸ In the modal case, then, we have the following.

- (36) a. John must be at the store.
- b. $[_{CP} \text{ASSERT}_{e_2} [_{Mod} \text{MUST} [_{TP} \text{PRES} [_{AspP} \text{PFV} [_{vP} \text{John be to the store}]]]]]]]$
 = $\lambda w. [\text{ASSERT}'(e_2, w) \ \& \ \forall w' \in \text{CON}(e_2): \forall w'' \in \text{BEST}_{g(e_2)}(\bigcap f(e_2)): [t = t_u \ \& \ \exists(e_1) [\tau(e_1) \subseteq t \ \& \ \text{John-be-at-the-store}'(e_1)(w'') = 1]]]$
- c. “In all worlds w' compatible with the content of the assertion e_2 in w , all of the best worlds w'' according to g in f are such that the utterance time is included in a John-being-at-the-store event, e_1 in w' .”

Again, this is unproblematic, given our semantics.

When we consider eventive prejacentes with root modals, our next question is why *these* are acceptable. My explanation of the acceptability of the root modals with eventive predicates presupposes that modal sentences are themselves derived statives. It makes sense why this would be so. If we recall that both GEN and FUT produce derived statives, and so have the subinterval property, the contention that a modal operator in root position does so as well seems reasonable. Moreover, if what root modals express has to do with possibility

⁵⁸It’s worth noting that the issue about whether stative predicates trigger default perfective or imperfective aspect is not absolutely settled. Smith [1991] thinks that present tense statives do have perfective aspect; it’s just that the initial and final endpoints of the eventuality are unspecified for states. Moreover, she says, the formal characterization of a stative perfective sentences is semantically like the imperfective. At the risk of idealizing somewhat, I find it more perspicuous to give an analysis of statives with imperfective aspect.

or necessity with respect to some salient ranking of circumstances, then the conclusion seems even more fitting. The holding of such a possibility/ necessity is intuitively a state as opposed to an event. Let us marshal some evidence for this claim before proceeding.

4.1.1 Modals Are Stative

Quite apart from either the intuitiveness or the theoretical pedigree of this claim, root modals pattern with stative predicates in the well-known stativity tests. As a first test, Lakoff [1966] notes that stative predicates tend to be unacceptable in the progressive. This would be difficult to test for modal auxiliaries in part because of their morphological properties. As we noted earlier, *must*, along with many other English modal auxiliaries, only takes present tense morphology. However, the periphrastic modal *have to* is more plastic in this regard, and it can serve as our example here. In the present context, we see that *have* can take progressive morphology when it is a main verb (37a), but when it occurs as a modal, it cannot (37c).

- (37) a. John is having a fit.
b. John is going to the store.
c. *John is having to go to the store.

Of course, *have* as a main verb is not the same as the modal *have to*. It could very well be that *have to* tends to be bad with progressive morphology because, as a periphrastic modal, it has the properties of modal auxiliaries, and as an auxiliary, it resists progressive morphology. But we do in fact see *some* instances of *have to* with the *-ing* affix associated with progressive morphology. It's fine as a gerund, unsurprisingly.

- (38) Having to apologize is often embarrassing.

But certain circumstances can conspire to allow *have to* to occur in the progressive.⁵⁹

(39) John is having to apologize again for breaking another dish.

If the progressive test is probative for stativity, one might worry that (39) indicates that *have to* is not stative. But in the fact the evidence here is more equivocal, since this test admits of exceptions. Uncontroversially stative predicates like the mental state verb *understand* can sometimes appear in the progressive.

(40) He is understanding French better the more he studies.

So although stative predicates tend not to be acceptable in the progressive, there are exceptions. So it seems that root modal *have to* patterns with stative predicates here; it also tends to be unacceptable in the progressive, though this generalization admits of exceptions. Secondly (and also from Lakoff [1966]), like other statives, modification by agentive adverbs is unacceptable.

- (41) a. John studied the answer intentionally.
b. * John knew the answer intentionally.
c. * John had to study the answer intentionally.

(41c) is only OK if *intentionally* modifies the embedded predicate *study*. There is no good reading where it modifies the modal. Lack of the relevant reading for (41c) does not seem due to a syntactic constraint on what such adverbials can modify. After all, frame adverbials can modify the modal, as in (42).⁶⁰

(42) John regretfully had to study for the test.

⁵⁹A google search will corroborate the claim here. While some *have to*-sentences resist the progressive, the construction is not categorically unacceptable.

⁶⁰In a later section, I will dispute the claim that the *modal* is being modified in such constructions. But we can ignore that complication for now; the important thing with the test is that there is a reading where the adverb doesn't merely modify the lower verb.

There is a reading of (42) where what is regretful is the obligation to study. Again, root modals pattern with statives according to this test.

Also due to Lakoff [1966] is the pseudo-cleft test; like stative predicates, modals are bad in pseudo-cleft constructions.

- (43) a. What she did was go to the store.
b. *What John did was be at the store.
c. *What she did was have to go to the store.

The following tests are due to Copley [2008a], who notes that in conditionals, eventive antecedents cannot have a present orientation, and they force the consequent to be future-oriented.⁶¹ So, you cannot modify the consequent with an adverbial, like *now*, that denotes the anchoring time (for simplicity's sake, we assume the anchoring time is the time of utterance).

- (44) a. *If John goes to the store, he will leave now.
b. If John is at the store, he will leave now.
c. If John must/ has to go to the store, he will leave now.

The reason (44a) is bad is that the antecedent, being eventive, it will have a future orientation; the putative going-to-the-store event would follow the utterance time. Then, since the event described by the consequent would follow the going-to-the-store event, modification with *now* is incompatible with this temporal constraint. In (44b), since *be at the store* is stative, it is present oriented, and therefore the consequent can be modified by *now*. When a modal is thrown into the mix, as in (44c), it patterns with the stative *be at the store* instead of the eventive *go to the store*, in spite of the latter being embedded under the

⁶¹They are always future-oriented with respect to the anchoring time; which, let us assume is the time of utterance. Often, eventive consequents will force the temporal orientation of the consequent to be subsequent to the time of the antecedent, as is in *If John runs the race, he will win*. But as Copley points out, the consequent can be contemporaneous with the antecedent, as in *If you push the ball, it will move*.

modal. The fact that (44c) is acceptable with a temporal adverbial in the consequent that denotes the anchoring time, but (44a) is unacceptable indicates that the latter is eventive, but the former is not.

Also due to Copley is the “It’s true that...” test. “It’s true that” indicates the time of evaluation of the antecedent, and since eventives force a future-orientation on the antecedent, combining this locution with *now* will be bad for eventives, but OK for statives. On the assumption that modals are stative, we would predict that antecedents with a modal would be compatible with “it’s true now that...”, like stative antecedents and unlike eventive antecedents. In fact, this is what we find.

- (45) a. * If it’s true now that John goes to the store,... (except on futurate reading)
 b. If it’s true now that John is at the store,...
 c. If it’s true now that John must/ has to go to the store,...

Finally, due to Kamp and Reyle [2013], eventive and stative sentences differ with respect to how they situate the eventualities they describe in narrative time. In a narrative, sentences with eventive predicates introduce a new reference time/ topic time, resulting in a default interpretation that the eventuality described by an eventive sentence *follows* the previously described eventualities. Stative sentences receive a default temporal interpretation in narratives whereby the eventuality described by a stative sentence *overlaps* a previously introduced reference time. Put differently, eventive sentences advance narrative time, whereas stative sentences do not.

- (46) a. John walked over to his cupboard._{t1} It was empty._{t1} John went to the store._{t2}
 He considered what to buy._{t3}
 b. John walked over to his cupboard._{t1} It was empty._{t1} John had to go to the store._{t1} He considered what to buy._{t2}

In (46a), every eventive sentence introduces a new reference time, and each of these is interpreted as following the previous reference time, so $t1 \prec t2 \prec t3$. *Being-empty* is a stative predicate, so the sentence describing the cupboard’s being empty has a default interpretation whereby it overlaps with $t1$, the reference time introduced by the sentence that precedes it. The following sentence introduces a new reference time, which follows the walking-over event. In (46b), however, when the modal scopes over the eventive predicate, the sentence no longer introduces a new reference time. It is interpreted as overlapping the previous reference time, as we would expect if it were stative.

I don’t doubt that some of these tests are more probative than others. But a pattern emerges from this battery of tests. Even when a predicate is lexically eventive, embedding it under a modal makes the modal expression behave as though it is stative. Once the modal combines with the prejacent, the resulting expression patterns with stative sentences. I submit that we would do well to think of root modal expressions as derived states.

4.1.2 the Case of Root Modals

Putting some more content to the diagnosis that modals are stative, recall that we think of the vP as building up an eventuality description by adding material predicatively to the variable e . At some point in the derivation, this variable is existentially closed and turned into a predicate of times.⁶² At this point in the derivation, the eventuality description has all of its descriptive material specified. The eventuality in question is whatever answers to this description. Within the Reichenbachian/ Kleinian theory of tense we assumed above, this is where the situation time is then related to the topic time. The various operators

⁶²I’ve existentially bound e in Aspect. Champollion [2015] gives a semantics where the variable is bound in the lexical entry of the verb. This approach is also consistent with the one I’ve taken. What matters is that there is a point in the clause at which e is no longer accessible to modification. One thing that Champollion’s approach shows is that existential closure is but one way to represent this inaccessibility. It is, however, not a necessary way for the event variable to be rendered inaccessible.

we've discussed in the paper (furate, habitual) seem to apply to the event description before the situation time is related to tense. Since root modals also merge low in the clause, this creates an event description which has the modal as *part* of its descriptive content. Returning to the question at hand as to why eventive predicates with root modals are OK, let us see if the insight that modals are stative makes a satisfying explanation fall into place. The derivation of a root interpretation of (8) would then proceed as follows.

- (47) a. $[_{vP} \text{John go to the store}] = \lambda w.\lambda e. \text{John-go-to-the-store}'(e)(w)$
- b. $[_{Mod} \mathbf{MUST} [_{VP} \text{John go to the store}]] = \lambda w.\lambda e. \forall w' \in \text{BEST}_{g(e)}(\bigcap f(e)):$
 $\text{John-go-to-the-store}'(e)(w')$
- c. $[_{AspP} \mathbf{IMPF} [_{Mod} \mathbf{MUST} [_{vP} \text{John be at the store}]]]$
 $= \lambda w \lambda t \exists (e_1) [t \subseteq \tau(e) \ \& \ \forall w' \in \text{BEST}_{g(e_1)}(\bigcap f(e_1)):$
 $\text{John-go-to-the-store}'(e_1)(w')$
 $= 1]$
- d. $[_{TP} \mathbf{PRES} [_{AspP} \mathbf{IMPF} [_{Mod} \mathbf{MUST} [_{vP} \text{John go to the store}]]]]]$
 $= \lambda w [t = t_u \ \& \ \exists (e_1) [t \subseteq \tau(e) \ \& \ \forall w' \in \text{BEST}_{g(e_1)}(\bigcap f(e_1)):$
 $\text{John-go-to-the-store}'(e_1)(w') = 1]]]$
- e. $[_{CP} \mathbf{ASSERT}_{e_2} [_{TP} \mathbf{PRES} [_{AspP} \mathbf{IMPF} [_{Mod} \mathbf{MUST} [_{vP} \text{John go to the store}]]]]]]]$
 $= \mathbf{ASSERT}'(e_2, w) \ \& \ \forall w' \in \text{CON}(e_2): [t = t_u \ \& \ \exists (e_1) [t \subseteq \tau(e) \ \& \ \forall w' \in \text{BEST}_{g(e_1)}$
 $(\bigcap f(e_1)):$
 $\text{John-go-to-the-store}'(e_1)(w') = 1]]]$
- f. “In all worlds w' compatible with the content of the assertion e_2 in w , an event is included in the utterance time, where this event is a John-going-to-the-store event in all of the best worlds w' in f according to g .”

Happily, there is no reason to think the derivation crashes. Moreover, our contention that modals are derived states contributes to a plausible explanation of the acceptability of

(8).⁶³ Since modals are stative, the same theoretical considerations apply as in the case of lexical statives above and imperfective aspect is triggered in Aspect. On the account I'm advancing, stative sentences embedded under the modal are predicted to be acceptable, in accordance with our linguistic judgments.

Another consideration: an utterance of the sentence (8) is not claiming that there is an event answering to the description 'John-go-to-the-store' in the world of the context of utterance. Instead, it says that there are eventualities answering this description in all of the worlds in the modal domain that are determined to be ideal by the ordering source $g(e)$. Insofar as this event description holds of any eventuality in the actual world, it is a state, even if a derived one.⁶⁴

4.1.3 Tense and Modal Parameters: Some Problems

If modals are states, then we have a ready to hand explanation for why root modals with eventive prejacent are OK in the present tense. As we are supposing, root modals merge under Tense and Aspect, and being stative, the resulting expression would trigger imperfective aspect, allowing it to combine with present tense, yielding an on-going interpretation

⁶³For what it's worth, common usage supports the verdict that modals describe states as well. Modals express states of affairs, which we can gloss as "The *state* of being possible/ necessary..." Of course, this kind of linguistic data on its own makes for thin evidence. But in addition to the other considerations it joins, it makes a good case for my claim.

⁶⁴There is a potential confound here, but it is easily dispensed with. Hacquard [2009] proposes a pragmatic principle she calls the PED (Preservation of Event Description), which holds that events retain their predicative properties across worlds. So, if e_1 occurs in w_1 and w_2 , and e_1 is a P -event in w_1 , then it is, *ceteris paribus*, also a P event in w_2 . If such a principle holds, it would mean that if e_1 is a John-going-to-the-store event in all of the deontically best worlds, w' , then it is also a John-going-to-the-store event in the actual world w . The PED is part of Hacquard's recipe for deriving the actuality entailments for root modals under perfective aspect. However, on her analysis, imperfective aspect adds an additional layer of modality. This additional layer of modality scoping over the event description makes for truth conditions that don't require the instantiation of the event in the actual world. I haven't included these modal truth conditions for the analysis of the imperfective, but if you are not moved by my claim that (47) isn't describing an actual-world John-going-to-the-store event, and are concerned about (47) entailing the existence of a John-going-to-the-store event in the actual world on the basis of something like the PED, the extra layer of modality imposed by the imperfective would take care of that.

at the utterance time. However, prior to being able to advance this thesis, there are some issues with the logical form that ought to give us pause. First, according to the logical form in (47), e_1 is an event in all the best accessible worlds, but a state in the actual world.

This concern on its own is not particularly worrisome. As I claimed in the last section, an utterance of the sentence (8) is not asserting that there is an event answering to the description *John-go-to-the-store* in the world of the context of utterance. Instead, it says that there are eventualities answering this description in all of the worlds in the modal domain that are determined to be ideal by the ordering source $g(e_1)$. Insofar as this event description holds of any eventuality in the actual world, it is a state, even if a derived one.

This claim is not novel one. Additional predicative material on the event variable can change the aspectual class of the underlying eventuality. Usually, the aspectual type is shifted from, say, an activity to an accomplishment, as when the activity verb *draw* takes an indefinite NP argument like *a circle* to yield the accomplishment *draw a circle*. Examples of this nature can be multiplied. Certain analyses of the progressive are committed to a claim of this type. The progressive typically takes eventive vP arguments, and yet is itself stative. As we discussed earlier with Parsons [1990] analyzes the progressive by means of the Hold-predicate. This would mean that the addition of the Hold-predicate would render the expression stative. Or, in modal interpretations of the progressive, as in Dowty [1979] or Landman [1992], the progressive operator stativizes the expression. We'd have an eventuality which is a state in the actual world, but which is an event in all inertial worlds. So, claims that predicative material on an event variable can change the aspectual class of the expression, or that an actual-world state can be an other-world event are not problematic in and of themselves. Two other issues, however, are not so easily dispensed with. Let's call the first, *the problem of modal parameter setting*, and the second *the problem of modal event time*, and discuss them in turn.

The Problem of Modal Parameter Setting

Here is the problem of modal parameter setting in a nut-shell. The LF representation in (47) has it that e_1 is a going-to-the-store event in the relevant worlds, and *also* the event that is the argument to both the modal base and ordering source. Based on the definition of the modal base function in (27a), this means that a state which is like actual-world- e_1 will also exist in these worlds, since $\bigcap f(e_1)$ gives us a set of worlds compatible with e_1 . So what $\bigcap f(e_1)$ picks out is the set of worlds preserving the circumstances of e_1 ; let's call this the circumstance state. But it seems wrong to identify the circumstance state with e_1 , since e_1 is a going-to-the-store world. This worry is a little bit different from the complaint lodged above. An example will make clearer why this is troublesome for our analysis.

Suppose John's mother is due for a visit and his refrigerator is bare. The circumstance state in the actual world involves John's empty refrigerator and his goals. Let's say his sole goal is to have food in the fridge when his mother arrives. So $\bigcap f(e_1)$ gives a set of empty-fridge worlds, and $g(e_1)$ is the set of John's goals. *John must go to the store*, relative to these parameters, is true just in case every world in $\bigcap f(e_1)$ in which John has food in his fridge by the time of his mother's visit is one in which he goes to the store. This means that a John-going-to-the-store event populates all the worlds also populated by the John-has-an-empty-fridge state. But if e_1 is in fact that state, it cannot be the going-to-the-store event. Why? Because if e_1 is such an event, then his fridge wouldn't be empty in those worlds! We could perhaps finesse a reading whereby the going-to-the-store event follows the empty-fridge state in the relevant worlds, though both are predicated of e_1 .

The Problem of Modal Event Time

According to the derivation in (47), based on a standard semantics of the imperfective

and present tense, the utterance time includes the temporal trace of e_1 . Ipso facto, e_1 is contemporaneous with the utterance time. The problem here is this. We already know that e_1 serves as *both* the variable that is the source of the modal parameters (and so can be thought to represent the circumstance state), and the variable that the material comprising the vP is predicated of. But e_1 is also the variable that is the argument of imperfective aspect. These facts conspire to produce the logical form in (47) which represents the circumstance state as being contemporaneous with the going-to-the-store event. But, as discussed above, the state involving John and his empty fridge must be *followed* by the event of John-going-to-the-store (the “modal event”). That is, the modal event should be future-oriented with respect to the circumstance state. Again, the finessing we considered above is no help; there is no principled way to secure an interpretation whereby the circumstance state is understood to be the argument of imperfective aspect and the modal event is understood to be the event satisfying the vP event description, when *both* are represented by e_1 . If the vP event description is satisfied by e_1 , then e_1 must somehow follow the circumstance state, not be contemporaneous with it.

While we could live with the aspectual distinction across worlds, the problem of modal parameter setting and the problem of modal event time jointly make the logical form an untenable representation of the truth conditions of the root modal sentence (8). Here is the relevance for our attempts to explain the EC. The lesson from these problems is that the lack of epistemic modals with eventive prejacent is explained relatively easy with standard semantics of tense and aspect, which the Kratzerian account can accommodate with the Hacquardian revision. At the same time, explaining why root modals with eventive prejacent are good becomes more difficult. Note that it won’t do, for example, to claim that circumstantial modality automatically gives us the future-orientation by fixing a set of circumstances and leaving open what eventuates after those circumstances. The issue

is rather that the semantics of tense and aspects interact with the modal parameters in a way that constrains the temporal interpretation of the prejacent in an unacceptable way.

Here is the theoretical task facing the analysis at present: When the clause builds up the eventuality description, we need it to be stative by the time it merges with aspect in order to trigger imperfective, so that it will get the appropriate reading with present tense. We are able to say with some plausibility that intervening modal construction does this somehow, but the explanation fell short with respect to the next two desiderata. First, the eventuality that serves as the argument to the modal parameters (f and g) ought to preserve the relevant circumstances of the actual world in the accessible worlds. Second, the eventuality described by the prejacent ought to follow the circumstance state. These last two desiderata failed to be upheld on the logical form in (47).

4.2 Reifying the Circumstance State

There is a way to thread this needle, provided we have access to an *additional* event variable higher than the vP, but still below tense and aspect, which would represent the circumstance state. But do we have reason to think that there is such a thing? Would it not be ad hoc to posit one? In what follows, I want to answer in the negative to the second question and make a case for an affirmative answer to the first one.⁶⁵ To allay worries that positing extra structure like this is ad hoc, I will begin by noting some parallels to the grammatical environment of futurates, and discuss the most recent analysis of this construction by Copley. Copley's (2014) analysis of futurates is that they introduce a state that directly causes an eventuality satisfying the description of the embedded predicate. Part of the motivation behind this claim is that futurates are thought to refer not just to a

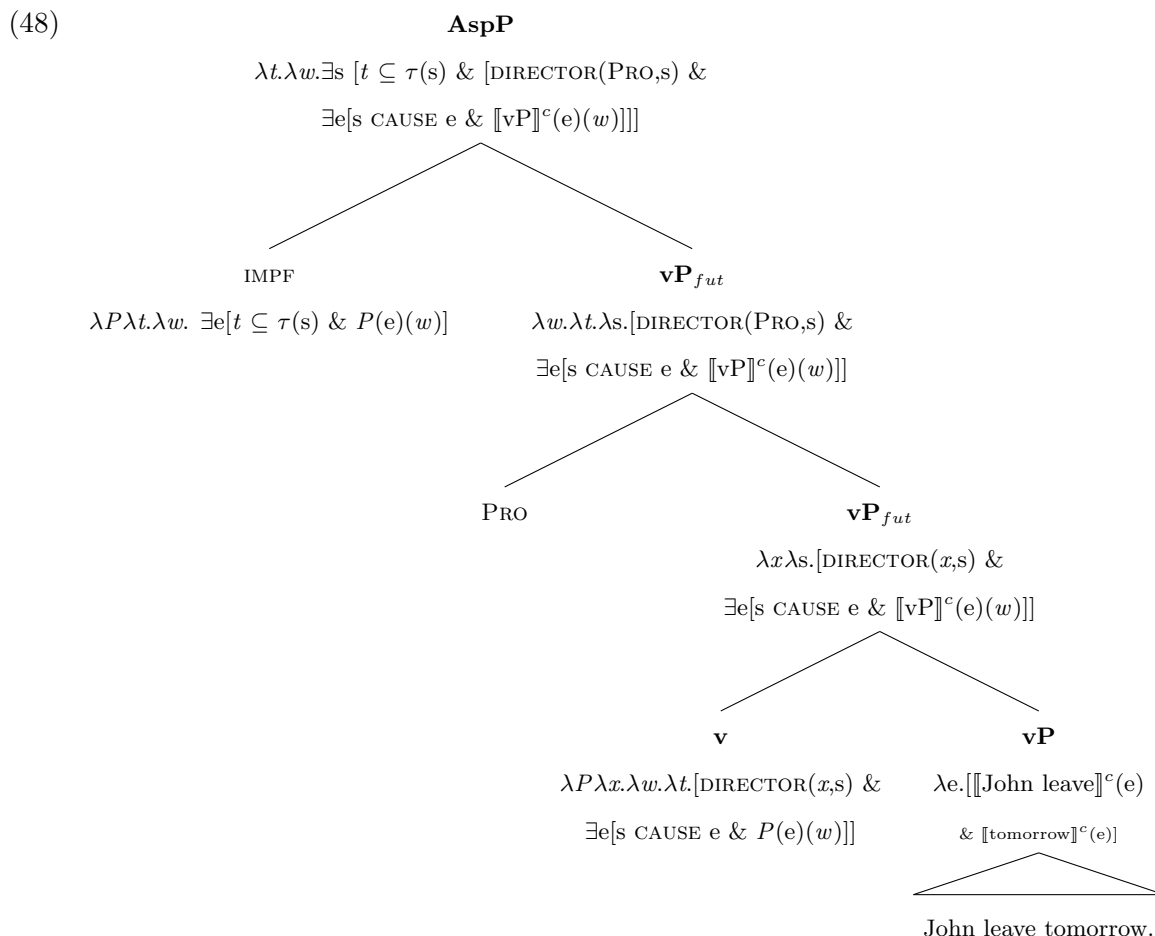
⁶⁵Homer [2011] proposes a kind of aspectual coercion operator to explain actuality entailments of modals under perfective aspect. His operator is also based on the putative stativity of modals, so his proposal bears some similarity to mine, but I leave a comparison to my proposal aside for now.

future event, but to a *plan* to carry out that future event.⁶⁶ This plan needs to be carried out by some agent, and it is often the futurate sentence’s matrix subject that fills this role, but it can also be some contextually determined agent. So, in *John leaves tomorrow*, it is plausibly John that is the agent of the plan, but in *The plane leaves at noon*, it is some contextually determined agent or group of agents that fills this role. Copley [2009] argues convincingly that both the plan and its agent constitute part of the asserted content of the sentence, and Copley [2014] gives a semantic analysis whereby the reified plan composes as an additional vP shell (“vP_{fut}”) on top of the existing vP. vP_{fut} then has its own external argument, and selects for a director.⁶⁷ See (48) below.⁶⁸

⁶⁶Cf. Lakoff [1971], Huddleston [1977], Vetter [1973].

⁶⁷We can think of this as an external “agent” argument which composes with the verb through event identification in the sense of Kratzer [1996], though the director argument comes with its own set of presuppositions not associated with a typical agent argument. I take this director argument to be responsible for the scheduled interpretation to be the hallmark of futurates. Cf. Copley [2009] for discussion.

⁶⁸The event variable introduced by vP_{fut} is of the same type as that introduced by the vP. Technically, it is another subscripted ‘e’, but I’ve followed Copley in rendering it ‘s’ to make clear that the underlying eventuality is a state.



If we bear in mind that eventive predicates in English get perfective aspect, and perfective eventives combining with present tense crash the derivation, adding vP_{fut} to the existing material is a rather fortuitous grammatical operation. Quite apart from its interpretation, we could think of the addition of vP_{fut} as a kind of aspectual coercion or a grammatical repair strategy, which supplies a structure that allows present tense eventives to get imperfective aspect on the one hand, and thereby allows for their interpretation as future-referring on the other. The state argument is what gets identified with the utterance time by present tense, as opposed to the event argument of the lower vP .

I propose a similar vP shell under the root modal when the embedded predicate is

eventive, making for the following hierarchical structure, where vP_2 introduces a stative eventuality.

$$(49) \quad \text{Tense} > \text{Aspect} > \text{Modal} > vP_2 > vP_1$$

Before making this proposal more precise, let me make the parallels to futurates explicit. First of all, the structure added by vP_{fut} repairs the aspectual mismatch between the lower predicate and the requirements of present tense. By assumption, eventive predicates trigger perfective aspect, and eventive perfectives composing with present tense would crash the derivation. Introducing the stative eventuality allows the expression to trigger imperfective aspect and compose with present tense without crashing the derivation. vP_2 , as proposed, would perform the same function. Secondly, the added structure secures the future-oriented interpretation of the eventuality described by the lower vP . As we saw in section (4.1.3), when the event variable from the lowest vP is the argument for aspect, and the tense of the clause is present, this makes securing a future-oriented interpretation of the vP -event difficult. By adding vP_{fut} , which relates the newly introduced state variable to the event variable from the lower vP via the *CAUSE* predicate, the state argument of vP_{fut} can be present-oriented while the lower vP is future oriented. In the root modal case, vP_2 would perform the same function, ensuring that the lower event follows the utterance time, in accordance with our intuitions about root modal sentences with eventive prejacent.

So, in positing this additional structure, we do not require it to do any more than it does in the case of futurates. If the structure is well-motivated for futurates, it ought to be well-motivated in the case of modals. Turning to my proposal, let's assume the vP shell introduces some kind of relation R that relates s to the lower e which, like *CAUSE*, requires of it that it e temporally follows s will yield the desired temporal result. As a first pass, let's say this state-introducing vP has the following content.

$$(50) \quad \llbracket vP_2 \rrbracket = \lambda s. \lambda P. \exists e [P(e) \ \& \ R(s, e)]$$

We will need to say what kind of relation R is. To a first approximation, let's say it is CAUSE.⁶⁹ The CAUSE predicate is already fairly ubiquitous in theories of causatives, resultatives, and decompositional theories of argument structure more generally.⁷⁰ Settling on CAUSE, then, the semantic contribution of vP₂ is as follows.

$$(51) \quad [\text{vP}_2] = \lambda s \lambda P. \exists e [P(e) \ \& \ \text{CAUSE}(s, e)]$$

Our derivation now looks like this:

- $$(52) \quad \begin{aligned} \text{a. } & [\text{}_{vP_1} \text{ John go to the store }] = \lambda w. \lambda e. \text{ John-go-to-the-store}'(e)(w) \\ \text{b. } & [\text{}_{vP_2} [\text{}_{vP_1} \text{ John go to the store }]] = \lambda w. \lambda s. \exists e_1 [\text{John-go-to-the-store}'(e) \ \& \ \text{CAUSE}(s, e_1)] \\ & (w) \\ \text{c. } & [\text{}_{Mod} \text{ MUST } [\text{}_{vP_2} [\text{}_{vP_1} \text{ John go to the store }]]] = \lambda w. \lambda s. \forall w' \in \text{BEST}_{g(s)}(\bigcap f(s)): \\ & [\exists(e_1) [\text{John-go-to-store}'(e_1) \ \& \ \text{CAUSE}(s, e_1)](w') = 1] \\ \text{d. } & [\text{}_{AspP} \text{ IMPF } [\text{}_{Mod} \text{ MUST } [\text{}_{vP_2} [\text{}_{vP_1} \text{ John be at the store }]]]] \\ & = \lambda w \lambda t \exists(s) [t \subseteq \tau(s) \ \& \ \forall w' \in \text{BEST}_{g(s)}(\bigcap f(s)): [\exists(e_1) [\text{John-go-to-store}'(e_1) \\ & \ \& \ \text{CAUSE}(s, e_1)](w') = 1]]] \\ \text{e. } & [\text{}_{TP} \text{ PRES } [\text{}_{AspP} \text{ IMPF } [\text{}_{Mod} \text{ MUST } [\text{}_{vP_2} [\text{}_{vP_1} \text{ John go to the store }]]]]]] \\ & = \lambda w [t = t_u \ \& \ \exists(s) [t \subseteq \tau(s) \ \& \ \forall w' \in \text{BEST}_{g(s)}(\bigcap f(s)): [\exists(e_1) [\text{John-go-to-} \\ & \ \text{store}'(e_1) \ \& \ \text{CAUSE}(s, e_1)](w') = 1]]]] \\ \text{f. } & [\text{}_{CP} \text{ ASSERT}_{e_2} [\text{}_{TP} \text{ PRES } [\text{}_{AspP} \text{ IMPF } [\text{}_{Mod} \text{ MUST } [\text{}_{vP_2} [\text{}_{vP_1} \text{ John go to} \\ & \ \text{the store }]]]]]]]] \end{aligned}$$

⁶⁹One would be justified in wondering whether the structure I am positing just *is* a futurate embedded under the root modal. Even if we adopt the view that the relation the vP introduces is CAUSE, I would hesitate to answer in the affirmative. For one thing, the resulting structure doesn't exhibit the properties of matrix futurates canvassed in section (3.2). It may be the case that what distinguishes futurates from the present case is the presence of the DIRECTOR argument. If this is the case, the DIRECTOR theta-role is responsible for many of the paradigmatic interpretive properties of matrix futurates. That strikes me as a reasonable prediction.

⁷⁰cf. Dowty [1979], Larson [1988], Folli and Harley [2007], Kratzer [2000], etc. for some examples.

$$= \text{ASSERT}'(e_2, w) \ \& \ \forall w' \in \text{CON}(e_2): [t = t_u \ \& \ \exists(s) [t \subseteq \tau(s) \ \& \ \forall w' \in \text{BEST}_{g(s)}(\bigcap f(s)): \\ \exists(e_1)[\text{John-go-to-store}'(e_1) \ \& \ \text{CAUSE}(s, e_1)](w') = 1]]]$$

- g. “In all worlds w' compatible with the content of the assertion e_2 in w , a state is included in the utterance time, where this state causes a John-going-to-the-store event in all of the best worlds w' in f according to g .”

The truth conditions in (52) require that the circumstance state is causally related to the event described by the lower vP. I haven't said much about the interpretation of CAUSE, but if this predicate is glossed as counterfactual dependency, as in Dowty [1979], the resulting truth-conditions accord nicely with our intuitions about (8). In relating the circumstance state to the going-to-the-store event via CAUSE, (52) says that the event of John's going-to-the-store should come about as a result of his circumstances— those of having no food in the fridge. Had he food in the fridge, his circumstances would not eventuate in a going-to-the-store. It might seem unexpected that the circumstance state is *causally* related to the event, but whatever strengthening of the truth conditions occurs as a result of the presence of the CAUSE predicate seems benign. Over and above not posing a liability, I will momentarily present a benefit of relating the eventuality variables causally, but for now, we can pause to review how the proposal meets the constraints on the parameters we posed before.

- eventuality fed to aspect is stative? ✓

The proposal stipulates that the eventuality that is the argument of aspect is stative. We meet this desiderata by fiat.

- parameter event preserves circumstances? ✓

This desideratum required that the relevant circumstances are preserved in the accessible worlds. (52) preserves them, because the reified circumstances serves as the argument to

the modal parameters. Doing this circumvents the problem we had in (47), where the relevant circumstances could not plausibly be identified with the event described by the vP. In (52), there is no need to identify them; they are separate eventualities.

- modal event follows utterance time? ✓

The introduction of the circumstance state and its relation to the lower vP-event via CAUSE ensure that the modal event follows the utterance time. The circumstance state is what holds at the utterance time, and the modal event is caused by the circumstance state in all the best, accessible worlds. Eo ipso, if the modal event eventuates at all, it follows the utterance time.

The introduction of vP₂ therefore meets the desiderata, and the parallels to the futurate safeguard the proposal against charges of *ad hoc*-ery. I will now make the case that we do in fact see evidence for this intermediate stative projection. First of all, the state can be modified independently of the lower verb. A parallel argument is given by Copley [2009] when she gives evidence for the syntactic reality of futurates. First, an example with a progressive futurate.

- (53) Last week, the Yankees were playing the Red Sox tomorrow (but the game got cancelled yesterday).

The adverbial *tomorrow* in (53) modifies the lower predicate *play the Red Sox*, but the frame adverbial *last week* modifies the time of the plan. Since the plan can ostensibly be modified by tense (the plan in (53) is in the past, as the continuation implies), this suggests that the syntactic realization of futurates sits higher than the vP but lower than tense.⁷¹ Similar considerations apply to the modal case. Here again we need to make use

⁷¹This test works for progressive futurates, in part because they can be modified by past tense. It's a bit of a mystery why simple futurates can only occur in present tense.

of the periphrastic modal *have to*, since its being able to inflect for past tense makes the modification clear.

CONTEXT On June 1st, John’s fridge is empty. He knows his mother is coming on the 16th, so he marks on his calendar to go to the store on the 15th. In the meantime, he subsists on takeout. On the 14th, John’s roommates decide to do him a favor and do his shopping for him to stock up his fridge for his mother’s visit. One of his roommates utter:

- (54) For two weeks, John had to go to the store tomorrow (but we wound up going for him).

Intuitively, (54) means that John had an obligation to go to the store at a certain time (where *tomorrow* = June 16th), and that this obligation lasted (at least) two weeks. Note first of all that this is the same kind of adverbial evidence given for the syntactic reality of a dedicated projection for futurates. Second of all, vP_2 allows a simple explanation for what’s going on with these two modifiers. The higher adverbial modifies the higher state introduced by vP_2 , whereby John’s obligation-providing circumstances lasted two weeks. The lower adverb modifies the verb’s event variable.⁷²

Secondly, futurates have a particular kind of agent argument, the DIRECTOR argument, which, according to (48) they get by vP_{fut} getting a certain kind of agent argument. The additional structure introduced by our vP_2 provides the possibility for an additional external argument, over and above the external argument for vP_1 . Do we ever see such arguments for root modals? It seems that we do. There are the so-called agentive readings of root modals (also called “ought-to-do” readings), in particular of deontic modals. It has long been noted in both the philosophy and the semantics literature that root modals can

⁷²A parallel explanation is available for the case of the non-availability of agentive adverbs in the modal case in (4.1.1). *John had to study the answer intentionally* is bad on the reading where *intentionally* doesn’t modify the lower predicate. That’s because it would then be modifying the eventuality introduced by vP_2 . This is bad in virtue of the eventuality being a state.

often have an ought-to-do reading.⁷³ Without getting into the analyses proposed for this kind of reading, I will note that my proposal makes a rather simple explanation for this reading available. A curiosity about these readings is that they only arise on future-oriented readings of root modals. Such future-oriented readings are precisely those which have the extra structure provided by vP_2 , and the agentive readings may come about because vP_2 gets an external argument, where the agent is contextually supplied. Another curiosity of such agentive/ “ought-to-do” readings is that the putative agent need not be the agent specified by any argument of the lower verb. To draw on a similar example from Ninan [2005], in *Billy must stop hitting Jacob*, the putative agent to putting an end to Billy’s hitting is taken to be the addressee of the utterance (say, Billy’s parent), not Billy. We can capture this fact rather simply on the present account, as follows.

$$(55) \text{ ASSERT}'(e_2, w) \ \& \ \forall w' \in \text{CON}(e_2): [t = t_u \ \& \ \exists(s) [t \subseteq \tau(s) \ \& \ \forall w' \in \text{BEST}_{g(s)}(\bigcap f(s)):$$

$$[\text{AGENT}(s, x) \ \& \ [\exists(e_1)[s \text{ CAUSE } e_1 \ \& \ \text{Billy-stop-hitting-Jacob}'(e_1)](w') = 1]]]]$$

In (55), vP_2 simply takes an agent argument, whose variable, x , gets a contextually determined value. vP_2 ’s agent is, importantly, not the agent of the the lower vP , but of the circumstance state, whose agentivity consists in *causing* an eventuation of the lower vP . In sum, I take it as evidence in favor of the proposal that, in addition to satisfying the desiderata, it provides explanations for these other phenomena as well.

4.3 Extensions of the Account

Since my explanation of the EC appeals to the embeddedness of present tense and perfective aspect under epistemic modals, there are a few downstream predictions that could be attributed to the account, and it makes sense to ask of these predictions whether they are sound. If they are not, it would reflect poorly on the account.

⁷³Cf. Portner [2009] and Hacquard [2010] on the semantics side, and Schroeder [2011] and Wedgwood [2006] on the philosophy side.

First of all, English is rather unique in disallowing the simple present form for anything but habitual and futurate constructions. Many other languages tolerate this, and allow a continuous reading of the present, resulting in an interpretation of the predicate as on-going at speech time. According to Bohnemeyer and Swift [2004], the data suggest that these languages (so-called telic languages) have a default perfective reading of telic predicates, as opposed to eventive predicates more generally (of which telic predicates are a subset). In particular, atelic activity predicates are tolerated in the present tense provided they have a continuous reading. This is indeed a kind of imperfective meaning available to the simple present tense form in these languages.⁷⁴ The question presents itself, if the continuous reading of the simple present is available fairly widely in language, is there an acceptable epistemic reading of *must* for activity predicates in these languages? If there is not, this would throw doubt onto my claim that present tense is to blame for the readings excluded by the EC. Again, a rigorous cross-linguistic examination is beyond the scope of this essay, but I can provide some evidence in favor of this claim. Let's take German as an example, where the equivalent of *must* is the modal *müssen*. At first blush, it doesn't look terribly promising, because, whereas (56a) and (56b) is OK, it is exceptionally hard to get epistemic readings of (57a) and (57b).

- (56) a. Es regnet.
 It rains-PRES.
 'It is raining.'
- b. Er rennt.
 He runs-PRES.
 'He is running.'

- (57) a. Es muß regnen.

⁷⁴My account then predicts that modal interpretation in such languages would be bound by a "Telicity Constraint" as opposed to an EC, but the mechanism explaining the constraint would be the same.

- b. Er muß rennen.

However, the difficulty in accessing epistemic readings of (57a) and (57b) seems to be due to the pragmatic idiosyncrasy of the epistemic sentences in question, as opposed to a genuine prohibition against epistemic readings. We know that continuous readings of (56a) and (56b) are in principle available, because activity predicates yield such readings, but actual utterances of these sentences would be odd without adverbials or an appropriate context. The case with (57a) and (57b) is not that different. A relative clause can make the epistemic reading quite prominent with the a continuous reading of the activity verb in the simple present embedded underneath.

- (58) a. Soweit ich weiß, muß es regnen.
So-far I know, must it rains.
'As far as I know, it must be raining.'
- b. Soweit ich weiß, muß er gerade rennen.
So-far I know, must he now runs.
'As far as I know, he must be running right now.'

This stands in stark contrast with English, where relative clauses of of this sort fail to make an epistemic reading available for eventive prejacent. So, continuous readings of activity predicates under epistemic modals do exist, a fact which supports my view.

The second issue is this. So far, the data pertaining to the EC has focused on *must* and the present tense. This is not accidental, since most modals in English do not inflect for past tense. There is certainly no past tense form of *must*. But the semi-modal *have to* does inflect for past tense, as we have seen in earlier examples (eg., (26)). Interestingly, even when inflected for past tense, as in (59), the modal seems to conform to the EC. To wit, *had to* in (59) lacks an epistemic reading.

- (59) Mary had to go home (at the time of the crime).

This could be a headache for my account because I appealed to the syntactic and semantic features of the present tense to rule out the unattested epistemic readings. Since there is nothing in the syntax or semantics of the past tense that would make it incompatible with eventive prejacent, we'd expect there to be the following reading.

(60) HAVE TO [PST [PFV [Mary go home]]]

(60) is roughly equivalent to: 'it has to be the case that Mary went home.' However, there is no such reading. This doesn't contradict my account as much as it threatens to make it theoretically unsatisfying. It would be much better to have a common explanation for present- and past-tense EC behavior, *unless* there were some alternative explanation for why (59) does not have the reading glossed in (60).

Luckily, I think there is such a reason. Consider the Past+Perfective combination that is thought to be the missing reading. Using ϕ as a schema for the eventive prejacent, $\phi(e)$ with perfective aspect and past tense would be regimented as follows.

(61) $t \prec t_u \ \& \ \exists e [\tau(e) \subseteq t \ \& \ \phi(e)]$

In less formal terms: 'a completed ϕ -event occurs at a time that precedes the utterance time'. But there is another sentence in English which has precisely these truth conditions, namely *Mary must/ has to have gone home*. So, the missing reading here isn't due to the same constraints that give rise to the EC, but to the fact that English has a different way to express (60), and languages tend to strongly disprefer extraneous ways of expressing identical meanings.⁷⁵ The apparent lack of an epistemic reading of (59) doesn't tell against my account. The reading does not seem to be missing after all, just expressed differently.

⁷⁵Whether *Mary must have gone home* is simply the phonological realization of (60), or whether it has some other underlying form (like 'HAVE TO [PRES [PERF [Mary go home]]]') which is equivalent to (60) is a question I set aside. Either possibility sits well with my account.

4.4 the EC and Ramchand's [2014]

Though the kind of pattern that underlies the EC has been noted in several places, the only published paper that makes a sustained effort at explaining it is Ramchand [2014]. Before concluding, it is therefore necessary to compare Ramchand's account with my own. Two comments to preface this discussion. First, Ramchand and the present paper agree on a fundamental issue; that the kind of generalization encoded by the EC is best explained by an appeal to the interaction between modals and tense/ aspect, which requires a revision of the Standard Account. Insofar as a main goal of this paper is to argue that the EC suggests that recasting modal semantics in this way is a key component to explaining the EC if one is to maintain UNIFORMITY, Ramchand and the present paper are in agreement. So, if the reader is convinced of the need for a semantics like the one Ramchand proposes, the present paper is successful in its stated aims. Second, Ramchand's departure from the semantic framework of the Standard Account is greater than my own. She adopts a particular kind of situation semantics wherein modals are quantifiers over sets of situational types as opposed to sets of possible worlds. There may be independent reasons for adopting such a framework. My own aim was to see to what extent the EC requires a revision of the Standard Account, and how significant a departure was called for due to this problem. So, I won't remark much on the framework, and in order to avoid having to introduce too much new semantic machinery, I'll aim for a conceptual exposition of her account over the reproduction of the technical details, when possible.

4.4.1 Ramchand's modal semantics

Two key ingredients to Ramchand's account are her reinterpretation of modals as choices over sets of situational alternatives, and her idea that functional projections build situational descriptions of incrementally increasing complexity. Both of these ingredients

interact to give her favored explanation of the EC.

First of all, there's the role of the higher functional projections. These are the projections sitting immediately outside of the predicational structure of what I've been calling the vP. Following the theory of Ramchand and Svenonius [2014], we have a picture where the predicational structure of the vP builds an event description, roughly in line with the Davidsonian picture sketched above. The area of the verbal projection spine associated with the inflectional layers of the functional projections marks a sortal shift from event descriptions to situational descriptions. At its left extremity, this description is then anchored to an anchoring situation. The overall structure is a variant of the "Austinian propositions" discussed earlier. The resulting picture is one where the functional projections take an event description and incrementally build a more complex situational entity.⁷⁶ By way of example, when the event description built by the vP yields to a situational description beyond the external argument, the situational description is only specified for the *descriptive* material the situation is composed of. This descriptive material is determined by the vP. But as this situational description merges with additional functional heads to form higher functional projections, more complexity is added to this situational description as situational parameters are specified. When it merges with tense, its temporal parameter is thereby specified, and it becomes a situational description of an eventuality with a temporal parameter t specified by tense. And so on.

Secondly, Ramchand's modals are no longer restricted quantifiers over sets of possible worlds, but are instead *choices* over sets of situational descriptions. Necessity modals like

⁷⁶Ramchand doesn't comment on the metaphysical distinction between events and situations, so I'll leave the notions unanalyzed in my explanation. I don't think the difference between the two matters as much as the mere fact that at a certain point in the structural derivation, the event variable is closed off, inaccessible to further modification, and a new variable is introduced which is then successively modified. This is all in line with a tradition in generative grammar which sees a tripartite clausal structure composed of an innermost predicational layer, a middle inflectional layer, and an outermost informational layer. Cf. Carnie [2010] for discussion.

must express an exhaustive choice over the set of alternatives, whereas possibility modals like *might* express a non-exhaustive choice over the alternatives. Unlike the traditional implementation of alternative semantics (like, e.g., Rooth [1992]), the alternatives in Ramchand's framework aren't propositions. This designation is reserved for fully anchored situational descriptions. Instead, the alternatives in question are situational descriptions of varying complexity. The CHOICE-predicate employed in her alternative semantics is a primitive, but intuitively it trades on the idea that modals say something about the live alternatives in play, and the modal's CHOICE indicates which amongst the alternatives is proposed to hold.

The way these two components interface both allows us to see the difference between epistemic and root modals, and offers a path to an explanation of the EC. So far, I've just appealed to this notion of a choice over a set of alternatives without indicating how Ramchand thinks the alternatives come about. Here is where the role of functional projections come into play. The set of alternatives is constructed using the complement of the modal. Modals combine directly with a constituent which denotes a situational description of some sort, with some properties specified and others yet unspecified. The set of alternatives is generated first by including polar alternatives to the event predicate, and second by filling in different values for the unspecified parameters. Since epistemic modals merge with a constituent whose temporal parameter has been specified by tense, the live alternatives are simply the positive and negative polarity of the event predicate (so, the set of alternative situations includes *P*-eventualities and not-*P*-eventualities). Root modals combine with a constituent whose denotation is a situational description where the temporal parameter has *not* been specified for tense, so the live alternatives include not only the polarity of the event, but also additional alternatives constructed by filling in different values for the

temporal parameter.⁷⁷

This gives us the basics for how modals generate a set of situational alternatives and express a choice over these. But recall that only anchored situational descriptions are full-fledged propositions, so even after the modal combines with its complement, there is no resulting proposition until this situational description is anchored. Likewise, until the situational description is anchored, the temporal parameter specified by tense is unbound. (*Mutatis mutandis* for any other parameters specified by the functional projections in the clause.) Here is where Ramchand's explanation of the EC comes into relief.

Ramchand's explanation of the EC appeals to a distinction between what she calls *indexical* and *anaphoric* modals. The indexical/ anaphoric distinction tracks the distinction between so-called subjunctive modals and non-subjunctive modals. Subjunctive modals are those that bear past tense morphology that seems largely idle.⁷⁸ This puts *must* on the indexical side of the ledger, and *might* on the anaphoric side, the latter originally being a past tense form of *may*. According to Ramchand, this morphological marker cleaves the modal system into indexical and anaphoric modals, and places different anchoring constraints on the modals.

Tense establishes a relationship between the situational description denoted by the constituent tense combines with and the situational anchor of the clause; namely one of precedence or overlap/ containment. Ramchand argues that modals are like tense in this respect; they are "endowed with information that establishes such a relationship." More specifically, indexical modals have their situational variable identified directly with the deictic anchor, the utterance situation, whereas for anaphoric modals, the situational

⁷⁷For Ramchand, past times are no longer considered in play, and are therefore not part of the set of alternatives. This accounts for the future orientation of root modals.

⁷⁸For other discussions of the modal significance of this kind of tense morphology, cf. Iatridou [2000]. Cf. Fintel and Iatridou [2008] for a discussion of subjunctive morphology on modals. von Stechow and Iatridou do not, however, leverage this distinction in service of an explanation of the EC.

variable is resolved anaphorically, either by binding from something in the linguistic context or to some purely discourse contextual topic situation. She gives the following definitions for the different kinds of anchoring.

- (62) a. indexical: $s=s^*$ (the utterance situation). The situational variable is identified directly with the deictic anchor, the utterance situation
- b. anaphoric: s must have its reference resolved anaphorically, either by binding from something in the linguistic context or to some purely discourse contextual topic situation.

Let's look at how this plays out for epistemic readings of the indexical modal *must* and anaphoric *might*. Let ALT be a function from situations to sets of situational alternatives (where these are defined in line with the intuitive gloss I gave above), and let P be a predicate standing for a fully saturated event description. The lexical entries proposed for *might* and *must* are given in (63).

- (63) a. $\llbracket \text{must} \rrbracket^{c,a} = \lambda x \lambda P \exists s_{e1,t*,w*} [P(s1) \ \& \ s1 \text{ is the only CHOICE for } x \text{ in } c], \text{ where } s1 \in \text{ALT}(s1) \text{ and alternative semantic value } \text{ALT}(s1) = \{s: s_{e,t*,w*}, \text{ where alternative values of } e \text{ are } e1 \text{ and not-}e1\}$ ⁷⁹
- b. $\llbracket \text{might} \rrbracket^{c,a} = \lambda x \lambda P \exists s_{e1,t1,w1} [P(s1) \ \& \ s1 \text{ is a CHOICE for } x \text{ in } c], \text{ where } s1 \in \text{ALT}(s1) \text{ and alternative semantic value } \text{ALT}(s1) = \{s: s_{e,t1,w1}, \text{ where alternative values of } e \text{ are } e1 \text{ and not-}e1\}$

Notice the parameters on the situational description $s1$; specifically the t parameter.

⁷⁹ALT is a function from situations to the set of situational alternatives. The function is defined as I indicated above; the positive and negative polarities of the event are in the range, as are situational descriptions where the as yet unspecified parameters are given different values. Since our example is an epistemic modal, ALT only picks out the polarities. Also, note how CHOICE is relativized to x . This encodes the idea that the choice proposed by the modal is relative to a person in some way— either given her information state in the case of epistemics, or because the modal expresses a permission for/ requirement of her. x may itself be anaphorically resolved, but for roots it is often the sentential subject.

The situational description will have this parameter specified when the constituent that is denoted by it combines with tense. But it is bound when the entire situational description is anchored at the highest level of the clause, in CP. Anaphoric modals allow anchoring to an anaphorically resolved situation. This affects the interpretation of the modal indirectly, by constraining the possible values of the parameters that are part of the situational description denoted by the modal's complement. This kind of anaphoric resolution is quite permissive in assigning a value to the parameter. The value of the parameter is, say, t_1 , which inherits the temporal properties of the situational anchor. However, for indexical modals, since the situational anchor is identified with the utterance situation, the temporal parameter is t^* , the time of the utterance situation.

Ramchand's explanation of the EC follows fairly quickly. Recall the contention, cited earlier, that the utterance situation is conceptualized as an instant. When the modal is indexical and the embedded situational description is eventive, then $\lceil \exists s_1 [P(s_1)] \rceil$ describes a situation that occurs over an interval, but the situational anchor constrains the temporal parameter on s_1 to an instant. In short, when there is an eventive predicate in P , there is no situation answering to the description $\lceil \exists s_1_{e_1, t^*, w^*} [P(s_1)] \rceil$. There is no such constraint when the modal is anaphoric, because t_1 is not required to have the temporal properties of the utterance situation. $\lceil \exists s_1_{e_1, t_1, w_1} [P(s_1)] \rceil$ is then a licit situational description, even when P is composed of an eventive predicate.

4.4.2 Concerns about the account

I find much to agree with in Ramchand's account of modals in general. However, I want to bring up a few issues that suggest that the indexical/ anaphoric distinction can't in the final instance serve as an explanation of the EC. First of all, I think the specification of anaphoric modals provides a subtly incorrect account of the truth conditions of anaphoric

modals with eventive prejacent. Eventive prejacent under epistemic *might* are predicted to be OK on Ramchand's account because *might* is anaphoric, so it allows anchoring to situations besides the utterance situation. Since these situations might be durative as opposed to instantaneous, the complement of the modal is not constrained to have a temporal parameter valued to be an instant. Ramchand's anchoring condition for anaphoric modals allows the situational description to be anchored to some purely discourse contextual *topic* situation. Sometimes, this works exactly as we would want it to. Consider (64).

(64) John might go to the store.

We can make a particular topic situation contextually salient, say, by asking what John will do later. The topic situation made salient by *later* can provide the anchoring for the modal in (64). But the fact that this works out quite nicely has to do with the future-orientation of the topic situation with respect to the time of utterance. A past or present topic situation can equally well be made salient, and if it is, nothing in the anchoring condition for anaphoric modals would prevent this past/ present situation from being a suitable anchor for (64). However, the situational description embedded in the clause then inherits the temporal properties of this anchoring condition. So, the modal expresses a choice amongst situational alternatives that are, whatever their other properties, contemporaneous with the anchoring situation. And since the putative anchoring situation is past/ present, the situational alternatives would be as well. But this generates truth conditions that do not track our intuitions; there is no such reading of (64).

Secondly, for all its suggestiveness, it's not clear that the explanation of the EC based on the indexical/ anaphoric modal distinction is empirically adequate. The data seems pretty clear with the contrast between *might* and *must*.⁸⁰ Looking at a range of other modals

⁸⁰Additionally, Ramchand canvasses data including *will/ would* and *can/ could* contrasts. I have some doubts about *can/could*, but let's grant that the indexical and anaphoric distinction tracks the differences between these modals.

starts making shaky predictions. First of all, *may* seems to have the same distribution as *might* in (at least superficially) allowing eventive/ non-stative prejacent. Ramchand recognizes this complication and suggests that the apparent epistemic readings of *may* as merely pseudo-epistemic in the following sense. They are, rather, circumstantial modals that have an epistemic-like sense to them due to the fact that we are uncertain about the appropriate range of live situational alternatives the modal appeals to, because of our uncertainty about the future. Even if we grant this, other modals prove problematic for the predictions made by the indexical/ anaphoric distinction as well. The distribution of *ought* and *should* suggest that these are subject to the EC. If *ought* and *should* have epistemic readings, then they seem, like *must*, to lack this reading when they have non-habitual, non-futurate readings of the prejacent. That is, if (65a) has an epistemic reading, this reading is unavailable in (65b).

- (65) a. John should/ ought to be at the store.
 b. John should/ ought to go to the store.

But of course, *should* and *ought* are anaphoric modals (if moribund past tense morphology makes for an anaphoric modal, then *should* and *ought* should be as well, being antiquated past tense forms of *shall* and *owe* respectively). So we see problem cases in both directions; *may* patterns, at least superficially, with anaphoric modals, and *ought* and *should* pattern with indexical modals. I submit that the indexical/ anaphoric distinction and the semantics based on it does not satisfactorily explain the EC. The account I advocate does not link EC-behavior to morphological features of the modals, so it is unthreatened by the behavior of modals that fails to track the subjunctive/ non-subjunctive (and therefore the anaphoric/ indexical) distinction.⁸¹

⁸¹However, my account does leave unexplained why *might/ may* does *not* exhibit EC-behavior. More about that shortly.

5 Taking Stock

I argued that the Standard Account of modals fails to predict the EC, and that the antecedent commitments of the view make it difficult to accommodate the pattern of modal interpretation the EC captures. The problem lies with the nature of the modal base parameter, which, provided we are serious about maintaining UNIFORMITY, is powerless to account for the EC as long as it takes a world argument. On the other hand, Hacquard's account of modal semantics maintains much of the Kratzerian paradigm, allows us to integrate modal semantics with tense/ aspect, and gives us the resources to explain it. I proposed just such an explanation, which trades on the interaction of modals with tense and aspect. As it turned out, explaining why epistemic modals lacked eventive prejacent was relatively easy. However, the assumptions that made the former explanation easy, made explaining why root modals were OK with eventive prejacent harder. My proposal was to posit a bit more structure below Aspect which made the apposite predictions and suggested explanations for some other well-known behavior of modals. I will end by addressing a few loose ends.

(1) First, given the state-introducing nature of vP_2 , it may now seem that the EC was a misnomer. After all, the complement of the modal is now stative, in *both* the epistemic and the root cases. This is a reasonable complaint, but the EC was meant to describe an apparent pattern, and putting the pattern this way still has some utility. After all, I described the addition of vP_2 as a kind of aspectual coercion, which occurs when vP_1 is eventive, and it's the predicative material in vP_1 that speakers will most readily take to be the complement of the modal. vP_2 does not add any lexical material and is otherwise only detectable by the means discussed in section 4.2.

(2) As I promised, the semantic account I provided gives an explanation of the EC that preserves UNIFORMITY. It does so at the cost of PRAGMATIC RESOLUTION, but this

is fine. Contravening PRAGMATIC RESOLUTION is only a cost if it turns out that that commitment to it is justified on methodological grounds, or in light of evidence. While UNIFORMITY was motivated by methodological concerns underwritten by cross-linguistic evidence, PRAGMATIC RESOLUTION merely encodes intuitions about the context sensitivity of modals in our theoretical vocabulary. As such, PRAGMATIC RESOLUTION was not defined in a particularly rigorous manner, and is often the case with intuitions that are scrutinized in the light of more evidence, they turn out wrong. But, we can have an updated version of this commitment as follows.

PRAGMATIC RESOLUTION*: The contextual parameters introduced by modals determine the meaning of the modal along the flavor dimension through the pragmatic assignment of values to the parameters within the grammatical constraints imposed on the parameters.

PRAGMATIC RESOLUTION* is as consonant with intuitions about the context sensitivity of modals as its predecessor and lacks its predecessor's faults. A worry one might have about PRAGMATIC RESOLUTION* is that it is difficult to square with UNIFORMITY. But this is only the case if the grammatical constraints are imposed on the parameters affect epistemic and root modals asymmetrically. We sidestepped this problem by adopting Hacquard's proposal about the event-relativity of modals.

(3) As Hacquard [2010] makes clear, whether a modal has a root or an epistemic interpretation is no longer a matter of context, but is essentially a reflex of the grammar. On my proposal, this was even more the case, since the value of the modal base hinged on the kind of eventuality argument the function combines with. This circumscribes the role of context in the resolution of the modal base parameter considerably, but comports with the empirical evidence provided by the EC. Context is still left an important role; exactly which kind of epistemic or root flavor the modal has is a matter of context, as is the resolution

of the ordering source parameter, g . For example, within the class of root interpretations, whether the modal gets, say, a deontic or a teleological interpretation is still a matter of context. Within the class of epistemic modals, the nature of the information state is also still determined contextually.

(4) My proposal leaves an open question. In explaining why some modals conform to the EC, my account makes it mysterious why some of them don't. If the logical form is as I've said it is, and if the explanation for the lack of eventive-perfective epistemic readings of certain modals is correct, then it is mysterious why epistemic *might* and *may* seem perfectly acceptable with an eventive prejacent. A path lay open here. Notice that both of these problem cases are possibility modals, and further, that even on an epistemic reading they have an obligatory future orientation. If the future orientation were due to some element in the logical form (say, the null futurate modal FUT) then we could say that the EC is in fact perfectly general, and neither of these modals pose an exception. However, recall from section 3.1 that what makes the presence of FUT under *must* so apparent was the similarity in felicity conditions between matrix futurates and futurates under epistemic *must* (namely they both adhered to something like a plannability constraint for the predicate). Should the explanation of this fact go as I'm suggesting, the plannability constraint obviously does not hold under *might* or *may* to the same degree as under necessity modals, or in unembedded environments. The difficulty here would be in explaining why the felicity conditions of futurates embedded under necessity modals are so similar to matrix futurates, whereas futurates under possibility modals have much more relaxed felicity conditions. Justifying my claim here would require additional evidence justifying the existence of FUT in these constructions on the one hand, and an explanation for the difference in felicity conditions on the other. I leave this task to future work.

(5) The account places additional constraints on the metasemantics of modals. For exam-

ple, we may adopt Dowell [2011]’s contextualist account of the metasemantics of modals, but her claim that “When a bare modal expression is used, its ‘flavor’, as bouletic, epistemic, or deontic, etc. is determined by a speaker S’s publicly manifestable intentions in a context of use,” (Dowell [2011]) is not, strictly speaking, correct. It is not a matter of S’s intentions that the modal’s flavor be epistemic or root. However, her contention elsewhere (Dowell [2013]) that “Context selects f , an accessibility relation on the world of evaluation, which determines the modal base (a set of worlds),” is more accurate, since context may in fact select an f , but the possible values of f are constrained by some non-contextual means having nothing to do with the intentions of the speaker. In short, the metasemantics of modals turn out to be conditioned by the kind of grammatical constraints underwriting remarks (2) and (3) above.

There is a final consequence of this proposal which deserves further attention. The arguments of epistemic and root modals are structurally different, with the complements of epistemic modals having inflectional elements like Tense and Aspect that the complements of root modals lack. The very fact that epistemic and root modals differ with respect to the aspectual and tense information their complements have is suggestive, and it raises the question whether it is profitable to think of prejacentes as a unified class. I suspect that these differences are worth exploring in more detail.

References

- E. Bach. On time, tense, and aspect: a essay in english metaphysics. In P. Cole, editor, *Radical Pragmatics*. Academic Press, London, 1981.
- E. Bach. the algebra of events. *Linguistics and Philosophy*, 9:5 – 16, 1986.
- K. Bach. Perspectives on possibilities: Contextualism, relativism, or what? In A. Egan

- and B. Weatherson, editors, *Epistemic Modality*. Oxford University Press, 2009.
- J. Bohnemeyer and M. Swift. Event realization and default aspect. *Linguistics and Philosophy*, 27:263–296, 2004.
- D. Braun. An invariantist theory of 'might' might be right. *Linguistics and Philosophy*, 35(6):461–489, 2012.
- G. N. Carlson. Generics, habituals and iteratives. In A. Barber, editor, *Encyclopedia of Language and Linguistics*. Elsevier, 2005.
- A. Carnie. *Constituent structure*, volume 5. Oxford University Press, 2010.
- L. Champollion. The interaction of compositional semantics and event semantics. *Linguistics and Philosophy*, 38(1):31–66, 2015.
- G. Cinque. *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. Oxford University Press, 1999.
- B. Comrie. *Aspect*. Cambridge University Press, 1976.
- C. Condoravdi. Temporal interpretation of modals. In D. Beaver, S. Kaufmann, B. Clark, and L. Casillas, editors, *The Construction of Meaning*, pages 59 – 88. CSLI Publications, 2002.
- B. Copley. Temporal orientation in conditionals. In J. Guéron and J. Lecarme, editors, *Time and Modality*, volume 75 of *Studies in Natural Language and Linguistic Theory*. Springer, 2008a.
- B. Copley. the plan's the thing: deconstructing futurate meanings. *Linguistic Inquiry*, 39(2):261–274, 2008b.

- B. Copley. *the Semantics of the Future*. Routledge, 2009.
- B. Copley. Causal chains for futurates. In M. Kissine, P. de Brabanter, and S. Sharifzadeh, editors, *Future times, future tenses*,, pages 72–86. Oxford University Press, 2014.
- O. Dahl. the marking of the episodic/ generic distinction in tense-aspect systems. In M. Krifka, F. J. Pelletier, G. N. Carlson, A. ter Meulen, G. Chierchia, and G. Link, editors, *the Generic Book*, page 412. University of Chicago Press, 1995.
- D. Davidson. the logical form of action sentences. In N. Rescher, editor, *the Logic of Decision and Action*. University of Pittsburgh Press, 1967.
- J. Dowell. A flexible contextualist account of epistemic modals. *Philosopher’s Imprint*, 11 (14), 2011.
- J. L. Dowell. Flexible contextualism about deontic modals: A puzzle about information-sensitivity. *Inquiry*, 56(2-3):149–178, 2013.
- D. Dowty. *Word Meaning and Montague Grammar: the Semantics of Verbs and Times in Generative Semantics and in Montague’s PTQ*, volume 7 of *Studies in Linguistics and Philosophy*. Springer, 1979.
- H. B. Drubig. On the syntactic form of epistemic modality. 2001.
- K. v. Fintel and A. S. Gillies. Must... stay... strong! *Natural Language Semantics*, 18 (4):351 – 383, 2010.
- K. v. Fintel and A. S. Gillies. ‘might’ made right. In A. Egan and B. Weatherson, editors, *Epistemic Modality*, pages 108 – 130. Oxford University Press, 2011.
- K. v. Fintel and I. Heim. Lecture notes on intensional semantics. 2002.

- K. v. Fintel and S. Iatridou. How to say ought in foreign: the composition of weak necessity modals. In J. Guéron and J. Lecarme, editors, *Time and Modality*, Studies in Natural Language and Linguistic Theory, pages 115 – 141. Springer, 2008.
- R. Folli and H. Harley. Causation, obligation, and argument structure: On the nature of little v. *Linguistic Inquiry*, 38(2):197–238, 2007.
- F. Giorgi and A. Pianesi. *Tense and Aspect. From Semantics to Morphosyntax*. Oxford University Press, 1997.
- H. P. Grice. *Studies in the Way of Words*. Harvard University Press, 1989.
- V. Hacquard. On the interaction of aspect and modal auxiliaries. *Linguistics and Philosophy*, 32:279 – 315, 2009.
- V. Hacquard. On the event relativity of modal auxiliaries. *Natural Language Semantics*, 18:79 – 114, 2010.
- V. Hacquard. Modality. In *Semantics: An International Handbook of Natural Language Meaning. HSK 33.2*, number 3, pages 1484–1515. Mouton De Gruyter, 2011.
- P. Hallman. Instants and intervals in the event/ state distinction. MS, 2009.
- I. Heim. *The Semantics of Definite and Indefinite Noun Phrases*. PhD thesis, UMass Amherst, 1982.
- I. Heim and A. Kratzer. *Semantics in Generative Grammar*. Blackwell, 1998.
- J. Higginbotham. On semantics. *Linguistic Inquiry*, 16:547–593, 1985.
- V. Homer. French modals and perfective: a case of aspectual coercion. In *Proceedings of the 28th West Coast Conference on Formal Linguistics*, pages 106–114, 2011.

- R. Huddleston. The futurate construction. *Linguistic inquiry*, 8(4):730–736, 1977.
- S. Iatridou. The grammatical ingredients of counterfactuality. *Linguistic Inquiry*, 31(2): 231 – 270, 2000.
- R. Jackendoff. *Semantic Interpretation In Generative Grammar*. MIT Press, 1972.
- H. Kamp and U. Reyle. *From discourse to logic: Introduction to model theoretic semantics of natural language, formal logic and discourse representation theory*, volume 42. Springer, 2013.
- S. Kaufmann. Conditional truth and future reference. *Journal of Semantics*, 22(3):231 – 280, 2005.
- A. Kenny. *Action, Emotion And Will*. Humanities Press, 1963.
- P. Klecha. Modality and embedded temporal operators. *Semantics and Pragmatics*, 9, 2016.
- W. Klein. *Time in Language*. Routledge, 1994.
- A. Kratzer. What must and can must and can mean. *Linguistics and Philosophy*, 1(1):337 – 355, 1977.
- A. Kratzer. The notional category of modality. In H.-J. Eikmeyer and H. Rieser, editors, *Words, Worlds, and Contexts. New Approaches in Word Semantics*, pages 38 – 74. De Gruyter, 1981.
- A. Kratzer. Modality. In A. von Stechow and D. Wunderlich, editors, *Semantik: Ein internationales Handbuch zeitgenoessischer Forschung*, pages 639 – 650. De Gruyter, 1991.

- A. Kratzer. Severing the external argument from its verb. In L. Z. Johan Rooryck, editor, *Phrase structure and the lexicon*, pages 109–137. Springer, 1996.
- A. Kratzer. More structural analogies between pronouns and tenses. In *Semantics and linguistic theory*, volume 8, pages 92–110, 1998.
- A. Kratzer. Building statives. In *Berkeley Linguistic Society*, volume 26, pages 385–399, 2000.
- A. Kratzer. Situations in natural language semantics. In *Stanford Encyclopedia of Philosophy*. 2008.
- A. Kratzer. *Modals and Conditionals*. Oxford Studies in Theoretical Linguistics. Oxford University Press, 2012.
- A. Kratzer. Modality for the 21st century. In *19th International Congress of Linguists*, pages 181–201, 2013.
- M. Krifka. Nominal reference, temporal constitution and quantification in event semantics. In R. Bartsch, J. F. A. K. van Benthem, and P. van Emde Boas, editors, *Semantics and Contextual Expression*, pages 75–115. Foris Publications, 1989.
- M. Krifka. Quantifying into question acts. *Natural Language Semantics*, 9(1):1–40, 2001.
- M. Krifka, F. J. Pelletier, G. N. Carlson, A. ter Meulen, G. Chierchia, and G. Link. Genericity: An introduction. In *the Generic Book*. University of Chicago Press, 1995.
- G. Lakoff. Stative verbs and adjectives in english. Nsf-17, Harvard Computational Laboratory Report, 1966.
- G. Lakoff. Presupposition and relative well-formedness. *Semantics: An interdisciplinary reader in philosophy, linguistics, and psychology*, pages 329–340, 1971.

- F. Landman. The progressive. *Natural Language Semantics*, 1(1):1–32, 1992.
- R. K. Larson. On the double object construction. *Linguistic inquiry*, 19(3):335–391, 1988.
- M. Lekakou and Ø. Nilsen. What aspect can tell us about the future of must. In *Proceedings of the 8th international conference of Greek linguistics*, 2008.
- S. Leslie. Generics: Cognition and acquisition. *Philosophical Review*, 117(1):1–47, 2008.
- S. Leslie. Generics oversimplified. *Noûs*, 47(3):28–54, 2013.
- D. Lewis. General semantics. *Synthese*, 22(1-2):18–67, 1970.
- A. Mourelatos. Events, processes and states. *Linguistics and Philosophy*, 2:415 – 434, 1978.
- D. Ninan. Two puzzles about deontic necessity. In J. Gajewski, V. Hacquard, B. Nickel, and S. Yalcin, editors, *New work on modality*, volume 51, pages 149–178. MIT Working Papers in Linguistics, 2005.
- T. Ogihara. Tense and aspect in truth-conditional semantics. *Lingua*, 117(2):392–418, 2007.
- T. Parsons. *Events in the Semantics of English: A Study in Subatomic Semantics*. Number 19 in Current Studies in Linguistics. MIT Press, 1990.
- P. M. Pietroski. On explaining that. *Journal of Philosophy*, 97(12):655, 2000.
- P. Portner. *Modality*. Oxford University Press, 2009.
- G. Ramchand. Stativity and present tense epistemics. *Proceedings of SALT*, 24(102 - 121), 2014.
- G. Ramchand and P. Svenonius. Deriving the functional hierarchy. *Language Sciences*, 46: 152–174, 2014.

- F. Recanati. *Perspectival Thought: A Plea for Moderate Relativism*. Oxford University Press, 2007.
- H. Reichenbach. *Elements of Symbolic Logic*. Dover Publications, 1980.
- M. Rooth. A theory of focus interpretation. *Natural language semantics*, 1(1):75–116, 1992.
- S. Rothstein. *Structuring Events*. Blackwell, 2004.
- H. Rullman, L. Matthewson, and H. Davis. Modals as distributive indefinites. *Natural Language Semantics*, 25(1 - 2):139 – 201, 2008.
- G. Ryle. *The Concept of Mind*. Hutchinson and Co, 1949.
- D. Sackris. An invariant content theory for epistemic uses of modal terms. *Topoi*, pages 1–10, 2015.
- M. Schroeder. Ought, agents, and actions. *Philosophical Review*, 120(1):1–41, 2011.
- C. S. Smith. *the Parameter of Aspect*, volume 43 of *Studies in Linguistics and Philosophy*. Springer, 1991.
- C. S. Smith. Activities: states or events? *Linguistics and philosophy*, 22(5):479–508, 1999.
- J. Stanley. Context and logical form. *Linguistics and Philosophy*, 23(4):391–434, 2000.
- J. Stanley and Z. G. Szabó. On quantifier domain restriction. *Mind and Language*, 15(23): 219–261, 2000.
- M. J. Steedman. Verbs, time, and modality. *Cognitive science*, 1(2):216–234, 1977.
- E. Swanson. Modality in language. *Philosophy Compass*, 3(6):1193 – 1207, 2008.
- B. Taylor. Tense and continuity. *Linguistics and Philosophy*, 1(2):199 – 220, 1977.

- R. H. Thomason. Indeterminist time and truth-value gaps. *Theoria*, 36(3):264–281, 1970.
- Z. Vendler. Verbs and times. *the Philosophical Review*, 66(2):143 – 160, 1957.
- D. C. Vetter. Someone solves this problem tomorrow. *Linguistic inquiry*, pages 104–108, 1973.
- E. Viebahn and B. Vetter. How many meanings for '?' the case for modal polysemy. *Philosophers' Imprint*, 16(10), 2016.
- R. Wedgwood. The meaning of 'ought'. In R. Shafer-Landau, editor, *Oxford Studies in Metaethics: Volume 1*, pages 127–160. Clarendon Press, 2006.
- S. Yalcin. Modalities of normality. In N. Charlow and M. Chrisman, editors, *Deontic Modality*. Oxford University Press, 2016.