What aspect can tell us about the future of MUST[*]

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Abstract

According to a widespread view (Kratzer 1977 and subsequent work) modals are quantifiers over possible worlds, whose interpretation is heavily context dependent. On such an approach, grammatical factors are not readily expected to determine the available modal interpretations. We observe that grammatical aspect in Greek does precisely that: when perfective non-past is embedded under *prepi* 'must', only the deontic interpretation of the modal is available. The questions we address are (a) what the nature is of this clash between perfective non-past and epistemic interpretation of 'must' and (b) why only epistemic 'must', as opposed to deontic 'must' and to epistemic and root 'may', is sensitive to perfective aspect in this way. We derive the observation from the temporal properties of the perfective non-past and of epistemic 'must'. While maintaining a Kratzerian approach to modals, we propose a modification of the structure of the epistemic modal base and of the workings of the ordering source, in order to explain the observed temporal properties of epistemic 'must'.

1 Introduction

It is a well-known fact that modals give rise to a number of different interpretations (see Jackendoff (1972); Palmer (1986); Brennan (1993) for discussion). For instance (1) can be interpreted as expressing permission, which is the so-called root reading paraphrased in (1a). In addition, (1) can be interpreted as a statement of what the speaker considers likely to happen. This is the non-root (or epistemic) interpretation paraphrased in (1b).[1]

(1)   John may swim tomorrow.
   a. John is allowed to swim tomorrow.
   b. It is consistent with what the speaker knows that John will swim tomorrow.

In a series of papers, Kratzer (1977, 1981, 1991) proposes that modals are not ambiguous between these two (families of) readings, but rather vague: their core semantics leaves unspecified what the chosen interpretation will be. It is context (i.e. pragmatics) that determines the particular interpretation. For instance, the two contexts in (2) rule in the root and non-root interpretation of (1) respectively:

[1]We will use the terms *non-root* and *epistemic* modality interchangeably. This is because we will not make reference to the finer distinctions within the non-root category.

(2) a. (Uttered by John's mother) I don't like my children swimming every day. He swam yesterday, so John may swim (again) tomorrow.

b. (Uttered by John's friend) John likes swimming only when the water is very warm. The weather has been chilly so far, but the forecast for tomorrow is glorious. Therefore, John may swim tomorrow.

According to Kratzer, what is semantically encoded is that modals are quantifiers over possible worlds. The quantification can be either existential ($\exists$), contributed by modals such as *may*, *might* and *can*, or universal ($\forall$), expressed by *must*, *have to* and *ought to*. Quantification in natural language is restricted. In the case of modals, according to Kratzer, the restriction comes from two sources, both of which are contextually given: the *modal base* and the *ordering source*. The modal base is a function from propositions to possible worlds. Somewhat simplified, the modal base is (a function which delivers) the restricted set of worlds which the modal operator quantifies over. For instance, in (2a) the modal base contains worlds where the rules imposed by John's mother are respected and worlds where John swam the previous day, i.e. worlds where the corresponding propositions that are contextually made available hold. In at least one of these worlds, John swims. Similarly for (2b): the context sets up a modal base consisting of worlds where facts about John's swimming preferences and where the relevant facts about the weather hold. In at least one of these worlds, John swims. The ordering source further restricts the quantification effected through the modals by imposing an ordering among the worlds in the modal base. The role of the ordering source will be quite crucial in our proposal, so we return to this notion in more detail in section 4.

As is clear from the above, Kratzer's proposal assigns the resolution of the ambiguity of modals to contextual, i.e. pragmatic factors. From this perspective, which we adopt, it is not straightforwardly expected that grammatical factors should enter the picture in determining the interpretation that the modal will have. This, however, seems to be what is going on in Standard Modern Greek (henceforth Greek), when a particular combination of modals and grammatical aspect occurs. We now turn to this.

1.1 Preliminaries

There are two things we need to note about Greek before we proceed to the interaction between modals and grammatical aspect. First, Greek is a language where grammatical aspect, namely the distinction between perfective and imperfective, is always marked on the verb by means of affixation, root/stem allomorphy or suppletion. There is no grammatical finite verbal form which does not have an aspectual value for (im)perfectivity. Quite generally, the perfective aspect is used in episodic contexts, whereas the imperfective occurs in either habitual/generic statements or as a progressive (Giannakidou and Zwarts, 1999). In addition, Greek distinguishes between past and non-past tense. The paradigm in table 1, taken from Holton et al. (1997), illustrates the relevant part of the verbal paradigm in Greek, namely the combinations of past/non-past tense with perfective/imperfective aspect. Note the term 'dependent', which the authors coin for the combination of perfective and non-past; this verbal form is incapable of occurring on its own in a matrix context. We return to this fact in section 2.

The second thing to note is that Greek lacks infinitives and instead employs subjunctives. The subjunctive is introduced by the particle/ complementizer *na*. There is no indicative-subjunctive mood distinction in the Greek verbal forms themselves

Tense/Mood	Imperfective	Perfective
Non-past	graf–o 'I write' 'I am writing' **Present**	graps–o **Dependent**
Past	e–graf–a 'I used to write' 'I was writing' **Impefect**	e–graps–a 'I wrote' **Simple Past**
Future	tha grafo 'I will write (often)' **Imperfective Future**	tha grapso 'I will write (now)' **Perfective Future**
Imperative	grafe 'write (often)' **Imperfective Imperative**	grapse 'write (now)' **Perfective Imperative**

Table 1: The Greek TMA system (Holton et al., 1997)

(Holton et al., 1997; Tsangalidis, 1999).[2]

1.2 The puzzle

With these two facts in place, we may proceed to the topic of this paper, namely the interaction between modals and aspect. In Greek, modal verbs embed, unsurprisingly, subjunctive clauses. Consider, for instance, the examples in (3), where *bori* 'may'/'can' combines with an imperfective non-past (henceforth INP) in (3a) and a perfective non-past (henceforth PNP) in (3b). As illustrated in the translations, the modal can receive in both cases either a root or a non-root interpretation.

(3) a. Bori   na   fevji.
       may-3SG SUBJ leave-3SG.INP
       'It is consistent with the available evidence that he is leaving (now)/leaves (habitually).'
       'He is allowed/able to leave (habitually).'

    b. Bori   na   fiji.
       may-3SG SUBJ leave-3SG.PNP
       'It is consistent with the available evidence that he leaves.'
       'He is allowed/able to leave.'

Now consider the corresponding examples where we use *prepi* 'must' instead of *bori*, provided in (4). When *prepi* embeds an INP, as in (4a), again both the deontic and the epistemic interpretations are available. However — and here is where the puzzle lies — when its complement is a PNP, *prepi* can only receive the root (deontic) interpretation. The epistemic interpretation is unavailable, as is evident from the translation of (4b).[3]

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[2]The syntactic status of *na* (piece of verbal inflection, residing in IP/MoodPhrase, or complementizer heading complement clauses and residing in the C field) has been a matter of considerable controversy in Greek linguistics. For a concise overview of the existing accounts, as well as a recent proposal see Giannakidou (2007).

[3]The observation is, as far as we know, novel. Roussou (1999) regards examples such as (4b) as ambiguous between a deontic and an epistemic interpretation, whereas Iakovou (1999) notes that the epistemic reading is harder to get but not altogether unavailable.

(4) a. Prepi na   fevji.
        must SUBJ leave-3SG.INP
        'It follows from the available evidence that he is leaving (now)/leaves (habitually).'
        'He is obliged to leave (now/habitually).'
     b. Prepi na   fiji.
        must SUBJ leave-3SG.PNP
        'He is obliged to leave.'

Our aim is to derive the observed pattern from independently motivated properties of the contributing elements, while at the same time maintaining a Kratzerian semantics for modals, outlined above. In a nutshell, the explanation we will provide consists of two crucial ingredients: (a) the temporal properties of the PNP and (b) the temporal properties of epistemic 'must'. We discuss these two aspects of our account in sections 2 and 3 respectively. In section 4 we relate the temporal properties of epistemic 'must' that we rely on to the set up of the epistemic modal base, and to the way the epistemic ordering source operates.

2   Temporal properties of the PNP

In this section we focus on the temporal properties of the PNP which we deem crucial in its interaction with the modals. It is often noted that the Greek PNP is defective in some way. It cannot, for instance, occur on its own in a matrix context, but requires the subjunctive particle *na* (or some other particle or licensor, see below):

(5) *(Na) fijis.
     SUBJ leave.2SG.PNP
     'Leave.'

We believe that the defectiveness of the PNP lies in its semantic and in particular temporal properties (Giannakidou, 2007).[4] In virtue of being specified as non-past, the PNP cannot denote a past interval. This means that it has to denote either a present or a future time interval. In virtue of being perfective, the PNP cannot overlap the utterance time. The reason, explicated in, among many others, Comrie (1976); Smith (1997); Giorgi and Pianesi (1997) (see also Iatridou et al. (2002)), pertains to the universal unavailability of a present perfective. For instance, Giorgi and Pianesi (1997) propose the principle in (6). The speech time, to which utterances are temporally anchored in order to be interpreted, is a punctual event. The perfective presents a closed (i.e. bounded) event.

(6)   A closed event cannot be simultaneous with a punctual event.

In other words, the PNP cannot actually denote a present interval. The only option available to it is to be interpreted at a future-shifted time (Tsangalidis, 1999). However, the Greek PNP cannot shift to the future on its own. It needs to be embedded under a future-shifting operator.

Let us consider the distribution of the PNP. The PNP can occur under the subjunctive marker *na*, the future/modal particle *tha*, conditional *an*, and optative *as*. It can also occur under some temporal connectives, for instance *prin* 'before', *otan* 'when'

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[4]Temporal deficiency of the PNP should not be confused with temporal deficiency of the subjunctive *na* complements more generally. On the latter, see Roussou (1999) for discussion and references.

(Giannakidou, 2007, and references). These are all operators that are able to (directly or indirectly) shift forward the evaluation time of the verb they embed. For example, *otan* 'when' can introduce a a PNP clause, but only if it modifies a matrix clause in the future tense (7).

(7) Otan fijis, *katharisame/ tha katharisume to spiti.
    when leave-2SG.PNP cleaned-1PL.PERF/ FUT clean-1PL.PNP the house
    'When you go, we *cleaned/will clean the house.'

Moreover, the *na*-selecting predicates given in table 2 can embed a PNP (Giannakidou, 2007). These are all future-shifting predicates.

volitionals	*thelo* 'want', *elpizo* 'hope', *skopevo* 'plan'
directives	*dhiatazo* 'order', *simvulevo* 'advice', *protino* 'suggest'
permissives	*epitrepo* 'allow', *apagorevo* 'forbid'
negatives	*apofevgho* 'avoid', *arnume* 'refuse'
verbs of fear	*fovame* 'be afraid'
commissives	*anagazo* 'force'

Table 2: Licensors of the PNP

Giannakidou notes that the *na*-selecting verbs in table 3 do *not* embed a PNP. The complement of aspectuals and perception verbs shares the temporal location of the matrix verb. For example, if I start to walk, the interval at which the walking occurs overlaps the interval at which the starting occurs.

aspectuals	*arxizo* 'start', *sinexizo* 'continue'
perception verbs	*vlepo* 'see', *akuo* 'hear'

Table 3: Anti-licensors of the PNP

To sum up, in this section we saw that, due to the combination of perfective and non-past that it instantiates, the PNP needs to be interpreted at a future time. What is perhaps peculiar to the PNP in Greek (see, for instance, the discussion to follow in section 3) is that it cannot shift itself forward, but relies on some future-shifting operator (a particle, a connective, or a future-oriented predicate).

In the next section we turn to the temporal properties of epistemic *prepi*.

3 Temporal properties of epistemic 'must'

In discussing the temporal properties of sentences containing modals we find crucial the distinction discussed in Condoravdi (2001) between temporal perspective and temporal orientation. Temporal perspective relates to the evaluation time of the modal part of the utterance, while temporal orientation relates to the evaluation time of the embedded proposition. To illustrate, consider the example in (8). The sentence expresses possibility about the future from the viewpoint of the present. In other words, the temporal perspective of the sentence is now and the temporal orientation is tomorrow.

(8) John might leave tomorrow.

Condoravdi makes the claim that non-root modals with present perspective (what she calls "modals for the present") have future orientation optionally with stative predicates and obligatorily with eventive predicates. This is illustrated with the aid of tempo-

ral adverbials in the examples in (9), which contain stative and progressive predicates, and (10), which contain an eventive predicate:

(9)   a.   John might be sick now.

      b.   John might be sick tomorrow.

      c.   John might be leaving now.

      d.   John might be leaving tomorrow.

(10)   a.   * John might get sick now.

      b.   John might get sick tomorrow.

The observation may be correct for non-root existential modals, but it seems that the orientation of epistemic *must* does not pattern in the above way. Crucially, we believe that the orientation of non-root 'must' can never be future (Enc, 1996; Stowell, 2004). The examples in (11) and (12) show that the only orientation available is present, and this in turn is only available to stative predicates. Recall that eventive (perfective) predicates cannot be simultaneous with the utterance time.

(11)   a.   John must be sick now.

      b.   * John must be sick tomorrow.

(12)   a.   John must be getting sick now.

      b.   * John must be getting sick tomorrow.

(13)   a.   * John must get sick now.

      b.   * John must get sick tomorrow.

The conclusion we draw from the data above is that epistemic *must* cannot have future orientation and is thus not a forward-shifting operator.

There seem to exist counterexamples to this claim. In a sentence such as (14) the modal appears to have future orientation. This is, however, only an apparent effect of the modal. Note that English allows a similar futurate reading of the present independently of a higher modal, as is evident in (15):

(14)   The boat must leave tomorrow.

(15)   The boat leaves tomorrow.

We predict an apparent future orientation of 'must' in languages which independently allow a futurate reading of their present tense.

As we have already seen, epistemic *prepi* 'must' cannot embed the PNP, and the PNP itself cannot occur in a matrix context unaccompanied. The INP, on the other hand, can be embedded under epistemic 'must' and allows a futurate reading when occuring in matrix clauses on its own.

(16)   To treno fevji   avrio.
      the train leave.3sg.INP tomorrow
      'The train leaves tomorrow.'

It therefore seems that, unlike epistemic *bori* 'may', epistemic *prepi* 'must' is not able to shift the temporal interpretation of its syntactic complement to the future. Since the PNP requires such shifting, it cannot occur under epistemic 'must.' Our task is now to explain why epistemic 'must' differs from epistemic 'can' in this way. To do so we need to take a closer look at how the epistemic modal base is structured, and what the workings of the ordering source are. This is what we now turn to.

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4 Modal bases and ordering sources

Recall from section 1 that in a Kratzerian approach to modals, their interpretation depends on a contextually given *modal base*, as well as an *ordering source*. To see why both are needed consider the following example due to von Fintel (2005). Imagine that Jane has violated the speed limit, and gotten caught doing so.

(17) Jane must pay a fine.

This is an instance of a deontic modal sentence. Suppose that we try to interpret (17) with respect to a deontic modal base alone, i.e. without an ordering source. A natural candidate for the modal base in this example would be the set of worlds where the laws of the country in question are obeyed. A moment's reflection reveals that this will not do, however. With that as a modal base, the meaning of (17) would be (18):

(18) All law-abiding worlds are worlds where Jane pays a fine.

Assuming that Jane only pays a fine if she has actually committed an offense and gotten caught doing so, this is a contradiction: In perfectly law-abiding worlds, one could only pay fines by mistake, since there are no offenses committed in such worlds. But (17) can perfectly well report Jane's obligation to pay a fine because she *has* committed an offense. So we must be quantifying over worlds that are less than perfectly law-abiding. A theory of modals that only countenances modal bases would have a hard time explaining that intuition. Suppose, instead, that we have the following pair of a modal base and an ordering source for our example:

(19) a. *Totally Realistic* modal base:
          All worlds that are exactly like the actual one up to now, and may diverge later on.
      b. Ordering source: $w_1 > w_2$ (w_1 is ranked higher than w_2) iff w_1 has fewer law violations than w_2.
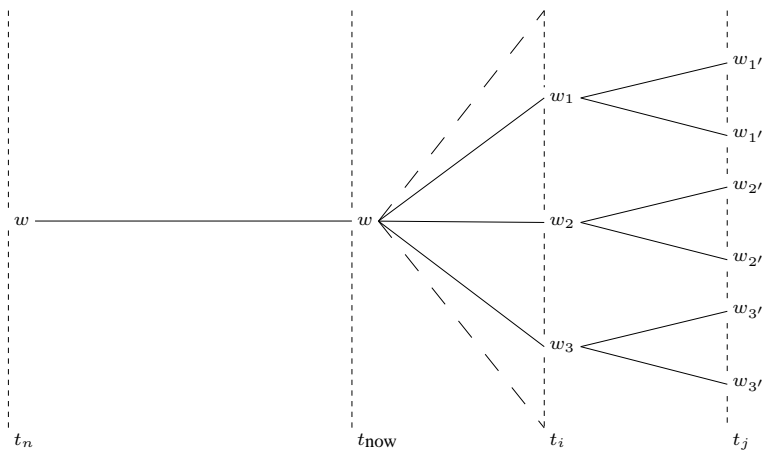

Figure 1: Totally realistic modal base

Totally Realistic modal bases impose a branching time structure on the set of possible worlds, as illustrated in figure 1. See Thomason (1984) for formal definition and discussion.

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We can now interpret (17) as meaning that all the worlds in our modal base that are ranked highest by our ordering source, i.e. the ones with the smallest number of law violations, are worlds where Jane pays a fine.

4.1 Condoravdi's Diversity principle

Condoravdi (2001) argues that the Diversity principle governing modal bases is crucial in accounting for (some of) the temporal properties of some modals. Let μ be a modal base for a modal that embeds a clause φ.

(20) Diversity principle (Condoravdi, 2001)[5]
   μ must contain worlds where φ is true, as well as ones where φ is false.

Condoravdi shows that by assuming the Diversity principle, we can explain why deontic modals cannot embed a past proposition. Recall from our discussion of (17) that deontic modals have a Totally Realistic modal base. Since, by definition, a Totally Realistic modal base contains all and only those worlds that agree with the actual one on the truth or falsity of all propositions up to the present moment, such a modal base cannot satisfy the Diversity Principle for past propositions. Fur future shifted propositions, however, Diversity *can* be satisfied, because the worlds in a Totally Realistic modal base can disagree amongst themselves concerning the truth or falsity of future propositions. Condoravdi's proposal was based on English facts, but the following example shows that it can be generalized to Greek, as well (Roussou, 1999, 176). (21a,b) can only be understood on the epistemic reading.

(21) a. Prepi na   efije.
        must SUBJ left-3SG.PERF
        'It must be the case that he left.'

    b. Bori   na efije.
        may-3SG SUBJ left-3SG.PERF
        'It is possible that he left.'

4.2 An Epistemic modal base

We would now like to suggest that Condoravdi's line of reasoning can be extended to our puzzle with Greek *prepi* and the PNP. Epistemic *prepi* can embed past propositions. Hence, given the reasoning in the previous sub-section, it would seem to follow that the modal base for an epistemic modal cannot be Totally Realistic. That this is so is made plausible by the simple observation that epistemic modals are used precisely to reason about what the actual world is like. Hence, they should not be restricted from the outset to quantify over worlds that agree with the actual one. But, then, what *is* the modal base for an epistemic modal? We would like to suggest that an Epistemic modal base contains alternative courses of history that are consistent with our evidence. Put differently, an epistemic modal base is obtained by taking all our doxastic alternatives, and treating them as the "actual world" for a Totally Realistic modal base. The epistemic modal base is the set of alternative courses of history so obtained. Figure 2 illustrates

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[5]This principle is most likely part of a much more general pragmatic principle of relevance. Grice's maxim of Relevance can plausibly be stated as a requirement that a proposition must settle some *issue* which is part of the common ground of the interlocutors. An issue, can, in turn, be thought of as a question. A polar question can be thought of as a partition of a set of worlds into those worlds where the corresponding assertion is true, and those where it is false Groenendijk and Stokhof (1984). We will have to leave for future research the interesting relation between issues and Diversity.

such a modal base graphically. We furthermore suppose that the ordering source will rank entire courses of history, rather than individual worlds.
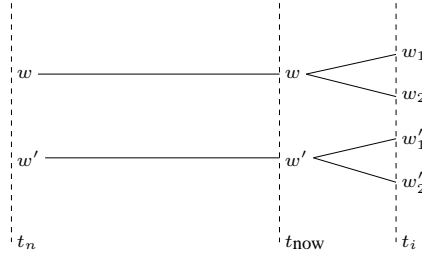

Figure 2: Epistemic modal base

To see how this works, we first consider an example of epistemic 'must' embedding a past proposition. Suppose that John always keeps the lights on in his office when he is at work, and only turns them off when he goes home for the day. Suppose, moreover, that we notice that the lights are out in his office. In that case, we could utter (22a), with the pseudo-logical form in (22b).

(22) a. John must have gone home for the day.
      b. MUST($[\lambda t.$John have gone home at $t]$(now))

(23) a. Evidence: The lights are out in John's office.
      b. Ordering source: $w_1 < w_2$ iff w_1 complies less with John's typical behavior than w_2

The modal base will consist of alternative courses of history that are consistent with the lights now being out in John's office, as well as other things we might believe to be true. The ordering source ranks the alternative courses of history according to how prototypical John's behavior is in each of them. The meaning of (22a) ends up being that the best courses of history (i.e. the ones that deviate the least from John's typical behavior), that are complatible with our evidence (John's lights are out) are all courses of history where John has gone home.

Condoravdi (2001) provides the following example of a future shifting 'might', and we go through how our proposal would capture that. Suppose that a committee has decided that John will meet the dean tomorrow or else that he will meet the provost tomorrow.

(24)   John might meet the dean tomorrow, and he might meet the provost.
      a. Evidence: information about the meeting of the committee.
      b. Ordering source: Information about the typical behavior of the committee and of John.

The evidence consists of information about the decisions of the committee, and other things we might know or believe. The ordering source is again a prototypical one, i.e. it ranks courses of history according to how well they conform with the usual behavior of John, the provost, the committee, and so on. The sentence ends up meaning that the most prototypical courses of history that are compatible with the committee's decision contain at least one world where John meets the provost tomorrow.

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4.3   No future for MUST

Suppose that we modify Condoravdi's example in the following way: We add to the modal base the information that the provost is on vacation in Greenland, and that the committee knows about this. Since the committee is unlikely to require of John that he travel to Greenland for his meeting, the ordering source would now rule out a meeting between John and the provost. Hence, we ought to be able to utter (25) with an epistemic reading of the modal, and a future shifted complement:

(25)   # John must meet the dean tomorrow.

But (25) cannot be interpreted epistemically. Why not? Recall our assumption that an epistemic modal base is a set of alternative courses of history as shown in figure 2, and that the ordering source ranks entire courses of history. Each course of history will agree with some doxastic alternative of the speaker's up to *now*, and then it will branch into the future.

There are two scenarios to consider in this context. (a) The evidence entails the truth of φ_{fut}, where φ_{fut} is the future shifted complement of the modal. In this case, all the alternative courses of history in the epistemic modal base will verify φ_{fut}. But, if so, Condoravdi's Diversity Principle will be violated. Hence this should not lead to a possible epistemic modal base. (b) The evidence does not entail the truth of φ_{fut}. Some of the futures included in the modal base will be relatively outlandish from the point of view of the ordering source. In the case at hand, there will be futures, for example, in each alternative course of history, where the committee tells John to travel to Greenland to meet the provost, or where John decides to quit his job, and, therefore meets neither the dean nor the provost, and so on. Therefore, the Diversity Principle will be satisfied in this case. But 'must' requires all worlds (in all alternatives) to verify the proposition it embeds. Hence it follows that an example like (25) with an epistemic reading of the modal, is necessarily false.

We propose, then, that the epistemic reading of a sentence like (25) is ruled out because it cannot be true in any context. More generally, epistemic 'must' cannot lead to truth with respect to a future shifted complement. Hence speakers should strongly prefer a root reading of the modal.

Returning now to the Greek PNP and its interaction with *prepi* 'must,' we can use this as an explanation for why *prepi* cannot receive an epistemic interpretation when it embeds a PNP. The PNP requires a future shifted interpretation. Epistemic *prepi* cannot embed such a future shifted proposition, since that would either lead to a violation of the Diversity Principle, or else to a necessary falsehood.

The claim we are making should be carefully distinguished from another one. We are not claiming that a predicate embedded under epistemic 'must' cannot end up being evaluated at a future time. This can happen if there is an additional, future-shifting operator applying to the predicate in question. An example of such a future-shifting operator is the English progressive (Landman, 1992). A sentence like (26) means, very roughly, that all futures where Johns *present* intentions are fullfilled, are futures where he meets the dean.

(26)   John is meeting the dean tomorrow.

Consider now (27), where we add the epistemic 'must.' This sentence *does* allow for an epistemic reading of 'must,' thus contrasting with (25).

(27)   John must be meeting the dean tomorrow.

But this sentence does not involve a *future oriented* 'must:' it means that it must be the case (at present) that all the futures where John's present intentions are fulfilled are ones where he meets the dean.

Recall that in English, certain eventive predicates can receive a future shifted interpretation under epistemic 'must'.

(28)   The train must leave at 14:05 tomorrow.

These examples require some kind of schedule, or "plan" to be available in the context, and have been discussed by (Kaufmann, 2005, and references cited there). He argues that the English present tense should always involve a universal modal that quantifies over such plans. We refer the reader to Kaufmann for detailed discussion. Our diagnosis for the English sentences like (28) is that they contain two universal modals; one epistemic one, and another, covert scheduling modal. The crucial point is that the scheduling modal is responsible for shifting the evaluation of the predicate to the future. The resulting complex is itself evaluated at the present. Hence, it is compatible with embedding under epistemic 'must.' [6]

We would like to point out that this explanation of the temporal properties of the modals does not rely on the presence of syntactic dependencies or "selection." Root modals do not "select for" future shifted complements, and epistemic ones do not select against them. The co-occurrence restrictions observed between root and epistemic modals on the one hand, and the tense/aspect of the embedded clause on the other, can be derived entirely from the independently motivated semantic properties of modals, tenses, and aspects.

5 Summary

In this paper, we set out to explain why *prepi* cannot be interpreted epistemically when its complement contains a PNP, while *bori* can. To achieve this, we follow Giannakidou (2007) in assuming that the PNP is temporally defective. We argue that its deficiency is that it can only occur under operators that are able to shift the temporal evaluation of their complements to the future. While we do not provide a formal account for this deficiency of the PNP (see Giannakidou's work), we argue that it is crucially involved in the puzzling properties of the Greek modals. We observe that epistemic *bori* is compatible with future shifted complements, while epistemic *prepi* is not. This is why the epistemic *prepi* is incompatible with the PNP.

We argue that the incompatibility of epistemic *prepi*, and epistemic 'must' in other languages, with future-shifted complements can be derived by making two crucial assumptions about the interpretation of epistemic modals. First, we assume that an epistemic modal base is a set of alternative courses of history, each constituting a Totally Realistic modal base with one of the speaker's doxastic alternatives functioning as the "actual world." Secondly, we suggest that the ordering source for an epistemic modal ranks entire courses of history, rather than individual worlds. This leads to a situation where epistemic 'must' with a future-shifted complement will either violate Condoravdi's Diversity Principle on modal bases, or else denote a necessary falsehood.

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[6]On this approach the Greek PNP must be incompatible with such a silent universal scheduling modal. This property of the PNP needs to be better understood, and is plausibly related to the deficiency discussed by Giannakidou (2007).

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