# Ambiguity in the 'Non-root Modal + PERF' Construction Revisited

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## 1. Introduction

The interaction of modality and other phenomena has received much discussion in recent syntax and semantics literature. This paper adds to the effort by dealing with one particular case of the interaction. It has been observed that certain 'non-root modal + PERF(ect)' combinations are ambiguous between epistemic and metaphysical readings (Mondadori, 1978; Condoravdi, 2002), as exemplified in (1):

(1)  John might have won the game.
  a. John might have already won the game, (*but he didn't in the end).        (**epistemic**)
  b. At that point John still might have won the game, (but he didn't in the end).    (**metaphysical**)

The two readings of (1) are truth conditionally distinct: the epistemic reading is not compatible with an ensuing statement by the same speaker that John did not win, but the metaphysical reading is.

The epistemic reading of the 'non-root modal + PERF' construction involves some past possibility or necessity seen from the perspective of the speaker's utterance time. In this sense it has a present perspective and past orientation, and gives rise to the backward shifting reading. At stake for this reading is the speaker's information state as of the utterance time about the happening (or not) of some eventuality in the past of the utterance time. On the other hand, the metaphysical reading involves a then-future possibility or necessity envisioned at sometime in the past of the utterance time. It has a past perspective and future orientation, and gives rise to the forward shifting reading. At stake for this reading is how a world might/would evolve from this past time regarding some eventuality. The latter interpretation generally has a counterfactual implicature: though the eventuality denoted by the complement of 'non-root modal + PERF' was metaphysically possible or necessary at some past time, it did not actually occur as of the utterance time and the possibility/necessity for it to occur no longer exists. Take (1b) for example. Although the possibility of John winning the game existed at the relevant past time, John did not actually win, and the metaphysical possibility of his winning is no longer a valid one.

This paper attempts to offer a unified analysis of the above ambiguity which is more explanatorily adequate than its scope-based precedent. The core idea of my analysis is that the metaphysical/epistemic ambiguity correlates with whether the evaluation time of the modal is shifted towards the past by an operator or not. In section 2, I review the traditional scope-based analysis of the ambiguity, according to which the epistemic reading has the modal scoping over PERF, and the metaphysical reading has the reverse scope relation. Then I discuss several theoretical and empirical problems that the analysis suffers from. In section 3, I outline a new, non-scopal analysis. The metaphysical reading involves shifting the modal evaluation time toward the past by an operator. The operator can be either overt in the form of 'still', 'originally', etc, or simply covert. The epistemic reading does not involve such temporal shifting. In section 4, I discuss how the new analysis avoids the problems with the scope-reversal alternative.

## 2. The Scopal Analysis

### 2.1. Condoravdi 2002

The epistemic versus metaphysical ambiguity of the 'non-root modal + PERF' construction is perhaps most thoroughly discussed by Condoravdi (2002). As a starting point, she holds that a non-root modal makes a uniform semantic contribution with respect to its temporal interpretation. The varieties of temporal interpretation of a non-root modal arise from the interaction of its semantics and the scopal relation it has relative to what it combines with. The evaluation time ($t_{eval}$ henceforth) of a non-root modal is determined by its immediate scopal relation with some temporal operator. Let us for now focus on non-root modals that are not embedded under attitude verbs. When such a modal scopes under PRES(ent) and over PERF at the same time, it takes the utterance time ($t_{now}$) contributed by PRES as the $t_{eval}$ and exhibits the backward-shifting, epistemic reading. When the modal scopes immediately under PERF, which in turn takes narrow scope relative to PRES, $t_{eval}$ is sometime in the past of $t_{now}$, and the sentence exhibits the forward-shifting, metaphysical reading. The two readings of (1) can be formally represented as in (2). Here, MB stands for the modal base[1]. For epistemic modals, MB($w, t$) is the set of possible worlds which are consistent with what the speaker knows or with the evidence available in world $w$ at time $t$. For metaphysical modals, MB($w, t$) is the set of metaphysical alternatives in $w$ at $t$. The function $\tau$ yields the termporal trace of an eventuality in a world (Condoravdi, 2002).

(2) John might have won the game.
a. PRES(MIGHT$_{MB}$(PERF(John win)))
$\lambda w \exists w' \exists t'[w' \in \text{MB}(w, t_{now}) \,\&\, t' \prec [t_{now}, \_) \,\&\, \exists e[\![\text{John win}]\!](w')(e) \,\&\, \tau(e, w') \sqsubseteq t']]$
b. PRES(PERF(MIGHT$_{MB}$(John win)))
$\lambda w \exists w' \exists t'[t' \prec t_{now} \,\&\, w' \in \text{MB}(w, t') \,\&\, \exists e[\![\text{John win}]\!](w')(e) \,\&\, \tau(e, w') \sqsubseteq [t', \_)]]$

The semantics in (2a) says that there is a world $w'$ which is epistemically accessible from the base world $w$ at the utterance time, such that the event of John winning the game in $w'$ is included in a temporal interval that precedes the interval $[t_{now}, \_)$. Thus the winning event is in the past of $t_{eval}$, which is the utterance time in this case. On the other hand, the semantics in (2b) says that there is a world $w'$ which is metaphysically acessible from the base world $w$ at some past time $t'$, such that the future of $t'$ includes the event of John winning the game. Thus the winning event is in the future of $t_{eval}$, which is some time past relative to $t_{now}$.

According to Condoravdi, the counterfactual implicature that is often associated with the metaphysical reading arises from pragmatic inference. Metaphysical possibilities decrease as time goes by; past times are compatible with more possibilities than are future times. So when the speaker uses a 'modal for the past' (e.g. 'might have') rather than a 'modal for the present' (e.g. 'might'), her intention is to enlarge the domain of metaphysical possibilities and, by doing so, to convey to the hearer that the eventuality expressed by the complement of the modal is an unactualized one and the possiblity for the eventuality to happen or realize does not exist any more. The interested reader can refer to Condoravdi (2002) for more formal discussion of the counterfactual implicature; for criticism of her idea, see Abusch (2008) and Portner (2009).

### 2.2. Problems with Condoravdi's Anslysis

Condoravdi's analysis provides a satisfactory account of the data that she considers. Her analytical intuition is on the right track: the most essential difference between the two readings lies in the temporal perspective and orientation of the non-root modal. However, the analysis faces several challenges when it comes to new empirical data that are relevant yet excluded from her discussion.

First, when a modal embeds under an attitude verb, the $t_{now}$ contributed by the PRES operator in the semantics of the 'non-root modal + PERF' construction is anchored to the internal now of the attitude holder (Abusch, 1997). When the embedding attitude verb is in the past tense, the $t_{eval}$ of the metaphysical reading of the construction should be some time prior to the internal now of the attitude

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[1]For the sake of simplicity, in this paper I do not consider the ordering source of a modal. See Kratzer (1981, 1991) for discussion. Doing so does not affect the overall argument.

holder (e.g. $t_b$ in (3b)), which, in turn, precedes the utterance time. Condoravdi's analysis would predict the embedded clause in (3a) to have a metaphysical reading in which the metaphysical possibility of John winning the game existed prior to, but no longer as of, Mary's belief time. However, this reading is very difficult to come by.

(3)    a. Mary believed that (yesterday) John might have won the game.
        b. $\lambda w \exists w' \exists t'[t' \prec t_b$ & $w' \in MB(w, t')$ & $\exists e[[\![John\ win]\!](w')(e)$ & $\tau(e, w') \sqsubseteq [t', \_)]]$

Furthermore, even when the 'non-root modal + PERF' construction is embedded under a present tense attitude verb, it does not have a metaphysical reading. The sentence in (4), for instance, only has an epistemic reading which has to do with Mary's information state at her belief time. Any analysis which attempts to explain the restriction by ruling out the 'epistemic modal + metaphysical modal' combination as ungrammatical is doomed to fail, because the combination is indeed empirically observed. In (5) 'believe' is interpreted epistemically, and 'may' can (but not must) be interpreted metaphysically. This sentence also suggests that the broader attempt to analyze the restriction as a special case of the so-called 'modal concord' phenomenon (Zeijlstra, 2007) does not work here.

(4)    Mary **believes** that (yesterday) John might have won the game.

(5)    John believes that humanity may eventually destroy itself.

I should note that, in my attempt to interpret (3-4) metaphysically, I implicitly took the higher attitude verb and the lower modal verb to anchor to the same agent. More specifically, in (3-4) Mary was/is the believer and at the same time stood/stands in an evaluative relation to the embedded modal proposition. The speaker of the whole sentence does not play a role in assessing the embedded modal clause. However, nothing mandates the embedded metaphysical modal to be interpreted exclusively relative to the subject of the embedding sentence. There are cases where a non-root modal embedded under an attitude verb is interpreted relative to the attitude holder and the speaker of the whole sentence simultaneously. In such cases the metaphysical reading is possible for a modal clause embedded under a past tense attitude verb, and the metaphysical proposition has the speaker of the whole sentence as the assessor. The sentence in (6), for example, has a reading which describes the followers' epistemic state 'back then' that O'Fallon might become the first American Pope some time later, and in which, at the speaker's utterance time, this possibility – future with respect to the belief time of the followers – has not materialized and does not exist any more from the speaker's present perspective. The reading involves both epistemic modality and metaphysical modality, but they are anchored to the persectives of different agents. Condoravdi's analysis cannot explain the presence of such a 'dual modality' reading.

(6)    Back then O'Fallons followers believed that he might have become the first American Pope.

Third, PERF can take a temporal associate such as a *since*-phrase/clause or *for*-phrase/clause. It is reasonable to assume that a temporal associate shares the same scope relation with PERF. For Condoravdi, the metaphysical reading of 'non-root modal + PERF' has PERF scoping over the modal. Then, the temporal interval denoted by the temporal associate of PERF should scope over the modal as well. For (7), Condoravdi's analysis would predict it to mean that the possibility of the suspect staying in the city stretched from the time of case suspension to right before the utterance time. That is to say, for any temporal sub-interval $t_1$ in $[t_{case-suspension}, t_{now})$, there is some world $w_1$ which would evolve in such a way that the criminal stayed in a world $w_{11}$ which is metaphysically accessible from $w_1$ at $t_1$. This prediction is too strong. Rather, the metaphysical reading of the sentence is something like: as of the time of case suspension the following possibility existed: the possibility of the suspect's staying in the city ever since the suspension. For (7) to be true, it is sufficient even if this possibility existed very briefly, say at the very beginning of the $[t_{case-suspension}, t_{now})$ interval. In a nutshell, the temporal associate of PERF modifies the embedded eventuality, not the metaphysical possibility of happening (or not) of the eventuality. It is not the case that the metaphysical possibility fills the whole temporal interval of $[t_{case-suspension}, t_{now})$.

(7)    The suspect could have just stayed in the city since the suspension of the case. (Fortunately, he didn't, because he could have been killed by the surviving victim.)

Lastly, on a more empirical side, Condoravdi's scope-based analysis has nothing to say about the observation that some native speakers of (American) English can get the metaphysical reading of the 'non-root modal + PERF' construction only with the aid of such aspectual focus elements as 'originally' and 'still'. Even in the theoretical literature the explication of the metaphysical reading of the construction often involves 'still' (Abusch, 2008; Stowell, 2004). If Condoravdi conceded by saying that scope reversal somehow is not an option for these speakers, she would then have to face the unpleasant task of explaining why the introduction of certain aspectual focus elements makes the metaphysical reading accessible to these speakers. Pragmatics is not a right place to attribute the added meaning to, because in general pragmatics cannot bring about semantically unavailable meanings. Some other native speakers of (American) English do not need an aspectual focus element to get the metaphysical reading, but for them the presence of such an element still facilitates the reading [2].

The above problems with Condoravdi's analysis mostly arise from its strong reliance on scope reversal to derive the metaphysical reading. A non-scopal analysis will (hopefully) avoid these problems and (ideally) not bring other issues at the same time. In addition, an alternative analysis making no recourse to scope reversal is more economical, because scope operations are not free after all. The temporal shifting analysis outlined in the next section is an attempt along these lines. It shares the analytical intuition of Condoravdi's proposal: manipulating the temporal perspective and orientation of the non-root modal to get the two distinct readings. The two analyses, however, diverge with respect to how this manipulation is achieved semantically.

## 3. A Temporal Shifting Analysis

I start with the last problem noted above for Condoravdi's analysis, because it provides direct, intuitive motivation for the analysis I will pursue. Recall the observation that some native speakers of (American) English cannot get the metaphysical reading of the 'non-root modal + PERF' construction without the aid of such aspectual focus adverbs as 'still' and 'originally'. For these speakers, the effects that 'still' and 'originally' have on the metaphysical interpretation are too strong to be just pragmatic. I make significance out of this empirical observation and take these adverbs to contribute to the semantics of the metaphysical interpretation of the construction.

It is widely accepted that the $t_{eval}$ of non-root modals like 'might' and 'could', when not embedded under a past tense attitude verb or similarly manipulated, is anaphoric to $t_{now}$ (Abusch, 1997; Stowell, 2004). Even when talking about possible consequences of some past event, non-root modals are not evaluated against the past[3]. Take the sentence in (8) for example. The claim regarding the possibility of less enjoyable international flight is based on the evidence (or knowledge) that is available to the speaker as of the utterance time – tightened airport security, unusual delayed flight departures and arrivals, etc, rather than the evidence (or knowledge) available as of the time of the earlier, failed terrorist attempt.

(8)    That failed terrorist attack yesterday might make international flights a whole lot less enjoyable .

Recall that the metaphysical reading of 'non-root modal + PERF' has a past temporal perspective, that is, under this reading non-root modals are evaluated against some past time. This is crucially different from their epistemic reading, in which they are evaluated against the utterance time or attitude time. The metaphysical use of a non-root modal cannot have a past evaluation time on its own, and I

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[2]The discussion to follow focuses on 'still' as an aspectual focus element loosely meaning 'compared to the present time'. The same word has many additional uses, for example, in the sense of 'nevertheless' as in 'to be rich and still crave more' or in the sense of 'in addition' as in 'still more papers to write'. Some of these other, distinct uses of 'still' can co-occur with 'non-root modal + PERF', but by no means do they license or facilitate the metaphysical interpretation. For instance, the following sentence, where 'still' precedes 'might + PERF', does not have a metaphysical interpretation in the sense that I use in this paper:

(1)    Even if you have never seen an episode of MTV's 'The Real World' before, you still might have found yourself in the Campus Center Auditorium last Thursday.    **(Google Example)**

[3]von Fintel & Gillies (2008) pointed out that the evaluation time of epistemic modals can be in the past, but see Portner (2009) and Hacquard (2010) for arguments against this idea. I concur with the latter authors.

have shown that PERF cannot scope over 'might' to fix the $t_{eval}$ of the modal to some time in the past of $t_{now}$. There has to be some other semantic entity that does the job. The introduction of aspectual focus elements into the 'non-root modal + PERF' construction can license the metaphysical reading for some speakers and facilitate it for some others. So it is reasonable to posit that these elements somehow can manipulate the evaluation time of the modal.

Out of this motivation, I choose to analyze these aspectual focus elements as operators which backward shift the evaluation time of metaphysical modals to some past time, and this past time is either contextually implied or linguistically provided. The metaphysical vs. epistemic ambiguity of the 'non-root modal + PERF' construction correlates with whether or not the modal evaluation time is backward shifted from the utterance time to some past time by an operator.

For the sake of simplicity, in the discussion to follow I use 'still' to represent all the aspectual focus elements whose presence licenses or facilitates the metaphysical reading of 'non-root modal + PERF'; and 'might have' to represent all the epistemic/metaphysical ambiguous 'non-root modal + PERF' combinations. Presumably the discussion can be extended to other 'non-root modal + PERF' combinations and aspectual focus elements.

Now that I have outlined the gist of my analysis, the remaining task is to give a formal implementation of the idea. I follow Condoravdi (2002) to treat 'might' as denoting a function from properties of eventualities or properties of times to properties of times. The semantic definition in (9) requires that the property P be instantiated in a world $w'$ accessible from the base world $w$ at some evaluation time $t$, and the instantiation occurs in a temporal interval starting from $t$. For unembedded 'might', the variable $t$ in the semantics of 'might' gets evaluated by the PRES operator, so 'might' is evaluated against the utterance time. When 'might' is embedded under a past intensional context, $t$ is evaluated to the past time contributed by the past context, and 'might' is evaluated against this past time. AT($t$, $w$, P), as defined in (10), denotes that the property $P$ is instantiated in world $w$ at time $t$. How the property is instantiated depends on whether it is a property of events, states or times.

(9)  MIGHT: $\lambda P \lambda w \lambda t \exists w'[w' \in MB(w, t) \, \& \, AT([t, \_], w', P)]$

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

The aspectual focus element 'still' is a temporal shifting operator which functions to re-evaluate the $t_{eval}$ of 'might' to the modal topic time ($t_{mtop}$). In its semantic definition (11), I assume that 'still' takes a modal, rather than a modalized proposition, as its immediate argument. Nothing in my analysis really hinges on this assumption, however. What matters most is that 'still' shifts the $t_{eval}$ of a non-root modal towards the past. After applying the function denoted by 'still' to 'might', the evaluation time of 'might' is overwritten to $t_{mtop}$ (12). Except for this difference, the semantics of 'still might' is parallel to that of 'might' and thus does not complicate semantic computation in any significant way.

(11)  STILL: $\lambda Q[\lambda P \lambda w \lambda t_{mtop} Q(P)(w)(t_{mtop})]$, where $t_{mtop} \preceq t_{now}$

(12)  STILL(MIGHT): $\lambda P \lambda w \lambda t_{mtop} \exists w'[w' \in MB(w, t_{mtop}) \, \& \, AT([t_{mtop,\_}], w', P)]$

I should note that the $t_{eval}$ of 'might' cannot be in the future of $t_{now}$, as suggested by the infelicity of (13), unless it is forward shifted by an operator.[4] 'Still' is not a forward-shifting operator and thus cannot shift the $t_{eval}$ of 'might' towards the future of $t_{now}$. This requirement can be wired in as a presupposition in the semantics of 'still' (i.e. '$t_{mtop} \preceq t_{now}$' in (11)), and it is responsible for the unacceptability of (14). When $t_{mtop}$ is identified with $t_{now}$, which is the case when 'might' is not embedded, the shifting operator applies vacuously.

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[4]One example of forward-shifting operators is 'so that', as used in the following sentence. The evaluation time of 'might' in the 'so that' clause is sometime after the expansion of the lab area is done.

(1)  The lab area will be expanded for a bigger waiting area and a child area so that the child might be a bit safer on a table for blood work instead of in a parent's lap.  **(Google Example)**

(13)  *In view of evidence that will be available tomorrow/what the world will be like tomorrow, John may stay with his girlfriend for summer break.

(14)  *Tomorrow John still might have won the game next week.

The $t_{mtop}$ of 'might' can be overtly given in the linguistic context: in (15), the $t_{mtop}$ of 'might' is *yesterday*. The topic time can be implied or 'forced out' by the pragmatic contexts as well. Imagine that John had some assignments due on Monday. He had finished just half of them by Sunday afternoon and planned to do the rest on Monday. Then he went to a party where he got extremely intoxicated and spent the next few days in hospital. In such a scenario, for the sentence in (16) to make any sense, the topic time of 'might' has to be identified with some time before John got drunk (say, the afternoon before the party). Whether the modal topic time is overtly given or pragmatically implied does not affect the semantic computation of the metaphysical reading of the 'non-root modal + PERF' construction.

(15)  Yesterday John (still) might have won the game the day after tomorrow.

(16)  John still might have finished his home assignment on time.

The semantics of PERF (17) serves to locate the eventuality expressed by its complement in a time earlier than the end point of the topic time of eventuality ($t_{etop}$). For example, in (15), $t_{etop}$ is 'the day after tomorrow'. In modal contexts, when $t_{etop}$ is not overtly given in a sentence, it is identified with an interval extending from $t_{mtop}$ to $t_{now} - 1$. Nothing in my analysis requires $t_{etop}$ and $t_{mtop}$ to be related in any systematic way.

(17)  HAVE: $\lambda P \lambda w \lambda t_{etop} \exists t'[t' \prec \text{END-POINT}(t_{etop}) \& \text{AT}(t', w, P)]$

With all the preliminaries, the semantics of the metaphysical reading of 'non-root modal + PERF' can now be derived. The tree in (18) gives the skeleton of the syntactic representation of (15). $S_1$ through $S_5$ are the major nodes whose semantic representations are defined in (19), with irrelevant details put aside. In prose, the end result $S_5$ says that in some historical alternative $w'$ of the base world $w$ through the speakers yesterday it was metaphysically possible for John to win the game some time prior to the endpoint of the speaker's day after tomorrow. I believe this conforms to native intuition.

(18)
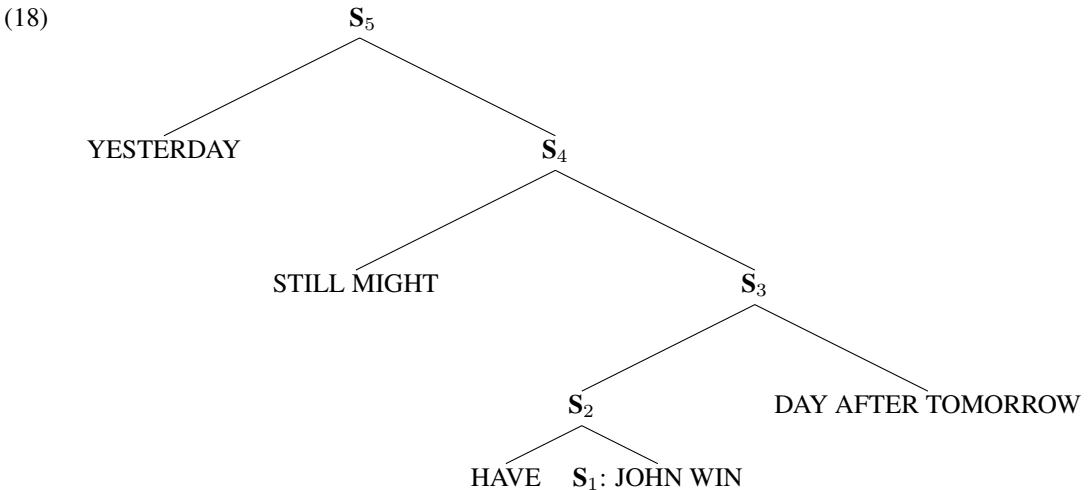


(19)  a. $[\![S_1]\!] = \lambda w \lambda e [\text{John win}](w)(e)$
      b. $[\![S_2]\!] = \lambda w \lambda t_{etop} \exists t' \exists e [t' \prec \text{END-POINT}(t_{etop}) \& [\text{John win}](w)(e) \& \tau(e,w) \subseteq t']$
      c. $[\![\text{day after tomorrow}]\!] = (+2, \text{day})$      $[\![\text{yesterday}]\!] = (-1, \text{day})$
      d. $[\![S_3]\!] = \lambda w \exists t' \exists e [t' \prec \text{END-POINT} ((+2, \text{day})) \& [\text{John win}](w)(e) \& \tau(e,w) \subseteq t']$
      e. $[\![S_4]\!] = \lambda w \lambda t_{mtop} \exists w' \exists t' \exists e[w' \in \text{MB}(w, t_{mtop}) \& [t' \prec \text{END-POINT}((+2, \text{day})) \& [\text{John win}](w')(e) \& \tau(e,w') \subseteq t'] \& \tau(e,w') \subseteq [t_{mtop}, \_)]$
      f. $[\![S_5]\!] = \lambda w \exists w' \exists t' \exists e[w' \in \text{MB}(w, (-1 \text{ day})) \& [t' \prec \text{END-POINT}((+2, \text{day})) \& [\text{John win}](w')(e) \& \tau(e,w') \subseteq t'] \& \tau(e,w') \subseteq [(-1, \text{day}), \_)]$

The above discussion reveals that temporal shifting operators play an important role in deriving the metaphysical interpretation of the 'non-root modal + PERF' construction. However, we have noted that not all native speakers of English need an aspectual focus element to get the counterfactual interpretation of 'might have'. For this I hypothesize that temporal shifting operators do not have to be phonetically realized for all speakers. But when the operator is overtly realized, shifting $t_{eval}$ is obligatory and the metaphysical reading is the only reading available. As a confirming example, (20) only has a metaphysical interpretation. The epistmic reading of the 'non-root modal + PERF' construction does not involve or allow temporal shifting of $t_{eval}$. I take this as the reason why the epistemic interpretation is not attested any more when temporal shifting 'still' appears in a 'non-root modal + PERF' sentence.

(20)    Even after losing the three states, John McCain still could have won the game.

My account of the counterfactual implicature associated with the metaphysical reading of 'non-root modal + PERF' is a pragmatic one, and in this sense is in the same spirit as Condoravdi's. From the fact that the speaker uses the strategy of backward temporal shifting to widen the domain of metaphysical possibilities for the modal, the hearer would infer that the speaker intends to communicate that the past metaphysical possibility was not actualitized and is no longer a valid one as of the utterance time.

It follows that when the metaphysical use of 'non-root modal + PERF' does not involve backward temporal shifting, counterfactuality does not arise. The prediction is borne out, as exemplified by the (rather weak) metaphysical reading of (21). The evaluation time of 'might' is the speaker's utterance time, and the sentence does not carry a counterfactual implicature. In addition, metaphysical modals which are not followed by PERF does not give a counterfactual implicature either, even when the sentence contains 'still' (22). This is because, for such cases, $t_{mtop}$ is identified with $t_{now}$, and the application of 'still' to the metaphysical modal only has a vacuous effect. This is true even if we adopt the rather strong assumption that all non-epistemic modals involve a historical/metaphysical modal base (Werner, 2006).

(21)    The detective might have found everything the lawyer needed by next week.

(22)    Humanity (still) may eventually destroy itself.

My analysis is compatible with the fact that 'can have', 'may have', 'shall have', etc. only have the epistemic interpretation and do not have the metaphysical interpretation. When the evaluation time of modals is shifted toward the past with respect to $t_{now}$, the past tense form of the modals ('could', 'might', 'should', etc) is called for, but 'can', 'may' and 'shall' are all modals of the present form.

I hope that I have so far established that my analysis can fully capture the metaphysical reading of the 'non-root modal + PERF' construction. The semantics defined above can account for the epistemic reading of the construction as well. Towards this end I need just one more reasonable assumption: in the epistemic reading the argument of the modal invariably is a state proposition $\epsilon$. That is to say, in this case the use of the AT function in the definition of 'might' selects the stative form among the three alternatives in (10). Note that the definition of PERF in (17) involves another use of AT function, and this use can take both the eventive form and the stative form. When it selects the eventive form so that 'HAVE + V-ed (+ Object)' embedded under the modal denotes an event, the state proposition that the modal requires as its argument is the result that comes into being after the (hypothetical) actualization of the eventuality embedded under the modal (Kamp & Reyle, 1993:chap. 5). Once the event was realized, the state of its having been realized persists as a fact in the matrix of time and space. For (23a) the relevant state proposition $\epsilon$ is the state of John already having won the game, which is then embedded under 'might' and gives the right result (23b): in a world $w'$ which is epistemically accessible from the base world $w$ at $t_{now}$, John won the game some time prior to yesterday, and the state of his winning the game in $w'$ overlaps with the future of $t_{now}$. The ovelapping relation is trivially satisfied because the state of John having won the game started existing immediately after John won the game, which happened in some world at some past time of $t_{now}$.

(23)    a. John might have won the game yesterday.
         b.$\lambda w \exists w' \exists t' \exists e [w' \in MB(w, t_{now})$ & $[t' \prec END\text{-}POINT((\text{-}1, day))$ & $[John win](w')(e)$ & $\tau(e,w')$
         $\subseteq t'$ & $\epsilon(e,w') \circ [t_{now}, \_]]]$

## 4. Condoravdi's Problems Avoided

Recall that Condoravdi's analysis makes use of a strong reliance on reversing the surface scope of 'might' and PERF to derive the metaphysical reading of the 'non-root modal + PERF' construction: the modal evaluation time is evaluated locally by the higher PERF. This gives rise to the several problems discussed in Section 2.2. By contrast, my analysis makes use of a temporal shifting operator to derive the metaphysical reading. It is most intuitively motivated by, and provides an obvious explantion of, the observation that some speakers of English need an aspectual focus element to get the metaphysical reading of 'non-root modal + PERF'. The other problems with Condoravdi's proposal are no challenge to my analysis either.

First, when a modal embedded under a past tense attitude verb is interpreted only relative to the attitude holder, the evaluation time of the modal is anchored to the internal now of the attitude holder. This can be captured along the lines of Abusch (1997)'s Upper Limit Constraint, as represented in (24).[5] I assume that temporal shifting discussed in the paper is subject to the same constraint. On the other hand, the metaphysical reading of 'non-root modal + PERF' requires the modal evaluation time to be earlier than the utterance time (for matrix non-root modals) or the attitude time (for modals embedded under an attitude verb). Temporal clash arises when a modal that is intended for metaphysical interpretation is embedded under a past tense attitude verb, because there is no time that can precede the attitude time and be identified with the attitude time simultaneously. This is why (3a) (repeated as (25)) does not have a metaphysical interpretation.

(24)  John believed $\lambda t_7$ [his bride might$_7$ become rich].

(25)  Mary believed that (yesterday) John might have won the game.

Second, the 'dual modality' reading of a modal sentence as discussed in Section 2.2 arises when a modal receives more than one interpretation, each relative to a different assessor. For the sentence like (6) (repeated as (26)), the embedded modal 'might' has both epistemic and metaphysical interpretations. The epistemic interpretation describes the followers' epistemic state 'back then'. For this reading, the $t_{eval}$ of the modal is the followers' belief time. The metaphysical reading can be derived via backward shifting the $t_{eval}$ of the modal from $t_{now}$ to the followers' belief time, which can be seen as the $t_{mtop}$. Because $t_{now}$ is the *speaker's* present and has nothing to do with the *follower's* epistemic state 'back then', the temporal shifting in this particular case is only relevant to the interpretation of the modal with respect to the speaker. Thus the metaphysical reading of the embedded sentence is anchored to the perspective of the speaker, and not to that of the followers.

(26)  Back then O'Fallons followers believed that he might have become the first American Pope.

Third, my analysis does not manipulate the scope relation between the non-root modal and PERF. Thus for the metaphysical reading, PERF does not scope over the modal. The temporal denotation of a temporal associate of PERF does not scope over the modal either. So my analysis, correctly, does not predict that, for (7) (repeated as (27)) to be true, the metaphysical possibility of the suspect staying in the city had to stretch from the time of case suspension to right before the utterance time. The temporal interval denoted by the *since*-phrase scopes under the embedding modal and modifies the (hypothetical) eventuality, not the possibility of happening (or not) of the eventuality.

(27)  The suspect could have just stayed in the city since the suspension of the case. (Fortunately, he didn't, because he could have been killed by the surviving victim.)

## 5. Conclusions

In English, the 'non-root modal + PERF' combination has two distinct readings: epistemic and metaphysical. The most crucial difference between the two readings lies in their temporal orientation and perspective. I showed that Condoravdi's analysis of the ambiguity as a scopal one fails to account for

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[5]Abusch intended her thoery for epistemic modals, but as far as the Upper Limit Constraint is concerned, nothing prevents it from being extended to metaphysical modals.

the full range of data, some of which were brought to attention in this paper for the first time. My proposal is that the ambiguity correlates with whether or not the evaluation time of the modal is backward shifted to its topic time by an operator, which is either phonetically realized or covert. My temporal shifting analysis does not face the problems that Condoravdi's scope-based alternative does.

It is still an on-going research of mine as to why aspectual focus elements can serve as temporal shifting operators. Focusing on 'still' for now, my hunch is that an extension of Krifka (2001) provides a potentially plausible explanation. Krifka analyzed aspectual focus elements like 'still' and 'already' in such a way that they pose a restriction on the alternatives to be considered. In (28), for example, 'still' removes the set {*one month old*, *two months old*} from the set of alternative semantic values for the focused element 'three months old'. If the sentence did not contain 'still', the former set would be included as valid alternative semantic values for 'three months old'. That is to say, the ordinary semantic value, *three months old*, is the 'lowest' ranked valid alternative value, and all of the alternative values that are 'lower' than the ordinary semantic value are filtered out. In this sense, 'still' makes the ordinary semantic value of its focus associate a reference point. Extending the idea to the metaphysical reading of the 'non-root modal + PERF' construction, 'still' associates with $t_{mtop}$. Thus $t_{mtop}$ is the reference point. On the other hand, intuitively, what is really subject to alternative semantic computation in the metaphysical interpretation of the 'non-root modal + PERF' construction is $t_{eval}$. It follows that aspectual focuse elements make $t_{mtop}$ the lowest ranked alternative for $t_{eval}$. The lowest ranked alternative for $t_{eval}$ is identical to the ordinary semantic value of $t_{eval}$. Therefore the ordinary semantic value of $t_{eval}$ is just $t_{mtop}$. The alternative filtering of 'still' manifests as temporal shifting in aspectual/temporal contexts.

(28)  Lydia is still **[three]**$_F$ months old.

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