

# ON THE INTERACTION OF ASPECT AND MODAL AUXILIARIES<sup>1</sup>

## ABSTRACT

This paper discusses the interaction of aspect and modality, and focuses on the puzzling implicative effect that arises when perfective aspect appears on certain modals: perfective somehow seems to force the proposition expressed by the complement of the modal to hold in the *actual* world, and not merely in some possible world. I show that this puzzling behavior, originally discussed in Bhatt (1999) for the ability modal, extends to all modal auxiliaries with a circumstantial modal base (i.e., *root modals*), while epistemic interpretations of the same modals are immune to the effect. I propose that implicative readings are contingent on the relative position of the modal w.r.t. aspect: when aspect scopes over the modal (as I argue is the case for root modals), it forces an actual event, thereby yielding an implicative reading. When a modal element scopes over aspect, no actual event is forced. This happens (i) with epistemics, which structurally appear above tense and aspect; (ii) with imperfective on a root modal: imperfective brings in an additional layer of modality, itself responsible for removing the necessity for an actual event. This proposal enables us to solve the puzzle while maintaining a standardized semantics for aspects and modals.

## 0. INTRODUCTION

This paper explores the puzzling implicative behavior of some modals: in certain environments, these modals seem to not merely express a possibility, but rather implicate the realization of their complement. Thus, while the ability modal in (1)a) expresses an ability of Jane, which may never have been instantiated, the same modal in (1)b) implicates that Jane did swim across Lake Balaton, hence the continuation seems contradictory:

- (1) a. In her twenties, Jane was able to swim across Lake Balaton, though she never did.  
b. Yesterday, Jane was able to swim across Lake Balaton, ??but she didn't.

(examples based on Pinon 2003)

A major breakthrough for this puzzle came with Bhatt (1999) who showed that the implicative behavior of the ability modal correlates with grammatical *aspect*: in languages that have a morphological distinction between perfective and imperfective aspect (such as French, shown

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below, Italian, Catalan, Bulgarian, Greek, and Hindi<sup>2</sup>), perfective (the aspect used for episodic statements) on the ability modal forces the proposition expressed by its complement to hold in the *actual* world, as in (2)b), while no such requirement holds with imperfective (the aspect used in generic statements), as in (2)a). Because the effect with perfective is uncancelable, Bhatt coined it an '*actuality entailment*':

- (2) a. Jane pouvait traverser le lac à la nage, mais elle ne le fit jamais.  
Jane can-past-**impf** cross the lake by swim, but she it never do-past-pfv.
- b. Jane put traverser le lac à la nage, #mais elle ne le fit pas.  
Jane can-past-**pfv** cross the lake by swim, #but she it do-past-pfv not.  
'Jane could (was able to) swim across the lake, but she didn't do it.'

Note that because English doesn't have an overt aspectual distinction, the past tense is ambiguous between either interpretation, though the adverbials *yesterday* and *in her twenties* help bring out the episodic (perfective) and generic (imperfective) readings respectively.

It thus appears as if perfective aspect somehow eradicates the modality. But how could a mere aspectual operator, whose usual function is to manipulate temporal properties of events, remove the very property of displacement that defines modals? Bhatt (1999) argues that, despite appearances, the ability modal is not a modal, but an implicative predicate like *manage* whose base meaning transpires with *perfective*; the modal interpretation of the ability modal with *imperfective* arises from the semantics of the imperfective itself, which independently brings in a layer of genericity, responsible for the ability meaning.

While Bhatt's account successfully derives actuality entailments with perfective, prevents them with imperfective, and still maintains a standard semantics for aspects, it unfortunately gives the ability modal a very idiosyncratic semantics, despite the fact that, cross-linguistically, it is expressed by the same words that express various kinds of modality. French *pouvoir* (illustrated in (2)), for instance, is used for ability, circumstantial, teleological, bouletic, deontic and epistemic possibilities. Should we postulate a systematic ambiguity between an implicative and a modal interpretation for possibility modals in language after language, or could we instead

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<sup>2</sup> Albanian, Basque, Galician, Portuguese and Spanish seem to have an extra counterfactual reading with perfective (cf. Bhatt 1999, Brogonovo and Cummins 2006). I put this complication aside and focus on French as representative of the languages that show the actuality entailment effect.

maintain a more standard semantics for modals, and derive actuality entailments by other means?

The goals of this paper are both empirical and theoretical. First, I will show that the Bhatt effect is found beyond ability modals, and in fact extends to all ‘*root*’ interpretations (deontic, teleological...) of both possibility and necessity modal auxiliaries, but, crucially, not to ‘*epistemic*’ interpretations of the same modal auxiliaries. Second, I will offer an account of actuality entailments that aims at maintaining a standardized account of both aspects and modals, such that modals still have a modal semantics, while providing answers to the following questions: (i) why does perfective, but not imperfective, on a modal like (2) force the realization of the complement? (ii) What differentiates root and epistemic interpretations of the same modals, so that perfective on the latter doesn’t yield the implicative effect? In the rest of this introduction, I briefly review background on aspect and modality (section 0.1), provide further data to show the generality of the problem (section 0.2), and sketch my proposal (section 0.3).

### 0.1. Aspect and Modality

While tense’s role is to relate the time of an event with respect to a time of reference (usually the speech time), aspect is concerned with the ‘temporal constituency’ of the event (Comrie 1976). Two main aspects can be found cross-linguistically: **perfective** and **imperfective**. These two aspects are often called *viewpoint aspect* (Smith 1991) because of the perspective they take with respect to the event they quantify over: perfective seems to describe the event from the outside, and thus describe a ‘completed’ event; imperfective takes a viewpoint from within the event, and thus describe an ‘incomplete’ event or series of events.

French—the language this paper focuses on—shows a perfective/imperfective distinction in the past only (for extensive accounts of the various French past tenses, see Kamp and Rohrer 1983, Corblin and de Swart 2004 and references therein). The *imparfait* (3)b/c) encodes a combination of past tense and imperfective aspect. The *passé simple* (simple past) (3)a) encodes a combination of past tense and *perfective* aspect. As it is now largely disappearing from spoken language, the *passé composé* (auxiliary + participle) (3)a’), which originally expressed present perfect, is now used to express past perfective as well (cf. Verkuyl et al. 2004). As the relevant contrast for our purposes is between the perfective and the imperfective (cf. footnote 3), we will ignore the perfect readings of (3)a’):

- (3) a. Jane dansa.  
Jane dance-pst-**pfv**  
*Jane danced.*
- a'. Jane a dansé.  
Jane has danced(**pfv**)  
*Jane danced.*
- b. Hier matin, Jane dansait.  
Yesterday morning, Jane dance-past-**impf**.  
*Yesterday morning, Jane was dancing.*
- c. A l'époque, Jane dansait.  
In those days, Jane dance-past-**impf**.  
*In those days, Jane used to dance.*

While a sentence with perfective describes a single, completed event of dancing (a/a'), the same sentence with imperfective describes an event in progress (b), or a sequence of events or *habit* (c). Aspects provide quantification over the event described by the verb phrase: perfective is an existential quantifier: (a/a') describes *some* event of dancing; imperfective a universal one: (b/c) describe a series of events: *all (relevant) events in a certain interval ('yesterday morning' or 'in those days')* are events of Jane dancing (cf. Bonomi 1997; Lenci and Bertinetto 2000, a.o.).

Modals are used to talk about possibilities and necessities, which can be captured formally by invoking 'possible worlds' (Kripke 1972, Lewis 1968, Kratzer 1981, 1991, a.o.). There is a multitude of ways the world could be, and each possible world represents a different variant. What modals do is quantify over different sets of worlds, as determined by an accessibility relation. Thus, a sentence like '*Jane must go to bed*' states that in all accessible worlds among a certain set (e.g., worlds in which her parents' orders are obeyed), Jane goes to bed. The *necessity* part of the meaning comes from universal quantification: Jane goes to bed in *all* worlds in which she obeys her parents. A possibility obtains by quantifying over *some* accessible world: '*Jane may watch TV*' means that there is at least a world in which Jane watches TV and still obeys her parents. Note that in both cases the *actual* world is not necessarily one of the accessible worlds: sadly for her parents, Jane may be a very disobedient girl in reality, and hence never go to bed. However, we still judge the sentence to be true. Modals, then, enable us

to talk about non actual (but possible) situations by invoking worlds other than the actual one.

## 0.2. The Puzzle

While our current semantics for aspects and modals are rather successful on their own, they cannot, when combined, capture the puzzle this paper focuses on. As we saw, Bhatt (1999) showed that certain modals require their complement to hold in the *actual* world, and not merely in some possible world, when the modals are marked with *perfective*, but not with *imperfective*. As noted above, past perfective in French is expressed either by *passé simple* or *passé composé*. Because *passé composé* sounds more natural, this is the form I use in the rest of the paper, though the pattern I describe holds for the *passé simple* as well, as we saw in (2)<sup>3</sup>:

- (4) a. Pour aller à Londres, Jane pouvait prendre le train.  
 To go to London, Jane can-past-**impf** take the train
- b. Pour aller à Londres, Jane a pu prendre le train.  
 To go to London, Jane can-past-**pfv** take the train  
*'To go to London, Jane could (was able to) take the train.'*

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<sup>3</sup> Since French *passé composé* is ambiguous between present perfect and past perfective, one may wonder whether actuality entailments are due to the perfect instead. Since actuality entailments also occur with the uncontroversially perfective *simple past*, and moreover occur with perfective, but not necessarily with the perfect in languages that morphologically distinguish perfect and perfective, such as Bulgarian (shown below), I simply assume the relevant readings involve perfective and ignore the perfect for this point on. For the interaction of modals and the perfect, cf. Condoravdi (2002).

- (i) a. Možah da vdigna masata (\*no ne ja vdignah) (R. Pancheva, p.c.)  
 can-**pfv**-past-1sg DA lift-pfv-non-past-1sg the-table but not it lift-pfv-past-1sg  
*'I could lift the table (\*but I didn't lift it)'*
- b. Vinagi sām možela da vdigna masata, no nikoga ne sām ja vdigala.  
 always be-pres-1sg can-**impf-perfect** DA lift-pfv-non-pst-1sg the-table but never not be-pres-1sg it lift-  
 impf-perfect  
*'I have always been able to lift the table but I have never lifted it'*

In fact, Mari and Martin (2007) show that *passé composé* on a root modal doesn't always yield actuality entailments, as in examples like (ii) below. However, the *passé composé* is ambiguous between a past perfective and a perfect interpretation, with the latter being itself ambiguous between a perfect+perfective and a perfect+imperfective interpretation. I believe that the lack of actuality entailments in these cases arises from a perfect+imperfective interpretation (the perfect time span in (ii) being introduced by the adverbial '*à un stade bien précis...*'), and results from the morphologically opaque presence of the imperfective (cf. Hacquard 2006). Note that if we switch to the unambiguously perfective simple past in (ii), the actuality entailment reappears.

- (ii) Notre nouveau robot a meme pu repasser les chemises à un stade bien précis de son développement.  
 Our new robot could-pfv even iron shirts at a particular stage of its development.

The truth conditions of (4)a) are as follows: there is a world among all accessible worlds in which Jane goes to London where she took the train to get there. This is compatible with a scenario in which Jane did not take the train in reality (nor went to London, for that matter). Things are different with (4)b): for the sentence to be true, Jane must have taken the train *in the actual world*. Any continuation stating that she didn't comes out as a contradiction.

The only difference between (4)a) and (4)b) is in the aspect on the modal: (4)a) has imperfective, (4)b) perfective. Descriptively, it appears as if perfective neutralizes the modality and forces the complement to hold in the actual world. But, why should there be a difference in 'actuality entailment' between perfective and imperfective? Both are using the same modal in the same sense (presumably here a goal-oriented modal). Whatever the meaning of one, we expect the other to vary along an aspectual or durational dimension, not a modal one. We will see that the imperfective is associated with its own modal component, which will be crucial to *avoid* actuality entailments. This modal component was already hinted at in section 0.1: the habitual/progressive sentences in (3) are judged true even if Jane takes a break in between dances in (b), or only dances on the weekends in (c); the quantification has to be restricted to *idealized* events. But while the imperfective may indeed involve a modal dimension, the puzzle with the perfective still remains: nothing in our semantics makes the perfective 'eradicate' modality<sup>4</sup>, nor should it. As we will see, perfective doesn't affect the non implicative behavior of an epistemic modal. Moreover, the example below shows that perfective on any modal construction doesn't always yield actuality entailment. '*Have the possibility*' is very close meaning-wise to the modal in (4), yet having perfective doesn't force an actualization of its complement. The continuation stating that Jane didn't take the train doesn't come as a contradiction, unlike in (4):

- (5) Jane a eu la possibilité de prendre le train, mais elle ne l'a pas pris.  
Jane has-past-pfv the possibility to take the train, but she didn't take it.

It thus seems that the Bhatt effect cannot be explained just in terms of the perfective, and arises from a property of the modals themselves (or a combination of the two). One might then wonder

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<sup>4</sup> One could hardwire a referential element in the semantics of the perfective to force the event it combines with to be anchored in the actual world. In fact, Arregui (2004, 2007) provides a referential account of the perfective (in order to derive the infelicity of certain counterfactuals), which does just that. While this option is worth pursuing, I choose not to do so here, as we would need to explain why perfective doesn't always yield actuality entailments, in cases like (5), or in complements of attitude verbs.

whether the modality is even present at all with actuality entailments (Bhatt argues it isn't for the ability modal). To evaluate this, we need to contrast a possibility and a necessity modal. Importantly, the effect is also found with the universal counterpart of (4):

- (6) a. Pour aller à Londres, Jane devait prendre le train.  
To go to London, Jane must-past-**impf** take the train
- b. Pour aller à Londres, Jane a dû prendre le train.  
To go to London, Jane must-past-**pfv** take the train  
*'To go to London, Jane had to take the train'*.

Here again, perfective in (6)b) forces the complement to hold in the actual world, while the corresponding sentence with imperfective in (6)a) imposes no such restriction. (4)b) and (6)b) are both true in situations where Jane actually took the train and went to London and false in situations where she didn't take the train. However, the two are not interchangeable: one is an (actualized) possibility, the other, an (actualized) necessity. With the latter, taking the train was the only possible option. With the former, other options may have been available, and we get the further impression that taking the train was Jane's preferred way to get to London. Thus, whatever is responsible for actuality entailments, the modals seem to still be there, and, actuality entailments aside, make their ordinary truth conditional contribution.

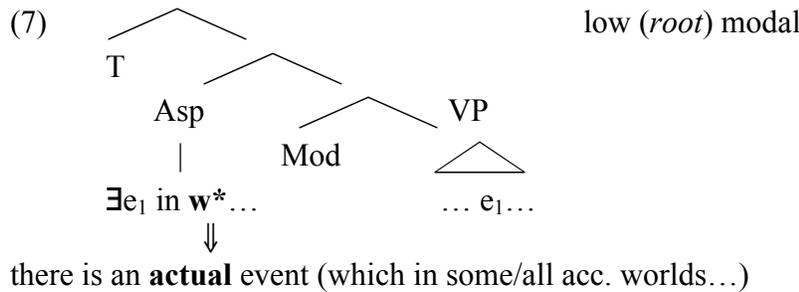
### 0.3. Sketching the Proposal

Recall the two questions that our puzzle raises. First, why should certain modal interpretations yield actuality entailments, but not others. As we will see in section 1, the ones that do are those traditionally called 'root' modals, and those that do not are epistemic modals. I will argue that the main factor responsible for this split in behavior is structural. The second question concerns aspect. Why does perfective on a root modal yield actuality entailments but not imperfective? The answer to this question will come from the semantics of the imperfective, which is cross-linguistically associated with a modal element. Following Bhatt (1999), I will take this additional layer of modality to be responsible for removing the need for an actualization.

Here is my proposal, in a nutshell. I take from the syntactic and semantic literature on modals (Jackendoff 1972, Brennan 1993, Piccolo 1990, Cinque 1999, Hacquard 2006, a.o.) that a

modal can appear in two positions, which correlate with two kinds of interpretation: either right above Tense (epistemic interpretation), or right above the VP (root interpretation). In both cases, the modal performs quantification over possible worlds, and combines with a proposition for the former, but with a property of events for the latter.

Assuming that a sentence with a modal like ‘*Jane can run*’ is monoclausal, it only has one aspect, whose role is to quantify over the event variable of the main predicate (the VP complement of the modal). I will argue that aspect comes with its own world of evaluation, and that the event it quantifies over (VP event) is anchored to that world. What underlies actuality entailments is the configuration of aspect with the modal: when aspect scopes over the modal (i.e., when the modal has a root interpretation), as in (7), its world of evaluation will have to be the matrix world (the actual world), unless it is itself in the scope of another modal element (i.e., if the clause is itself embedded under an intensional operator, such as an attitude verb). This forces the event it quantifies over (VP event) to occur in the actual world:

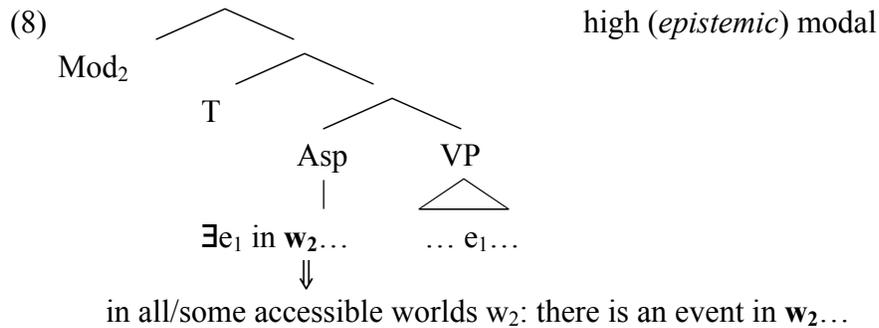


We obtain an actual event, which in some/all accessible worlds is a P-event (where P stands for the denotation of the VP). This doesn’t quite derive the full actuality entailment (i.e., an actual P-event). To do so, I will invoke a pragmatic assumption (*Preservation of Event Properties*), which states that the same event keeps its description across worlds, unless otherwise (morphologically) indicated (as with counterfactuals).

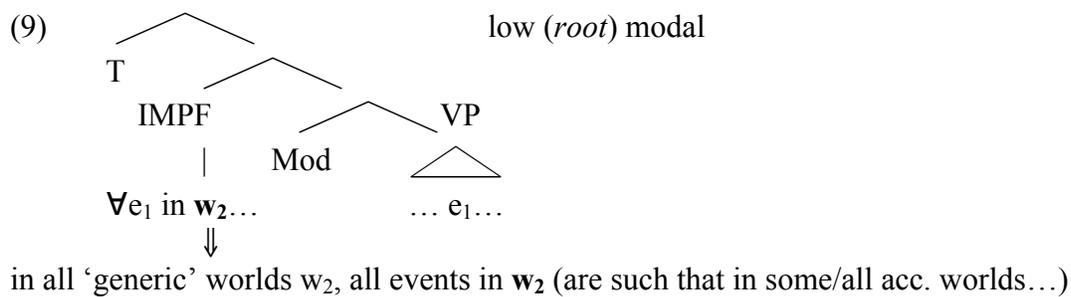
Modals with an epistemic interpretation scope over tense and aspect: they thus provide aspect its world of evaluation, and anchor the event to the worlds they quantify over (and not necessarily the actual world). Thus, because epistemics scope over aspect, they do not induce actuality entailments<sup>5</sup>:

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<sup>5</sup> Deriving the implicative behavior of a modal from a scopal interaction with tense and aspect is similar in spirit to



Finally, I will argue, following Bhatt (1999), that the lack of actuality entailments with imperfective is due to an additional modal (generic) element associated with the imperfective itself, as sketched below. This modal element is discussed in section 2.2.2:



Before delving into the analysis, I want to mention some alternatives<sup>6</sup>. First is a technical trick which would derive actuality entailments by restricting the domain of quantification to only one world: if the accessibility relation is reflexive and only picks one world, and in that world the complement holds, then necessarily, the complement holds in the actual world. A good candidate for such an accessibility relation is Kratzer’s ‘totally realistic’ conversational background (*in*

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Piñón’s (2003) proposal for English *able*. Piñón identifies two uses of English *able*: ‘opportunity-able’ and ‘ability able’, which correspond respectively to its implicative and non implicative uses, and derives the implicative readings through scopal differences between a possibility modal and a past tense. Piñón suggests that for opportunity-able, we are dealing with a historical possibility, where the modality is trivialized as it scopes above a past tense (if it is *historically* possible that past p, then it has to be the case that past p). For reasons of space, I won’t give a full account of his proposal but simply point out two challenges that it faces if we try to extend it to our modal auxiliaries. First, Piñón doesn’t relate the implicative behavior with aspect, so it is not clear why perfective would yield actuality entailments, but not imperfective. Second, one would need to find a way to generate the whole range of interpretations that the modals that yield actuality entailments can get (which go beyond ‘historical’ possibility).

<sup>6</sup> Two recent proposals have been offered in Mari and Martin (2007) and Portner (2009). For reasons of space, I won’t review these here and invite the interested reader to consult these references.

*view of what is the case...*), which depicts the actual world so as to uniquely pick it. This runs into major problems. First, we should use (4)a) and (4)b) against the same conversational background: we are talking about Jane wanting to go to London and the options available to her at that time, etc... Why would the version with perfective force a totally realistic conversational background, and the one with imperfective not?<sup>7</sup> We could stipulate that this is precisely what perfective does: it indicates or forces such a conversational background. But as we saw, perfective on a modal doesn't always yield actuality entailments. Moreover, this conversational background couldn't derive a meaning difference between (4)b) and (6)b): since it only picks one world, we shouldn't find a meaning difference between universal and existential quantification.

Assuming then that the 'actuality entailment' effect doesn't involve a 'totally realistic' conversational background, there are (at least) three theoretical moves one can make: the first is to deny that we are dealing with a modal, which, as we saw, is what Bhatt (1999) opts for. The problem with such an approach is that it treats the ability modal as a completely idiosyncratic construction, and doesn't extend easily to other modals. The second is to maintain that the modals that yield actuality entailments *are* modals, and that some feature in the semantics of the perfective removes their modal dimension. However, (5) showed that we cannot make the semantics of the perfective too strong, as it would overgenerate actuality entailments. Moreover, we saw truth conditional evidence with (6) that the modality doesn't completely disappear, even with actuality entailments. The last option is to maintain that all modals are modals and remain modals even with perfective, and have actuality entailments be a side effect of combining the two. This last option is the most desirable, given that it would allow us to maintain a unified semantics for both modals and aspects. This is thus the option I pursue.

This paper is organized as follows. Section 1 provides our empirical basis by going over the different interpretations of modal auxiliaries and determining which are sensitive to aspect and yield actuality entailments, and which aren't. As we will see, the ones that do are those with a circumstantial modal base (in the sense of Kratzer 1981), or 'root' interpretations, and the ones that do not are the epistemic ones; we will see that this difference in meaning correlates with a

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<sup>7</sup> An anonymous reviewer argues that this is an empirical question, and makes the interesting observation that when root modals have perfective aspect, they seem to 'lose' not only their ability component, as argued by Bhatt (1999), but deontic ones as well and turn into pure circumstantial modals. The reviewer suggests that the episodic nature of a perfective assertion may ensure that the conversational background considers properties of the situation rather than individual-level properties of the subject, which may impose a circumstantial reading. For discussion of whether the modality disappears with perfective, see section 3.2. I leave further exploration of this proposal for future research.

structural difference, which we will exploit to derive actuality entailments. Section 2 presents the proposal and shows how to derive actuality entailments with perfective on root modals and how to avoid them with imperfective. I discuss further issues and implications in section 3.

## 1. INTERPRETATIONS OF MODAL AUXILIARIES AND SENSITIVITY TO ASPECT

### 1.1. Modals and actuality entailments

The same modal words can be used to express various kinds of possibilities and necessities. In this section we examine which combinations of aspects and modal interpretations yield actuality entailments and which do not. We will see that not only do actuality entailments require perfective (as opposed to imperfective), but that they further only occur with modals with a ‘root’ interpretation, i.e., those with a ‘circumstantial’ modal base (notably ability, goal-oriented and deontic interpretations), but not with an epistemic one.

The first modal interpretation shown to yield implicative readings is the **ability** modal (Bhatt 1999), which expresses a possibility given the capacities and circumstances of the subject:

- (10) a. Jane a pu soulever cette table, #mais elle ne l’a pas soulevée.  
Jane can-past-pfv lift this table, #but she didn’t lift it
- b. Jane pouvait soulever cette table, mais elle ne l’a pas soulevée.  
Jane can-past-impf lift this table, but she didn’t lift it  
*Jane was able to lift this table, but she didn’t lift it.*

Another interpretation to yield actuality entailments is **goal-oriented** modality, which expresses possibilities and necessities<sup>8</sup> circumstantially available to the subject given his/her goals:

- (11) a. Jane a pu prendre le train pour aller à Londres, #mais elle a pris l’avion.  
Jane can-past-pfv take the train to go to London, #but she took the plane
- b. Jane pouvait prendre le train pour aller à Londres, mais elle a pris l’avion.  
Jane can-past-impf take the train to go to London, but she took the plane

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<sup>8</sup> Certain speakers (in particular, French Canadians) cannot use *devoir* for goal-oriented necessity, and prefer instead *falloir*, which also yields actuality entailments with perfective:

- (i) Il a fallu que Jane prenne le train pour aller à Londres, #mais elle a pris l’avion.  
It must-past-pfv that Jane take-subj the train to go to London, #but she took the plane

- Jane was able to take the train to go to London, but she took the plane.*
- (12) a. Jane a dû prendre le train pour aller à Londres, #mais elle a pris l’avion.  
Jane must-past-pfv take the train to go to London, #but she took the plane
- b. Jane devait prendre le train pour aller à Londres, mais elle a pris l’avion.  
Jane must-past-impf take the train to go to London, but she took the plane  
*Jane had to take the train to go to London, but she took the plane.*

The above examples relate the possibility/necessity of taking the train, given Jane’s goal to go to London. With perfective, both the possibility (11)a) and the necessity (12)a) modals require that Jane took the train in the actual world, whereas with imperfective, neither of them do. Finally, modals with a **deontic** interpretation<sup>9</sup>, i.e., those that express possibilities (permissions) and necessities (obligations) given certain laws also yield actuality entailments with perfective:

- (13) a. Lydia a pu aller chez sa tante (selon les ordres de son père), #mais n’y est pas allée.  
Lydia can-past-pfv go to her aunt (according to her father’s orders), #but didn’t go.
- b. Lydia pouvait aller chez sa tante (selon les ordres de son père), mais n’y est pas allée.  
Lydia can-past-impf go to her aunt (according to her father’s orders), but didn’t go.  
*Lydia could go the her aunt (according to her father’s orders, but she didn’t go.*
- (14) a. Lydia a dû faire la vaisselle (selon les ordres de son père), #mais ne l’a pas faite.  
Lydia must-past-pfv do the dishes (according to her father’s orders), #but didn’t do it.
- b. Lydia devait faire la vaisselle (selon les ordres de son père), mais ne l’a pas faite.  
Lydia must-past-impf do the dishes (according to her father’s orders), but didn’t do it.  
*Lydia had to do the dishes (according to her father’s orders), but she didn’t do it.*

All the above modal interpretations, which induce actuality entailments with perfective, form a class identified in the literature as ‘root’ modals, which contrasts both in meaning and structure with another class called ‘**epistemics**’. Meaning-wise, ‘roots’ express possibilities and necessities given certain circumstances of the base world while ‘epistemics’ express possibilities and necessities given what is known in the base world. Structure-wise, they differ in that roots scope at the VP-level and epistemics at the TP-level (cf. section 1.2).

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<sup>9</sup> For further discussion on deontic interpretations, see the Appendix.

One way to unambiguously distinguish an epistemic from a root interpretation is to look at the modal's interaction with tense. Epistemics scope above tense (cf. Iatridou 1990, Abusch 1997, Stowell 2004, Hacquard 2006); roots scope below it: Epistemics have to be evaluated at the local time of evaluation (the utterance time in matrix context): they cannot express past or future possibilities, but rather current possibilities about the past, present or future. Roots, on the other hand, are interpreted below tense: when combined with a past tense, they must express past possibilities/necessities. Thus, in the following sentences where the modal appear syntactically above tense and aspect, and hence has to be evaluated at the time of utterance, only an epistemic interpretation is available. No actuality entailment arises, as can be shown by the lack of contradiction when we conjoin two modals with contradictory complements:

- (15) Bingley peut (bien) avoir aimé Jane, comme il peut (bien) ne pas l'avoir aimée.  
Bingley can (well) have loved Jane, like he can (well) not her have loved.  
*'Bingley may (well) have loved Jane, just as he may (well) not have loved her.'*

An interesting morpho-syntactic peculiarity of French is that, unlike English, it allows tense and aspect morphemes to affix on the modal itself, even when they have to be interpreted below it, as is the case when the modal receives an epistemic interpretation. The sentence in (16) is thus ambiguous between an interpretation where the modal is epistemic (with the same meaning as (15): *Bingley may have loved Jane*) and one where it is circumstantial, though this reading is disfavored given the untamable nature of love (*Bingley was able to love Jane*). Importantly, while a circumstantial interpretation yields a contradiction (i.e., *#Bingley managed to love Jane, just as he managed not to love her*), an *epistemic* interpretation yields no contradiction: the complement is not asserted to hold in the actual world, but only in the best worlds compatible with the speaker's knowledge.

- (16) Bingley a (bien) pu aimer Jane, comme il a (bien) pu ne pas l'aimer.  
Bingley can-past-pfv (well) love Jane, like he can-past-pfv (well) not her love.  
*'Bingley may (well) have loved Jane, just as he may (well) not have loved her.'*

Thus aspect does not affect the non-implicative behavior of epistemic modals: no actuality

entailment arises with perfective<sup>10</sup>. Aspect still plays its traditional role, however, by affecting the durational properties of the event described by the complement. Both (16) and (17) express a current epistemic possibility, but differ in that the former suggests a completed (i.e., terminated) loving state, while the latter simply reports that the state was ongoing at the reference time:

- (17) (L'été dernier) Bingley pouvait (bien) aimer Jane.  
(Last summer) Bingley can-past-impf (well) love Jane.  
*'It may well be that Bingley was in love with Jane (last summer).'*'

We thus see that the Bhatt effect goes beyond abilities and extends to all 'root'—but not epistemic—interpretations of modals. In the next section, we review what sets these two kinds of interpretations apart.

## 1.2. Epistemics vs. roots: structure and meaning

According to the Kratzerian tradition, what sets epistemics from roots is that they express different kinds of possibilities/necessities, based on different kinds of information: known evidence for the former, particular circumstances for the latter. In Kratzer's (1981, 1991) system, the set of accessible worlds the modal quantifies over, which gives the modal its flavor (deontic, epistemic...), is contextually determined via *conversational backgrounds* (treated as parameters of the interpretation function), which come in two varieties: the *modal base*, which determines an initial set of worlds, and the *ordering source*, which provides an ordering on this set of worlds. A modal ends up quantifying over the best worlds of the modal base given the ideal set by the ordering source. The primary distinction between epistemics and roots lies in the modal base: the former take an *epistemic* modal base, the latter a *circumstantial* one. Let's start with an example:

- (18) In view of what is known, Jane must be home.

The modal base ( $B_w$ ) is epistemic and provides a set of propositions, the propositions known in the base world  $w$  (e.g., *that Jane is not at the Bingleys*). The set of accessible worlds is given by

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<sup>10</sup> We cannot show that epistemic necessity modals lack actuality entailments for independent reasons: since an epistemic accessibility relation is reflexive (unlike a deontic one), the actual world is one of the worlds universally quantified over, and hence the complement is taken to hold in the actual world.

intersecting these propositions. Epistemic modal bases contrast with *circumstantial* ones, which are used for all root modals, and pick out worlds in which certain facts of the base world hold. Further distinctions in interpretation arise from the *ordering source*, which determines the most ideal worlds of the modal base. Consider a sentence with a deontic modal:

(19) Jane must go to jail.

The modal base is ‘circumstantial’ (made up of certain relevant facts, e.g., *that Jane stole*). The ordering source is *deontic* and provides a set of propositions  $L$ , each of which is a law in the base world (e.g., *that there are no thieves, that thieves go to jail...*), which imposes the ordering  $\leq_{L-w}$ :

(20) Ordering  $\leq_{L-w}$ :

For all worlds  $u, z \in W$ :  $u \leq_{L-w} z$  iff  $\{p: p \in L \text{ and } z \in p\} \subseteq \{p: p \in L \text{ and } u \in p\}$

The ordering states that a world  $u$  is more ideal than a world  $z$ , if the set of laws obeyed in  $u$  is a superset of those obeyed in  $z$ . The most ideal worlds will be those in which no law is broken. A slightly less ideal world has one law broken (Jane stole), but the others obeyed (thieves go to jail), etc. If the modal base picks a set of worlds in all of which Jane stole, the most ideal ones in this set will be those in which there is a thief, Jane, but where she goes to jail.

A modal is thus a quantifier over possible worlds, whose restriction is determined by modal base  $B_w$  and ordering source  $\leq_w$ : it quantifies over the most ideal worlds of the modal base given the ideal set by the ordering source. This allows for single entries for *must* and *can*<sup>11</sup>:

(21) a.  $[[\mathbf{must\ p}]]^{w, B, \leq_w} = \forall w' \in \text{Max}_{\leq_w}(B_w): p(w')$

b.  $[[\mathbf{can\ p}]]^{w, B, \leq_w} = \exists w' \in \text{Max}_{\leq_w}(B_w): p(w')$

Where  $\text{Max}_{\leq_w}$  is the selection function that selects the set of  $\leq_w$ -best worlds.

To sum up, Kratzer argues that modals vary along three dimensions: the **force** (existential or universal), which is lexically determined; the **modal base**, which is either circumstantial (the

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<sup>11</sup> I am simplifying Kratzer’s theory slightly, with this particular implementation inspired by von Stechow and Heim (2005). I assume that *max* is undefined if there is no world that satisfies the restriction.

modal base of all ‘root’ modals) or epistemic; the **ordering source**, where what changes from one ordering source to the next is the kind of propositions that establishes the ordering: deontic (laws), bouletic (wishes), teleological (aims), stereotypical (normal course of events). Not all combinations of modal bases and ordering sources are possible: circumstantial modal bases combine with bouletic, deontic or teleological ordering sources; epistemic modal bases usually take stereotypical ones. The main difference in Kratzer’s system between epistemic and root modals is thus in the modal bases and the ordering sources associated with these modal bases.

An important body of literature shows that this difference in meaning actually correlates with a structural difference: epistemics scope above tense (as we saw in section 1.1), negation (cf. Drubig 2001, Cormack and Smith 2002), and quantifiers (cf. Brennan 1993, von Stechow and Iatridou 2003, Lee 2006), whereas roots scope below these elements. This is corroborated by Cinque (1999), who shows that functional heads (modals, tense, and aspect) are organized cross-linguistically along a rigid hierarchy. For reasons of space, I cannot go over this evidence in detail (for a review, see Hacquard 2006), and simply adopt from this literature that there are two positions for modals: one above tense, and one right above the VP, and that these two positions correlate with a particular type of modality: a high modal receives an epistemic interpretation (epistemic modal base) and a low modal receives a root interpretation (circumstantial modal base). I leave aside the question of why this correlation between structural position and modal flavor should hold (see Brennan 1993 and Hacquard 2006, 2009 for proposals). For the purposes of this paper, I follow the line that argues that modals come into two varieties, TP-level and VP-level modals (cf. Jackendoff 1972, Zubizarreta 1982, Piccolo 1990, Brennan 1993, Butler, 2003, Hacquard 2006), and alter Kratzer’s semantics slightly to allow modals to combine either with a proposition (which is what a TP denotes) or a predicate of events (which is what a VP denotes). Thus, a modal will be of type  $\langle \alpha, \alpha \rangle$ , where  $\alpha$  can either be a proposition or a property of events<sup>12</sup>. A completely unified account which maintains the Kratzerian insight that there is just one necessity modal and one possibility modal is still possible, but involves additional machinery, which would take us too far astray from the main purposes of this paper (for such a proposal, see Hacquard 2006, 2009). Let’s thus assume the following lexical entries. I will now simplify the notation in (21) by ignoring the ordering source (which doesn’t play a role in the

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<sup>12</sup> Alternatively, we could maintain that a modal takes a proposition as its complement, and postulate a type-shifting operator to allow the modal to combine with a VP.

puzzle I now focus on), and lexicalizing the modal base:<sup>13</sup>

- (22) a.  $[[\text{must}_{\text{circ}}]]^{w,B,\leq,c} = \lambda P_{\langle \text{set} \rangle} . \lambda e_{\langle e \rangle} . \forall w' \text{ compatible with circumstances in } w: P(w')(e)$   
 b.  $[[\text{must}_{\text{epis}}]]^{w,B,\leq,c} = \lambda p_{\langle \text{st} \rangle} . \forall w' \text{ compatible with what is known in } w: p(w')$
- (23) a.  $[[\text{can}_{\text{circ}}]]^{w,B,\leq,c} = \lambda P_{\langle \text{set} \rangle} . \lambda e_{\langle e \rangle} . \exists w' \text{ compatible with circumstances in } w \text{ s.t. } P(w')(e)$   
 b.  $[[\text{can}_{\text{epis}}]]^{w,B,\leq,c} = \lambda p_{\langle \text{st} \rangle} . \exists w' \text{ compatible with what is known in } w \text{ s.t. } p(w')$

Epistemics and roots then differ along two dimensions: a meaning dimension (epistemic vs. circumstantial modal base) and a structural dimension (TP vs. VP level), which correlate with one another: TP modals take an epistemic modal base, VP modals, a circumstantial one. In this paper, I exploit the structural dimension to derive actuality entailments (for supporting evidence that structure is what matters, see the Appendix): a root modal has to appear below aspect; this forces aspect to be evaluated in the matrix world of evaluation (the actual world), and thus yield an actual event. Because a modal with an epistemic modal base appears above tense and aspect, the modal itself determines the aspect's world of evaluation, thereby requiring the existence of an event only in the worlds quantified over by the modal.

## 2. PROPOSAL

Taking stock of what we have so far, we see that a modal can appear above or below tense and aspect: when above, it receives an epistemic interpretation; when below, it receives a root one. We further saw that only those modals interpreted below tense and aspect (i.e., root modals) yield actuality entailments (with perfective). The main claim I want to make here is that actuality entailments result precisely from the configuration of the modal with respect to aspect: when the modal is below aspect, it yields an actuality entailment, provided there is no additional layer of modality (as with imperfective). For this claim to go through, I will make one crucial assumption: aspect depends on the world of evaluation. Thus, when aspect is in the scope of a modal, the event it quantifies over is evaluated at the world provided by that modal. This is what happens with epistemics. When, on the other hand, aspect takes scope over the modal (as with roots), the event quantified over by aspect will have to occur in the matrix world of evaluation (the actual world) and thus yield an actual event. This section is organized as follows: Section

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<sup>13</sup> Type  $\epsilon$  is for eventualities;  $t^*$  refers to the utterance time,  $w^*$  the actual world.

2.1 focuses on the semantics of the perfective and shows how to derive actuality entailments with root modals; section 2.2 shows how to avoid them with imperfective.

## 2.1. Actuality entailment with roots and perfective

### 2.1.1. Perfective

As stated in the introduction, the role of aspect is to quantify over events. In the Davidsonian tradition (Davidson 1967) I take verbs to be predicates of events. Aspects quantify over these events and further locate the running time (or ‘temporal trace’ of the event  $\tau(e)$  following Krifka 1992) with respect to the evaluation time given by tense. The two main aspects are the perfective and imperfective. Perfective is standardly analyzed as an existential quantifier over events (cf. Kratzer 1998, Bonomi 1997, Lenci and Bertinetto 2000), which locates the running time of the event *within* the time interval provided by tense (and hence describes a completed event). I will use the following lexical entry as a starting point (adapted from Kratzer’s 1998 formalization of Klein 1994, assuming worlds are a metalanguage parameter):

$$(24) \quad [[\text{PERFECTIVE}]]^{w,B,\leq,c} = \lambda P_{\langle e,t \rangle}. \lambda t. \exists e[\tau(e) \subseteq t \ \& \ P(e)]$$

Perfective takes a predicate of events (VP) and returns a predicate of times, which then combines with tense. For concreteness purposes, I assume a referential analysis of tense (cf. Partee 1973), though nothing hinges on that assumption. Following Heim (1994) and Kratzer (1998), I take the two main tenses to be indexical pronouns (present and past). The ordering of the reference time with respect to the utterance time is done through a presupposition. For past, the context needs to provide a time interval that precedes the utterance time  $t^*$ , for present, one that overlaps with it.<sup>14</sup>

$$(25) \quad \begin{array}{l} \text{a. } [[\text{pres}]]^{w,B,\leq,c} \text{ only defined if } c \text{ provides an interval } t \approx t^*. \text{ If defined } [[\text{pres}]]^{w,B,\leq,c} = t. \\ \text{b. } [[\text{past}]]^{w,B,\leq,c} \text{ only defined if } c \text{ provides an interval } t < t^*. \text{ If defined } [[\text{past}]]^{w,B,\leq,c} = t. \end{array}$$

(26) illustrates the combination of perfective and the predicate of events *run*. The presupposition

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<sup>14</sup> Because French only shows a perfective/imperfective distinction in the past, and the morphemes used express both pastness and perfectivity or imperfectivity, one could treat each morpheme as a temporo-aspectual operator without further decomposition. I will however treat both items separately to allow my proposal to generalize to languages that have separate morphemes for tense and aspect.

associated with tense is given in curly brackets:

- (26) a. Jane a couru.  
Jane ran-pfv
- b.  $[[[a]]]^{w,B,s,c}$  is true iff  $\exists e[\tau(e) \subseteq t \{t < t^*\} \& \text{run}(e,j,w)]$

The exact nature of the imperfective is more controversial. Some take it to perform existential quantification, and differ from the perfective only by locating the running time of the event *around* rather than *within* the reference time given by tense (cf. Klein 1994, Kratzer 1998). However, this kind of formulation doesn't capture the intensional nature of the imperfective. This has led to proposals that give it a modal semantics (cf. a universal/generic quantifier over events; cf. Bonomi 1997; Cipria and Roberts 2000, Lenci and Bertinetto 2000). We will return to the imperfective in section 2.2 and focus on the perfective for now.

I propose to modify slightly the lexical entry for perfective in (24), so as to make it relative to a world of evaluation. In most cases (i.e., sentences which don't have a modal in the scope of aspect), this modification won't have any visible effects. However, when a modal appears in the scope of aspect, the world-relativity of aspect will result in two different world anchorings: one in the restriction of perfective and one in its scope (due to the modal). This assumption will allow us to derive actuality entailments with root modals (and avoid them with epistemic modals).

Relativizing aspect to a world of evaluation in its restriction might find some motivation from general considerations about quantification in natural language. Under the assumption that quantification should work as similarly as possible across domains, we would expect aspects (quantifiers over events) to (i) be restricted, and (ii) have their restriction be given their own world anchoring (cf. Percus 2000, a.o.). Furthermore, giving aspect a world argument has precedence in the literature. Landman (1992)'s analysis of the progressive essentially anchors an event to a world (the actual world in matrix contexts). According to his analysis, a progressive statement such as '*Jane is crossing the street*' involves an extensional element, namely an event  $e$  in the actual world, which corresponds to a beginning *stage* of a larger event, which in some continuation branch (in some possible world) is the completed event of crossing the street. Finally, the world-relativity of aspect seems to be tacitly assumed in modal accounts of the

imperfective (cf. section 2.2): the set of worlds introduced by the modal component of the imperfective has to be relative to a world of evaluation.

I thus propose to modify the entry in (24) as follows (the relevant change is underlined):

$$(27) \quad [[\text{PERFECTIVE}]]^{w,B,\leq,c} = \lambda P_{\langle e,t \rangle} . \lambda t_{\langle i \rangle} . \exists e [ \underline{e \text{ in } w} \ \& \ \tau(e) \subseteq t \ \& \ P(e) ]$$

Let's put all of the pieces together in a simple example:

(28) a. Jane a couru.

*Jane ran*

b. [TP past [AspP perf [VP Jane run ] ] ]

c. [[ [VP Jane run ] ] ]<sup>w,B,\leq,c</sup> =  $\lambda e . \text{run}(e,j,w)$

d. [[(a)] ]<sup>w,B,\leq,c</sup> is true iff  $\exists e [ e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\} \ \& \ \text{run}(e,j,w) ]$

In such simple cases, having a world in the restriction is indiscernible from not having it (cf. (26)). However, when aspect appears *above* a modal, the value of the world in the scope of the modal is given by that modal, while the world in aspect's restriction has to be the matrix world of evaluation (i.e., the actual world).

Let's thus look at what happens when we add a modal. First, let's ensure that we get the right truth conditions with a high (epistemic) modal:

(29) a. Jane a pu courir.

*Jane may have run.*

b. [ModP can [TP past [AspP perf [VP Jane run ] ] ] ]

c. [[(a)] ]<sup>w,B,\leq,c</sup> is true iff  $\exists w'$  compatible with what is known in  $w$  such that:

$$\exists e [ e \text{ in } w' \ \& \ \tau(e) \subseteq t \ \{t < t^*\} \ \& \ \text{run}(e,j,w') ]$$

*'There is a world  $w$  compatible with what is known in the actual world, such that there is an event in  $w$  located in a past interval which is a running event by  $J$ .'*

All (29) requires is the existence of a past running event by Jane in some world compatible with what is known in the actual world. This doesn't imply that Jane actually ran, but merely that it is

possible she did, given what is known. We avoid an actuality entailment.

Things become more interesting when a modal appears below aspect:

- (30) a. Jane a pu courir.  
*Jane was able to run*  
 b. [TP past [AspP perf [ModP can [VP Jane run ] ] ] ]

We can take our lexical entry for the modal in (23)a), repeated below:

- (31)  $[[\text{can}_{\text{circ}}]]^{w,B,\leq,c} = \lambda P_{\langle \text{set} \rangle} . \lambda e . \exists w' \text{ compatible with circumstances in } w \text{ such that } P(w')(e)$

The modal needs to combine with an intensional predicate of events. It combines with the VP *Jane run* via Intensional Functional Application (cf. Heim and Kratzer 1998):

- (32) **Intensional Functional Application (IFA)**: If  $\alpha$  is a branching node and  $\{\beta, \gamma\}$  the set of its daughters, then, for any possible world  $w$ , if  $[[\beta]]^w$  is a function whose domain contains  $\lambda w' . [[\gamma]]^{w'}$ , then  $[[\alpha]]^w = [[\beta]]^w (\lambda w' . [[\gamma]]^{w'})$

We thus obtain the following:

- (33)  $[[ [\text{ModP can } [\text{VP Jane run} ] ] ] ]^{w,B,\leq,c} = [[\text{can}]]^{w,B,\leq,c} (\lambda w' . [[\text{Jane run}]]^{w',B,\leq,c})$  (by IFA)  
 $= \lambda e . \exists w' \text{ compatible with circumstances in } w : \text{run}(e,j,w')$

- (34)  $[[ (30) ] ]^{w,B,\leq,c}$  is true iff  $\exists e [e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\} \ \& \ \exists w' \text{ compatible with the circumstances in } w \text{ s.t. } \text{run}(e,j,w')]$   
*'There is an event in the actual world located in a past interval, and there is a world compatible with the circumstances in the actual world where that event is a run by J.'*

In example (30), perfective is above the modal. This forces the event quantified by aspect to be anchored in the base world, in this case, the actual world. We thus obtain an *actual* event, which, in some possible world, is a running event by Jane.

What is the actual event in (30)? Everything else being equal, we take it to be a running

event by Jane in the actual world as well. How does this inference go through? Here we enter the thorny issue of the identification of events across worlds: does the same event necessarily keep the same properties across worlds? While we may want them to do so by default, both for actuality entailment and progressive cases, counterfactuals seem to indicate that they do not. Below I propose a way of preserving the description of events across worlds, via a pragmatic principle (***Preservation of Event Description Across Worlds, PED***), which takes counterfactuals to be a special case, based on the fact that, cross-linguistically, they seem to require special morphology (past/subjunctive in English, *conditionnel* in Romance). We start with the default assumption that an event (or an individual) remains the same across worlds: any alteration requires some morphological indication from the speaker.

Before turning to details of PED, I would like to note that the situation in (34) parallels analyses of the progressive (e.g., Landman 1992, Portner 1998), or of *try* (Sharvit 2003), which invoke an extensional element, i.e., an *actual* event corresponding to a subevent of a larger (completed) P-event in inertia/non-interrupted/success worlds. Under such accounts, ‘*John is building a house*’ is true if there is an event *in the actual world*, which is a non-final subpart of a completed house-building event in modal worlds. For such accounts to go through, a principle like PED must also be assumed: for the right truth conditions to arise, the extensional subevent better have the same description in the actual world as its counterpart in the modal worlds.

### **2.1.2. Preservation of event description across worlds (PED)**

Consider the following example:

- (35) Jane a pu s’enfuir, #mais elle ne s’est pas enfuie.  
Jane could-pfv escape, #but she didn’t escape.

What enables actuality entailments in the present system is having the same event occur both in the actual world and in the world(s) quantified over by the modal. To obtain the full inference that Jane actually escaped in (35), we need the event description to hold not only in the modal worlds but in the actual world as well. If the event quantified over by aspect in (35) is an escape by Jane in the actual world, then it follows that the continuation should be a contradiction. We

want the event description (provided by the VP) to hold across worlds:<sup>15</sup>

- (36) **Preservation of Event Description (PED):** for all worlds  $w_1, w_2$ , if  $e_1$  occurs in  $w_1$  and in  $w_2$ , and  $e_1$  is a P-event in  $w_1$ , then *ceteris paribus*,  $e_1$  is a P-event in  $w_2$  as well.

I take PED to be a default assumption according to which, whatever property is part of the VP description is taken to hold across worlds. This doesn't prevent an event from being further specified (as in (37)a), but it will prevent adding descriptive content that contradicts a component of the original VP description (as in (37)b): '*through the window*' has become an integral part of the description of the event in the actual world and cannot be removed).

- (37) a. Jane a pu s'enfuir. Elle s'est enfuie par la fenêtre.  
Jane could-pfv escape. She escaped through the window.  
b. Jane a pu s'enfuir par la fenêtre. #Elle s'est enfuie par la porte.  
Jane could-pfv escape through the window. #She escaped through the door.

While such a principle derives the right inferences for actuality entailments (and progressive statements), it is clearly violated by counterfactuals, whose very function seems to describe the same event/individual under different guises in different worlds. Consider the following examples (from N. Asher, Michigan Workshop in Linguistics and Philosophy):

- (38) a. I ran a mile in 5 minutes, but I could have run that race 5 seconds faster.  
b. Jane took the train to Paris, but she could have made the trip by car.

The above sentences describe events, which, in some counterfactual worlds have a different description than in the actual world (e.g., a shorter duration in (a)), blatantly violating PED. How

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<sup>15</sup> An anonymous reviewer proposes a way to get rid of this principle by hard-wiring the event description in the modal's lexical entry. Given that we are postulating independent lexical entries for circumstantial vs. epistemic modals, this certainly seems like a viable possibility and we can imagine the following entry for circumstantial *can*:

(i)  $[[\text{can}_{\text{circ}}]]^{w, B, \leq c} = \lambda P_{\langle \text{set} \rangle} . \lambda e. P(w)(e) \ \& \ \exists w'$  compatible with circumstances in  $w$  such that  $P(w')(e)$

I chose not to adopt it in paper for two reasons: (i) it fails to entail a lack of P-event in the actual world when negated; (ii) I have an ulterior motive to maintain a unified entry for modals (Hacquard 2006, 2009). Modulo these issues, this suggestion seems like an appealing solution to the puzzle and I leave it as an option to the reader.

can we reconcile our principle with counterfactuals? I propose that PED can only be violated in special circumstances: modifying a property already established as part of the event description comes at a cost, a morphological cost. Whenever event descriptions *conflict* from one world to the next, the speaker must indicate this mismatch by using counterfactual morphology<sup>16</sup> (*conditionnel* mood in French). The French translations of (38) obligatorily involve *conditionnel* on ‘can’:

- (39) Jane a pris le train pour aller à Paris, mais elle **aurait pu** faire le voyage en voiture.  
Jane took the train to Paris, but she could have made the trip by car

In English, the morphological hallmark of counterfactuality is *would*. Because *can* cannot fully inflect (*would have could* is morphologically blocked, as *have could* is not possible), this requirement for morphological marking may not be as evident, though it can be seen when we replace *can* with *be able to*: *Jane would have been able to make that trip by car*. Note that even with counterfactuals, PED may be at work: we want the event’s or individual’s properties to match as much as possible in the counterfactual worlds as in the actual world. This is what underlies Stalnaker/Lewis similarity function. Take Lewis’s famous counterfactual ‘*if kangaroos didn’t have tails, they would topple over*’: We need our kangaroos to be as similar (i.e., share as many properties as possible) in the counterfactual worlds where they have no tails as in the actual world, e.g., they shouldn’t have crutches.<sup>17</sup>

This precise characterization of PED may well turn out to be incorrect<sup>18</sup>, and future

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<sup>16</sup> This role for counterfactual morphology is inspired by Stalnaker (1968), who argues that subjunctive morphology is used to indicate that the speaker is going outside of the context set, see also Schlenker (2004).

<sup>17</sup> An anonymous reviewer points out examples like (i) which do not involve counterfactual morphology, but where we do not want to transfer the event’s properties from one world to the next:

- (i) An event is going to happen here today at 2pm involving both John and Mary. *It might be a friendly exchange/It can last longer than an hour.*

If the event description in the modal worlds (a friendly exchange/an event lasting longer than an hour) had to hold in the actual world, we would expect (1) to require that the future actual event *be* a friendly exchange/last longer than an hour. This example seems to point to a temporal asymmetry: in (i) the event hasn’t yet occurred. It thus appears that counterfactual morphology is required to indicate a *conflict* in descriptions. It remains to be determined whether the actuality entailment inference would also be relaxed in the future, a fact which we cannot test in French, as the perfective/imperfective distinction only occurs in the past.

<sup>18</sup> For one, nominals may call for further considerations of the exact statement and applicability of PED: PED may be restricted to VPs (but not nominalizations; see also Arregui 2007):

- (i) Elizabeth thought that Bingley’s wedding was a funeral. (K. von Fintel, p.c.)

research on the identification of events across worlds may provide a more adequate alternative. One may, for instance, exploit Arregui's (2007) account of *would* conditionals with perfective aspect, which, while substantially different in its details, reaches similar conclusions regarding the stability of an event's description across worlds, when associated with perfective aspect. I thus take some incarnation of PED to be a necessary stipulation for actuality entailments and accounts of the progressive that invoke an extensional element (for an alternative, see footnote 15), and would like to close this section by looking at actuality entailment cases involving Italian *volere* (*want*), which seem to lend further support to this principle. *Volere* shows the same implicative behavior with perfective (and non implicative with imperfective) as root modals (Hacquard 2006, 2008):

- (40) Gianni ha voluto parlare a Maria, #ma non lo ha fatto.  
Gianni want-pst-**pfv** talk to Maria, #but he didn't do it.

Because *volere* quantifies over (desirable) doxastic alternatives of the subject (cf. Heim 1992, a.o.), it is possible to come up with scenarios where the event description in Gianni's desire worlds doesn't match that of the event in the actual world (Gianni can have false beliefs). Crucially, in these cases, it is not possible to use a sentence with *volere* with perfective. Instead, we need some counterfactual marking to indicate the mismatch in event descriptions. Consider the following scenario (from Hacquard 2008):

- (41) Gianni is convinced the French president is responsible for all of the world's misery, and decides to kill him. He however thinks that George W. (who is actually the American president) is the French president. He goes to the G8 meeting and kills George W.

Here there is a mismatch in the description of the same event in the actual world and in Gianni's desire worlds: in the actual world, George W is the US President and the event is a killing of the US President; in Gianni's desire worlds, George W is the French president, and the event is a killing of the French president. As (42) shows, neither (a) nor (b) is expressible in Italian:

- (42) a. #Gianni ha voluto assassinare il presidente francese.

Gianni wanted to kill the French President.

- b. #Gianni ha voluto assassinare il presidente americano.

Gianni wanted to kill the American President.

The mismatch in the descriptions of the same event leads to ineffability: it is neither possible to describe it as a French president nor an American president assassination. Some counterfactual morphological marking (*conditionnel* mood) is necessary to indicate the mismatch in event descriptions across worlds<sup>19</sup>:

- (43) G. avrebbe voluto assassinare il presidente francese, ma ha assassinato quello americano.  
Gianni want-**COND** kill the french president, but he killed the american one.  
Gianni would have wanted to kill the French President, but he killed the American one.

Thus while PED may appear to overgenerate in the face of counterfactuals, this data show that mismatches in description across worlds are the marked case, and require special morphology.

To sum up, we have seen that actuality entailments with root modals follow from two independently motivated assumptions: (i) aspect depends on the world of evaluation (independently assumed for various aspectual operators like the progressive or generic/habitual operators); (ii) root modals scope under, while epistemics scope above tense and aspect. These two assumptions combined lead to an actual event, which is a VP event in the worlds quantified over by the modal. To get the full actuality entailment that this actual event is a VP event, we postulated PED, a principle that can be overridden in the presence of counterfactual morphology. We now show how to avoid actuality entailments with imperfective aspect.

## 2.2. Avoiding actuality entailments

In this section, we see when and how actuality entailments are avoided, in particular with imperfective. I argue that lack of actuality entailments with root modals results from an additional layer of intensionality.

### 2.2.1. Lack of actuality entailments in intensional contexts

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<sup>19</sup> It is also possible to use imperfective, which is independently used as a counterfactual marker, cf. Ippolito (2004).

We saw in (29) (repeated below) that epistemic modals do not yield actuality entailments because the modal takes scope over aspect. All that is required is that there be a running event by Jane in the worlds quantified over by the modal (i.e., in some epistemically accessible world):

(44) Jane a pu courir.

*Jane may have run.*

*'There is a world  $w$  compatible with what is known in the actual world, such that there is an event in  $w$  located in a past interval which is a running event by  $J$ .'*

The account further predicts that if we embed a root modal under an intensional operator (as in (45)), no actual event is required, but rather the event has to occur in the worlds provided by the intensional operator. That event then gets its description through PED:

(45) Darcy pense que Jane a pu s'enfuir (#mais il pense qu'elle ne s'est pas enfuie.)

*Darcy thinks that Jane was able to escape (#but he thinks she didn't escape).*

*'In all of Darcy's belief-worlds  $w$ , there is an event in  $w$  located in a past interval which is an escaping event by  $J$ .'*

This prediction is borne out: For (45) to be true, Darcy must believe that Jane did in fact escape (though she doesn't need to have *actually* escaped). Thus the term 'actuality entailment' is a bit of a misnomer: the effect is really an (uncancelable) inference of the realization of the modal's complement in the local world of evaluation.

In the next section, I will argue that this is precisely what happens when we switch to imperfective aspect on a root modal. Imperfective comes with its own layer of modality, which removes the requirement that the event take place in the actual world, but rather forces it to happen in the worlds provided by the modal element of the imperfective.

### **2.2.2. Lack of actuality entailments with roots and imperfective**

Recall from the introduction that actuality entailments do not arise with imperfective aspect:

(46) Jane pouvait soulever cette table, mais elle ne l'a pas soulevée.

Jane can-past-impf lift this table, but she didn't lift it  
*Jane was able to lift this table, but she didn't lift it.*

Note that while actuality entailments disappear with imperfective, imperfective is still compatible with a scenario where the complement occurs in the actual world. What we need to account for with the imperfective, then, is not how to *prevent* an actualized event, but how to not *force* it. Following Bhatt (1999), I will now show that the lack of actuality entailment is due to an additional layer of modality (e.g., genericity) associated with the imperfective.

It has been argued that the imperfective (at least in Hindi and Romance) not only provides aspectual quantification, but introduces modal quantification as well (Bhatt 1999, Cipria and Roberts 2000, Lenci and Bertinetto 2000, Menendez-Benito 2002, a.o.). This modal element allows the following sentences to be true even if the event described by the main predicate never was instantiated in the actual world. The sentence in (a) can be true if the machine has never been used, as can the one in (b) if mail never arrived from Antarctica:

- (47) a. Cette machine écrasait les oranges.  
This machine crush-pst-**impf** oranges.  
b. Jane s'occupait du courrier provenant de l'Antarctique.  
Jane handle-pst-**impf** the mail from Antarctica.

For the purposes of this paper, I encode the modal element responsible for the lack of instantiations in (47) directly in the semantics of the imperfective. This is a simplification: imperfective is associated with a range of meanings beyond the habitual/generic uses illustrated in (47). Imperfective further yields progressive (a) or counterfactual (b) interpretations, which also seem to involve a modal component (cf. Dowty 1977, Landman 1992, Portner 1998, Bertinetto 1986, and Ippolito 2004), though, the genericity-based semantics offered in this section doesn't straightforwardly extend to these cases:

- (48) a. Jane traversait la rue, quand elle s'est fait écraser.  
Jane cross-pst-**impf** the street, when she got crushed.  
*'Jane was crossing the street, when she got run over'*

- b. Deux kilos de moins, je rentrais dans ma robe. [Berthonneau & Kleiber 2006]  
Two kilos less, I fit-**impf** in my dress.  
*With two less kilos, I would have fit in my dress.*

Providing a unified account of the imperfective that covers all of these readings is however beyond the scope of this paper. It is unclear that a single modal operator could do the job, and one may want to treat the imperfective instead as some kind of default triggered by various modal operators. My goal here is simply to illustrate how the lack of actuality entailments with imperfective can be derived by invoking a modal element(s) independently required to handle the lack of instantiations in (47) (or lack of a completed event of crossing the street or of fitting in my dress in (48)). For simplicity sake, I focus on the generic/habitual reading of the imperfective and ignore the readings in (48), by assuming that the imperfective has the semantics of a generic/habitual operator. Nothing, however, should in principle prevent other readings of the imperfective when it combines with a root modal, and thus lack of actuality entailments need not be tied to genericity (and may be associated with e.g., counterfactuality, cf. Hacquard 2006).

This section makes a simple claim: whatever accounts for the lack of actual instantiations with imperfective sentences without an overt modal like (47) will also be responsible for the lack of instantiations in sentences with a root modal like (46). For concreteness purposes I adopt the proposal of Lenci and Bertinetto (2000)<sup>20</sup>, though any account that captures the modal nature of the imperfective is in principle compatible with the main claims of this paper.

Lenci and Bertinetto (2000) argue that habitual imperfective not only involves universal quantification over events, as opposed to existential quantification for perfective (following Bonomi 1997), it further introduces a modal element, responsible for the nomic nature of habitual sentences. The ‘habit’ described is non-accidental and doesn’t even always require verifying instances. Sentences like (47) describe law-like generalizations about the occurrence of events given particular circumstances (not necessarily met in the actual world). In their system, imperfective is associated with a Generic Operator (inspired by Kratzer 1981, Heim 1982, Condoravdi 1994, Krifka et al. 1995), analyzed as a universal modal (whose modal base  $B_w$  is contextually determined, and whose ordering source  $\leq_w$  picks out the most normal/ideal worlds of the modal base), which can bind free event and individual variables (we ignore individuals

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<sup>20</sup> Thanks to an anonymous reviewer for pointing me to this literature.

here), and which we will encode directly in the semantics of the imperfective (IMPF). As an aspectual operator (like perfective), IMPF further encodes in its restriction a temporal relation between the running time of the events quantified over and the time provided by tense (the formulation below is simplified and modified from Lenci and Bertinetto 2000 to match the current framework)<sup>21</sup>:

$$(49) \quad [[\text{IMPF}]]^{w,B,\leq,c} = \lambda P_{\langle \text{set} \rangle} . \lambda t_{\langle i \rangle} . \forall w' \in \text{Max}_{\langle w \rangle}(B_w) ; \forall e [e \text{ in } w' \ \& \ \tau(e) \approx t : P(w')(e)]$$

The restrictor of IMPF need to be further restricted by the presuppositions of the sentence (Schubert and Pelletier 1989), or by an overt *when/if* clause. A machine crushing oranges requires that it be used, and this presupposition gets accommodated in the restriction, such that (47)a) will roughly be equivalent to (50)a) and yield the truth conditions in (50)b):

- (50) a. Whenever this machine would be used, it would crush oranges.  
 b. In all most normal worlds  $w$  among those compatible with the engineer's intentions in  $w^*$ , all past events  $e$  of using the machine in  $w$  are orange-crushing events in  $w$

Since the actual world is not necessarily one of the most normal worlds, the sentence is true even if the machine has never crushed an orange in the actual world.

What happens when we add a root modal? The modal is in the scope of the generic operator, as illustrated in (b). We obtain the truth conditions in (c):

- (51) a. Cette machine pouvait écraser les oranges.  
 This machine can-impf crush oranges.  
 b. [past[impf [can [machine crush oranges]]]  
 c. In all most normal worlds  $w$  among those compatible with the engineer's intentions in  $w^*$ , for all past events  $e$  of using the machine in  $w$ , **there is a world  $w'$  compatible with the circumstances in  $w$  such that  $e$  are orange-crushing events in  $w'$**

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<sup>21</sup> In Lenci and Bertinetto (2000), IMPF further binds time intervals  $t'$  of a contextually specified size, and relates  $t'$  to the time  $t$  provided by tense via an overlap relation to derive the 'on-goingness' of the imperfective.

PED will apply in this case as well and the description of the events will be the same in the worlds  $w$  quantified over by IMPF as in the circumstantially accessible world  $w'$ : all events  $e$  of using the machine properly in all most normal worlds among those compatible with the engineer's intentions will be orange-crushings. And here again, given that the actual world is not necessarily among those, the sentence is judged true even if there is no actual event of the machine crushing an orange.

To sum up, we have seen an illustration of how the lack of actuality entailments with imperfective on a root modal is not due to the modal itself, but derives from the modal semantics of the imperfective itself. This allows us to explain our original data, while maintaining a unified account for modals and for aspects.

### 3. FURTHER ISSUES AND IMPLICATIONS

#### 3.1. Interaction with Negation

We have seen that perfective on a root modal yields actuality entailments. What happens with negation? Does the entailment disappear or do we get an entailment of non actuality? The interaction of modality and negation is notoriously complicated by the fact that it seems to depend on the nature of the modality (epistemic or root) and the force of the modal (possibility or necessity), as well as language-specific and lexical idiosyncracies (for discussion and proposals, see Coates 1983, Palmer 2001, Drubig 2001, Cormack and Smith 2002, Moscati 2008, de Haan 1997). Here I simply scratch the surface by reporting speakers' intuitions and sketching how my proposal can capture these intuitions.

It is traditionally assumed, based on syntactic evidence, that negation appears rather high (between tense and aspect). Thus, the sentence in (52)a) should have the LF in ((52)b):

(52) a. Darcy n'a pas pu s'enfuir.

Darcy NE has can-pfv escape.

'Darcy wasn't able to escape'

b.  $[[\text{(a)}]]^{w,B,\leq,c}$  is true iff  $\neg\exists e[e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\}] \ \&$

$\exists w'$  compatible with the circumstances in  $w$ :  $\text{escape}(D,e,w')$

*'There is no event in the actual world located in a past interval, s.t. in any world compatible with the circumstances (notably, Darcy's abilities) in the actual world*

*that event is an escape by Darcy.*'

What this LF readily gives us is that Darcy didn't escape in the actual world: if there is no actual event that is an escape by Darcy in any world compatible with the circumstances, there is no escaping event by Darcy in the actual world: we get a "non-actuality" entailment. Is there more to the meaning of (52)? Intuitively, (52) indicates not only that Darcy didn't escape, but moreover, that he lacked the ability/opportunity altogether (as one would expect from negating a possibility in a standard modal account). Strictly speaking, however, nothing in this LF precludes that some escaping event by Darcy did occur in some world compatible with his abilities.<sup>22</sup> In other words, this LF doesn't give us directly that Darcy lacked the ability to escape. What is the nature of this lack of ability inference and how can we derive it? I would like to suggest that it is a strong implicature, rather than an entailment, which may be cancelled: a sentence of the form 'X can-pfv not do Y' triggers the implicature that X tried, but failed, to do Y, which in turn, triggers the implicature that X lacked the ability to do Y (since his attempt failed)<sup>23</sup>. The LF in (52) tells us there is no event, which in any accessible world, notably any world where Darcy gets to use his abilities in which that event is an escape. There are two ways to satisfy these truth conditions. One, Darcy tried to escape. In this case, there is an event in the actual world, i.e., an *attempt* to escape, which in no accessible world where Darcy gets to use his abilities is a successful escape. The actual event is thus a failed escape. From this attempted, but failed attempt, we infer that Darcy lacked the ability to escape, which is the inference that (52) intuitively generates. The second option is that Darcy didn't escape because he didn't even try (in which case it doesn't matter what he does in his ability worlds). Why is it that we seem to understand (52) under the first option (failed attempt), rather than the second (no attempt)? Here we can invoke pragmatic competition: if the speaker merely wanted to convey that Darcy didn't escape, he would have used the unmodalized sentence '*Darcy ne s'est pas enfui*' (Darcy didn't escape). That this lack of ability inference is an implicature rather than an entailment predicts it should be cancellable. And indeed the continuation in (53) forces the dispreferred *no attempt* option:

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<sup>22</sup> Thanks to David Beaver (p.c.) for pointing out this issue.

<sup>23</sup> Thanks to Daniel Büring for suggesting this pragmatic route.

(53) Darcy n'a pas pu s'enfuir. En fait, il en avait les moyens, mais il n'a même pas essayé (parce qu'il n'avait plus l'envie de se battre).

Darcy NE has can-pfv escape. In fact, he of it had the means, but he NE not event try-pfv  
*'Darcy wasn't able to escape. In fact, he had the means to do so, but he didn't even try, (as he no longer had the will to fight).*

Turning now to the negation of necessity modals, intuitions are a bit murkier<sup>24</sup>, but most of my informants feel that negating a necessity modal with perfective also yields a 'non-actuality' implication (note that (54) is completely acceptable with imperfective aspect)<sup>25</sup>:

(54) Jane n'a pas dû faire la vaisselle, ??mais elle l'a faite quand même.

Jane NE has must-pfv do the dishes, ??but she still did it.

'Jane didn't have to do the dishes, ??but she still did them'.

What does our account predict? (54) should have the following truth conditions:

(55)  $[[ (54) ] ]^{w,B,\leq c}$  is true iff  $\neg \exists e [e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\}]$ :

$\forall w'$  compatible with the circumstances in  $w$ : wash\_dishes( $e, j, w'$ )

<sup>24</sup> One obscuring factor is the fact that, unlike root possibility modals which always take narrow scope with respect to negation, negation is sometimes interpreted below a deontic necessity modal: (I'm using present tense to see the scope of negation without perfective distracting intuitions, as suggested by an anonymous reviewer):

- (1) Darcy ne doit pas prendre le métro.  
 Darcy NE must not take the subway.  
 a. Darcy is not allowed to take the subway ( $\neg \diamond \equiv \square \neg$ )  
 b. Darcy is not obliged to take the subway ( $\neg \square$ )

If one assumes, following standard practice, that the structural position of negation is fixed, the LFs in (a) and (b) could be due to a structural difference between two types of deontics, *ought to be* and *ought to do* deontics, with the former being structurally high (cf. Appendix) and underlying the LF in (a).

<sup>25</sup> Some speakers accept the following dialogue, where Bingley's utterance simply negates that Jane was under the obligation to do the dishes, not that she actually did them. This, however, could be an instance of meta-linguistic negation, as pointed out by an anonymous reviewer:

- (1) Darcy: M. Bennet est un vrai tyran. Il force sa fille Jane à faire tout le ménage. On était chez eux hier, et Jane a passé 3 heures à laver des assiettes.  
*Mr Bennet is a real tyrant. He forces his daughter Jane to do all the chores. We were at their place yesterday and Jane spent 3 hours washing dishes.*  
 Bingley: Tu exagères. M. Bennet ne l'oblige pas à faire le ménage. Hier soir, elle **n'a pas dû faire la vaisselle**. Elle l'a faite pour éviter d'avoir à nous parler.  
*You're unfair. Mr Bennet doesn't force her to do the house chores. Last night, she must-pfv not do the dishes. She just did it to avoid talking to us.*

*'There is no event in the actual world located in a past interval, s.t. in all worlds compatible with the circumstances (notably Jane's obligations) in the actual world, that event is a dishwashing by Jane.'*

The LF in (55) tells us that there is no actual event which in *all* worlds compatible with Jane's circumstances, including her obligations, is a dishwashing event. This, again, is compatible with two possibilities. The first is that there is no such event, because Jane didn't do the dishes in the actual world or in any of the accessible worlds (which, this time is the interpretation that best matches speakers intuitions). The second option is a case where Jane did the dishes in the actual world. In this case, however, we would have an actual event of dishwashing, which in some of the accessible worlds would not be a dishwashing event. But how could the same event both be a dishwashing and not a dishwashing?<sup>26</sup> We already saw that PED rules out such cases. Hence, only the first option prevails.

### **3.2. Is the Modality Detectable?**

In his account of actuality entailments, Bhatt (1999) argues that the ability modal lacks a modal (ability) component: despite appearances, the ability modal is not a modal, but an implicative predicate. The modal meaning that emerges when the 'ability modal' combines with imperfective is due to the imperfective itself, which reflects the presence of a generic operator. Bhatt provides the following example (from Thalberg 1969), to support this claim. In the context in (a), we would be reluctant to say that Brown had the *ability* to hit three bulls-eyes in a row, yet we're able to report the fact that he managed to hit those bulls-eyes with a perfective 'ability' modal (b). Using the imperfective in this context (c), on the other hand, is odd:

- (56) a. Yesterday, Brown hit three bulls-eyes in a row. Before he hit three bulls-eyes, he fired 600 rounds, without coming close to the bulls-eye; and his subsequent tries were equally wild.
- b. Brown a pu tirer trois fois de suite dans le mille.  
Brown could-pfv hit three bulls-eyes in a row.
- c. ??Brown pouvait tirer trois fois de suite dans le mille.

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<sup>26</sup> This is different from the escaping attempt of the previous example, which was an escaping in no world: here we would have an event that would both be a P and a not-P event.

Brown could-impf hit three bulls-eyes in a row.

For Bhatt, the ability modal is at base implicative, hence (b) doesn't report an ability. A modal meaning emerges from the genericity associated with imperfective, which provides an 'ability' meaning by describing characterizing generalizations/dispositions of the subject.

In the current account, root modals (including ability modals) are real modals, and remain modals even when they combine with perfective. Nothing, however, forces the modal in (b) to be an *ability* modal: it could be a purely circumstantial modal (no ordering source), which describes a possibility given Brown's particular circumstances at that moment. The strangeness of (c), on the other hand, can still be blamed on genericity: the possibility to hit 3 bulls-eyes in a row shouldn't occur in all of the normal/ideal worlds quantified over by the imperfective modal: the feat was a fluke, not a repeatable pattern.

If my proposal is right, root modals are real modals, regardless of aspect. Do we have independent evidence that the modality is really there? Can the presence of the modal go undetected? To see that the modality is still present, and truth-conditionally detectable, we need to turn specifically to goal-oriented interpretations, in order to contrast possibility and necessity. Goal-oriented modals express possibilities and necessities given a particular goal of the subject, expressed by a purpose clause. Following von Stechow and Iatridou (2004), I take these modals to take a circumstantial modal base, further restricted by the purpose clause:

- (57) a. Jane a pu prendre le train pour aller à Paris.  
*Jane was able to take the train to go to Paris.*
- b.  $[[[a)]]^{w,B,\leq,c}$  is true iff  $\exists e[e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\} \ \& \ \exists w' \in \text{Acc}(w) \ \& \ \text{J-go-to-P. in } w']$   
take-train( $e,j,w'$ )]
- c. 'There is an actual past event such that in some circumstantially accessible world where Jane goes to Paris, that event is a train-taking by Jane'
- (58) a. Jane a dû prendre le train pour aller à Paris.  
*Jane had to take the train to go to Paris.*
- b.  $[[[a)]]^{w,B,\leq,c}$  is true iff  $\exists e[e \text{ in } w \ \& \ \tau(e) \subseteq t \ \{t < t^*\} \ \& \ \forall w' \in \text{Acc}(w) \ \& \ \text{J-go-to-P. in } w']$   
take-train( $e,j,w'$ )]
- c. 'There is an actual past event, and in all circumstantially accessible worlds where

*Jane goes to Paris, that event is a train-taking by Jane'*

(57) and (58) differ truth conditionally in a scenario where Jane had other options for going to Paris (e.g., taking the plane, riding a horse, etc.). In this scenario, (57) is true, and (58) false. The reason why the latter is false is that Jane takes the train in *all* circumstantially accessible worlds where she goes to Paris. There is thus no accessible world in which she reaches her goal but doesn't take the train, i.e., there is no possibility to ride a horse or take a plane...

We thus get a truth conditional difference between a universal and an existential modal, even with an actuality entailment. While both require the event in the complement to take place *in the actual world*, like the unmodalized version in ((62)a), the necessity modal further requires that this event takes place in *all* (best) accessible worlds. In other words, Jane has no choice.

- (59) a. Jane a pris le train pour aller à Paris.  
Jane took-pfv the train to go to Paris
- b. Jane a pu prendre le train pour aller à Paris.  
Jane could-pfv take the train to go to Paris
- c. Jane a dû prendre le train pour aller à Paris.  
Jane had to-pfv take the train to go to Paris

There is one additional meaning component involved in (b), namely the intuition that the train was Jane's **preferred** mean of transportation. No such inference arises with (a) nor (c). How can we cash out these intuitions? Where does this desirability inference come from? It seems to be an implicature, which can be cancelled:

- (60) Jane a pu prendre le train. En fait, elle aurait préféré prendre l'avion, mais il n'y avait aucun autre moyen d'aller à Paris.  
*Jane was able to take the train. In fact she would have preferred to fly, but there was no other way to go to Paris.*

The implicature would arise as follows: *can* and *must* are scalar alternatives, with *must* being the stronger, given that *must p* entails *can p*. Upon hearing (59)b), the hearer infers that the speaker

is not in a position to assert ((59)c). Thus, he infers that there are accessible worlds in which Jane goes to Paris but where the event of taking the train doesn't happen, further inferring that there are other ways for Jane to reach her goal of going to Paris (i.e., there are other accessible worlds where Jane goes to Paris which do not involve taking the train). He will then deduce that Jane had options. Because she took the train while having options, taking the train must have been preferable. The unmodalized (a) doesn't have a competitor: no such inference arises.

Similarly, with an ability modal, we can derive that the event described by the complement is not a trivial outcome. Bhatt (1999) argues that the ability modal (which, again, for him is simply an implicative predicate) involves a conventional implicature, which states that the complement required some effort: this is why (a) is weird out of the blue, but fine with the preceding sentence in (b):

- (61) a. #Timmy peut respirer.  
#Timmy is able to breathe. Bhatt (1999)
- b. Timmy had a terrible car accident as a result of which he lost control over most of his muscles. Thankfully, he is able to breathe.

We can derive this 'effort' component pragmatically: because the modal is existential, we infer that there are accessible worlds in which Timmy has the abilities that he has and the circumstances are as in the actual world, where Timmy doesn't breathe, which is odd, unless breathing is no longer trivial, due to peculiar circumstances.

### 3.3. Beyond Modal Auxiliaries

We saw that actuality entailments with root modals arose from a certain configuration between aspect and the modal. This analysis predicts that actuality entailments should occur whenever perfective scopes over a modal element, while binding the event argument of its complement. As it turns out, actuality entailments with perfective occur in a series of covertly or overtly modalized constructions, which, at first blush, may not seem to form a natural class (*too and enough* constructions, *have the courage/strength... to, permit*; cf. Hacquard 2006). Under the view proposed here, what they would share is a particular configuration: a single aspect, which binds an event variable across the modal element, as schematized below:

(62)  $\exists e_1$  MOD VP( $e_1$ )

I would like to end this paper by showing that this seems to be the right recipe for actuality entailments. Recall from section 2.1.2. that Italian *volere* yields actuality entailments with perfective, as shown in the example repeated below:

(63) Gianni ha voluto parlare a Maria, #ma non lo ha fatto.  
Gianni want-pst-**pfv** talk to Maria, #but he didn't do it.

Interestingly, its French counterpart *vouloir* doesn't, despite *vouloir* and *volere* sharing a similar meaning in terms of quantification over desire worlds:

(64) Gianni a voulu parler à Maria, mais il ne lui a pas parlé.  
Gianni want-pst-**pfv** talk to Maria, but he didn't talk to her.

As argued in Hacquard (2008), the crucial difference between French and Italian *want* is structural. *Volere* is a restructuring predicate (as diagnosed syntactically by allowing clitic climbing and auxiliary switch): it forms a single clause with its complement, and thus involves a single tense and aspect layer. Its French counterpart, however, is biclausal: both the matrix and the complement clauses host their own tense and aspect projections. Thus, while the sentence in (63) describes a single event (an actual event of talking to Maria in both the actual world and Gianni's desire worlds), its French counterpart describes two: a wanting event in the actual world, and an event of talking to Maria in Gianni's desire worlds.

## CONCLUSION

This paper aimed at deriving actuality entailments when perfective appears on root modals without having to give up a standardized semantics for aspects, nor for modal auxiliaries. I argued that actuality entailments arise when aspect is interpreted above a modal. Being outside the scope of the modal, aspect has to be evaluated at the matrix world of evaluation—the actual world—thereby yielding an actual event. To derive the full entailment, I proposed a default

mechanism (PED), according to which the event description holds across the modal worlds and the actual world. I further showed that the lack of implicative readings available with imperfective was due to an additional layer of modality (genericity) associated with the imperfective itself, following Bhatt (1999). This account rides on a structural difference between epistemic and root modals that is independently needed, and allows us to maintain a unified semantics for both aspects and modals, which hold beyond the actuality entailment phenomenon. It further predicts that whenever a modal element is in the scope of an aspect which binds the VP event variable of the modal's complement, it will yield actuality entailments (provided that there is no additional layer of modality). This prediction seems to be borne out, as data involving Italian *want* seem to show.

#### APPENDIX – EPISTEMICS VS. ROOTS: STRUCTURE MATTERS

Brennan (1993) shows that deontic interpretations split in two categories: *ought to do* vs. *ought to be* deontics (following Feldman's (1986)). Consider the following examples:

- (65) a. Murderers ought to go to jail.  
b. Wickham ought to apologize.

(65)a)'s most natural interpretation is that *it ought to be the case that murderers go to jail*, rather than *murderers have an obligation to go to jail*. The moral obligation seems to fall on society (and at the very least the addressee of (65)a)), rather than on the murderers themselves. (65)b)'s most natural reading is one where the obligation is on the subject himself: *what Wickham ought to do is apologize*. Note that the same sentence can be ambiguous (cf. Bhatt 1998). With an *ought to do* interpretation, (66) expresses an action that the subject, Kitty, ought to do, if she doesn't want to get cavities, or be scolded by her mother, but it also has an *ought to be* interpretation, as when it is uttered by Kitty's mother to her babysitter: it ought to be that Kitty brushes her teeth.

- (66) Kitty has to brush her teeth.

Note that with a non human subject, a deontic is most naturally interpreted as an *ought to be*. In

(67) the obligation is on the addressee, not on the plants:

(67) The plants have to be watered.

Brennan (1993) argues that *ought to be* deontics pattern with epistemics (based, notably, on their interaction with subjects) and *ought to do* deontics pattern with other roots in terms of their structural properties: the former are TP-level, the latter VP-level modals. For Hacquard (2006) the reason why both epistemics and addressee-oriented deontics appear high is that they are connected to a participant of the speech event (the speaker and the addressee, respectively), while all root modals appear low because they are connected to a participant of the VP event. Importantly, both *ought to be* and *ought to do* deontics share a very similar meaning in terms of obligation, and differ only in that the obligation falls on the addressee (and a perhaps larger community) *versus* the subject. They differ crucially, however, in terms of structure: *ought to be* deontics are high (above tense/aspect) and *ought to do* deontics low modals (below tense/aspect).

Interestingly, *ought to be* deontics seem to pattern with epistemics with respect to actuality entailments. We already saw that *ought to do* deontics yield actuality entailments. Can we get an *ought to be* interpretation with perfective and get actuality entailments? The answer seems to be no. Consider a scenario where I address my housesitter, who was supposed to take care of my plants (the non human subject and ‘*Congratulations!*’ help bring out the addressee-oriented reading, as the speaker performs a (sarcastic) congratulatory act to her addressee):

(68) ??Les plantes ont dû être arrosées, mais elles ne l’ont pas été. Bravo!

The plants must-pfv be watered, but they weren’t. Congratulations!

The sentence is infelicitous. Note that the oddity does not come from the fact that the continuation seems contradictory. Even if I see that the plants have been watered, I cannot utter (68)<sup>27</sup>. Why is (68) bad? *Ought to be* deontics seem to double a modal statement with a performative act, namely that of putting an obligation on the addressee (cf. Ninan 2005, for such

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<sup>27</sup> Note that it is possible to give the modal an *ought to do* interpretation (without ‘*Congratulations!*’), with the obligation on the implicit agent of the watering event. In that case, the sentence reports a past necessity and crucially, we obtain an actuality entailment. Thus the relevant distinction for deontics is whether the modality is tied to a participant of the speech act (the addressee) or participants of the embedded event (often the subject, except with passives, where the agent is not necessarily expressed overtly).

an account of English deontic *must*). Following Brennan (1993) and Hacquard (2006), *ought to be* deontics are interpreted above tense and aspect (as was the case for modals with an epistemic interpretation). What is responsible for (68)'s infelicity is their performative dimension: it is impossible to request of someone to bring about a *past* state of affairs<sup>28</sup>.

To sum up, both addressee-oriented deontics and epistemics scope above tense/aspect. With past tense, the resulting interpretation for epistemics is a present possibility/necessity that a past proposition held. For deontics, it results in an impossible interpretation. Thus, what seems to be crucial for getting actuality entailments lies not so much in the particular modal interpretation, but rather where the modal is interpreted with respect to tense and aspect (though the two are correlated in that high modals can only be interpreted as epistemics or addressee-oriented deontics and low modals as roots): low modals yield actuality entailments, high modals do not.

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<sup>28</sup> Note that imperfective is acceptable, with a counterfactual interpretation, allowing the sentence to express a reproach to the addressee for not having done what she was supposed to (see Hacquard 2006).

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