

The weakness of future morphemes and epistemic modals: modal adverbs measuring speaker's confidence

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Abstract

In recent work, we have defended the thesis that future morphemes in a number of European languages associate with epistemic modal bases and therefore behave, to all intents and purposes, as epistemic modals (Giannakidou and Mari to appear a,b, 2013, 2013). When this happens, future morphemes, including English, receive non-future, non-predictive readings, akin to *must*. In this paper, we enhance the epistemic modal analysis by considering the co-occurrence of future morphemes with modal adverbs of varying force such as *possibly, probably, definitely*, etc. We note first that these adverbs can be used with future morphemes in predictive ('true' future) uses including e.g. *Maybe John will be here at 5*, as well as non-predictive (non-future) uses such as *That will probably be the mailman*. All future variants are non-veridical (Giannakidou 1998, 1999), i.e. epistemically weaker than their respective non-modalized positive assertions which are veridical. We argue that the adverbs measure the speaker's confidence that the actual world is among the best worlds non-predictive use), or the most reasonable futures (true future use) quantified universally by the future modal. The variable force of the adverb (possibility, probability, necessity) reflects higher or lower confidence. This analysis allows a new understanding of the phenomenon of so-called modal concord. In both predictive and non-predictive uses, the adverb serves the function of revealing the role the speaker plays in making judgments about the actual world. We call this *modal modulation*.

1 Introduction: future morphemes and epistemic modality

The question of whether the category 'future tense' in natural languages is a tense or modality has received a lot of attention in linguistic semantics, and both answers have been explored (for modal accounts see Bertinetto, 1979; Enc 1996, Copley, 2002; Squartini, 2004; Kaufmann 2005, Mari, 2009, to appear Klecha 2011, Giannakidou 2012, Giannakidou and Mari 2012, 2013; for a defense of the temporal analysis see Kissine 2008). Certainly, the English future word 'will' is a modal verb, and admits purely epistemic readings. We read, e.g. in Palmer, that 'it is tempting to refer to the meaning of *will* as probability,

alongside possibility and necessity for *may* and *must*. A better paraphrase is in terms of conclusion: ‘A reasonable conclusion is that..., (Palmer 1987: 136)’.

- (1) a. The French will be on holiday this week.
- b. No doubt, you’ll remember John.

The sentences above are conjectural: *will* conveys epistemic modality: given what I know, it is quite likely or it is quite plausible, or in cases of stronger certainty, it must be the case that that the French are on holiday this week. Other non-predictive uses of *will* circulated in the literature are generic or with mixed ability and epistemic readings:

- (2) a. Ed will get upset over nothing
- b. Ed will lay in bed all day reading trashy novels. (Huddleston 1995)
- c. As far as I know, oil will float on the water. (Haegeman 1993)

In these cases too, *will* comes out as the product of reasoning based on knowledge that the speaker has (see Giannakidou 2012, Mari, 2009,2010, Chiou 2012, and Tsangalidis 1998 for earlier discussion of similar Greek data).

Purely modal uses for futures have also been observed for Dutch. Very much in the spirit of the quote from Palmer, Broekhuis and Verkuyl 2013 propose that Dutch *zullen* is an epistemic modal operator used to express that the prejacent proposition is the result of reasoning based on information that judged as ‘reliable and well-founded’. To quote from the conclusions:

‘We think that the best way to describe the meaning of WILL(p) is to say that the speakers using this modal verb feel sufficiently confident to say p is true at n or is to be made true at i’. This confidence relies on information judged as reliable and well-founded. It may take all sorts of form dependent on the situation: as a hypothesis, a confident expectation, a reassurance, etc. What these circumscriptions have in common is that the speaker has entrance to sufficiently many worlds to be able to pick out the ones that seem convincing.” (Broekhuis and Verkuyl 2013: Conclusions).

This is a very appealing analysis of the future morpheme, and indeed resonating with recent proposals we made about Greek and Italian futures (Giannakidou 2012, Mari, 2009,2010; Giannakidou and Mari 2012, 2013). The idea that the future is modal is also common in the Italian literature (Bertinetto 1979, Mari 2012 and more works cited therein), and modal uses of Greek *tha* have also been noted in Greek grammars and literature. Moreover, there is considerable evidence from Slavic languages that future morphemes do not have purely temporal contribution either (see e.g. Blaszcak and Klimek-Jankowska 2012). These crosslinguistic studies jointly support the idea that if indeed in so many languages future morphemes are systematically employed to convey epistemic readings, then the ‘future’ as a temporal category becomes redundant. It must be better understood as relying on epistemic modality.

The implications of this idea are large, therefore in the present paper, we would like to present additional arguments to support the epistemic analysis of the future. We will study the co-occurrence of future morphemes with modal adverbs, in producing both purely epistemic and predictive ("real" future) readings. We will show first a parallel with epistemic modals such as *must*, which seem to be equivalent to the future, but then we will also discuss possible restrictions. Though the apparent co-occurrence of adverbs with modals makes us think of ‘modal’ concord, we will show that the relation between the adverb and the modal is more loose, and goes beyond matching force, which is usually required for modal concord (Huitink 2012). We will claim that future sentences

are *perspectival*, i.e. they express the speaker’s judgment about the possible truth of the prejacent proposition, and *non veridical*, i.e. they are *epistemically weaker* than unmodalized assertions (Giannakidou 1998, 1999, to appear). The function of the adverb is to ‘modulate’ the perspective: it measures the speaker’s confidence about where to place the actual world. The bottomline of the discussion will be that epistemic modal sentences, and therefore also future sentences, are multidimensional, and that modal morphemes, by themselves do not make claims about the actual world. The adverbs are needed to do that, and this gives us a more refined view of the phenomenon of modal ‘concord’.

The discussion proceeds as follows. In section 2, we discuss the purely epistemic uses of the Greek and Italian morphemes, presenting also the main data from adverbs and the parallel with necessity modals. It will become evident that the claims with future can be relatively weak, as observed especially in Italian. In section 3, we make similar observations about the predictive use, where we find even weaker adverbs. In section 4, we outline our analysis of FUT as an necessity modal, and discuss the role of the adverbs. We consider possible implementations based on Giannakidou 2002 and Lassiter 2011, but end up suggesting that the adverbs do not compose directly with the modal but are rather presupposition inducers. They bring in the speaker’s perspective into the discussion and modulate the modality. As a result, epistemic modals at a least, end up having a multidimensional semantics, with a subjective component that makes reference to speaker’s confidence about where to place the actual world.

2 Purely epistemic readings in Greek and Italian: non-veridicality and epistemic weakening

For the future, Italian and Greek do not have a modal verb, but employ a morpheme - which we will call FUT in this paper: a bound one (Italian), and a particle that precedes the tensed verb (Greek). FUT can be followed by a nonpast or a past tense form and retain an epistemic, non-predictive reading (Mari to appear, Giannakidou 2012, Giannakidou and Mari 2012a,b):

- (3) a. I Ariadne tha troi tora. (epistemic, now)
the Ariadne FUT eat.non-past3sg now
b. Giacomo ora mangerà
Giacomo now FUT-eat
‘Giacomo/Ariadne must/will be eating now’
- (4) I Ariadne tha milise xthes. (epistemic, past)
the Ariadne FUT talk.past.3sg yesterday
‘Ariadne must have spoken yesterday.’
- (5) Giovanni sarà malato. (epistemic, now)
Giovanni FUT-be sick
‘John must be sick.’
- (6) Giovanni sarà stato malato. (epistemic, past)
Giovanni FUT-be been. PERF. sick
‘John must have been sick.’

None of the examples here above is ‘future’, i.e. referring to an event that follows the utterance time. Rather, as can be seen in the translations, these are all modal sentences

with an epistemic interpretation. In all these cases, given evidence that the speaker has at the time of the utterance, he assumes that, in worlds that satisfy certain normality constraints, p is true. The future sentences, in this respect are interchangeable with epistemic modals equivalent to *must*, as indicated also in the translations. See also the examples below, in Greek and Italian with the actual equivalents of MUST (in Greek *prepi* takes a subjunctive *na*-complement, like all modal verbs; Giannakidou 2009):

- (7) a. I Ariadne *prepi na troi tora.* (epistemic, now)
the Ariadne must subj eat.non-past3sg now
b. Giacomo ora *starà mangiando*
Giacomo now FUT-be eat-gerund
c. Giacomo *deve star mangiando*
Giacomo must be eat-gerund
‘Giacomo/Ariadne must/will be eating now’
- (8) I Ariadne *prepi na milise xthes.* (epistemic, past)
the Ariadne must subj talk.past.3sg yesterday
‘Ariadne must have spoken yesterday.’
- (9) a. Giovanni *sarà stato malato.* (epistemic, past)
Giovanni FUT-be been. PERF. sick
b. Giovanni *deve essere stato malato*
Giovanni must be be, sick
‘John must have been sick.’

Given this epistemic non-predictive usage, the parallel with MUST, and the lack of future reading, it becomes very appealing to argue that the future morpheme behaves like an epistemic modal, and this is the line we pursue here, following our earlier works.¹

The future interpretation, which we call predictive, arises with the use of a perfective non-past in Greek (10).

- (10) a. Gianni *arriverà domani*
John arrive-fut tomorrow
‘John will arrive tomorrow’
b. O Janis *tha ftasi avrio*
The John FUT arrive.nonpast.perf.3sg tomorrow
John will arrive at 5pm/tomorrow

We will derive this interoperation in section 4 by a mix of epistemic and metaphysical analysis. For now, we focus on the purely epistemic reading.

2.1 Epistemic weakening with future and *must*: nonveridicality

Giannakidou 2002, to appear argues that FUT in the epistemic non-predictive use functions as a weakener of the speaker’s epistemic commitment to the truth of the prejacent. Epistemic weakening is defined as follows (see also Giannakidou to appear):

- (11) *Epistemic weakening* Epistemic weakening is the creation of a nonveridical epistemic space.

¹In previous works we argued that the epistemic interpretation holds with both statives and eventives (and more precisely with perfective non-past in Greek), an issue that we do not discuss here.

- (12) a. *Veridical and nonveridical modal space* (Giannakidou 1998, 1999)
 (i) A modal space (a set of worlds) W relevant to an epistemic agent i is *veridical* with respect to a proposition p just in case all worlds in W are p -worlds. (*Homogeneity*).
 b. If there is at least one world in W that is a $\neg p$ world, W is nonveridical. (*Non-homogenous space*).

The spaces we are talking about represent speaker’s knowledge. The idea is that sentences are not true or false in isolation but truth is always relevant to the knowledge of an epistemic agent i , also called the individual anchor (Giannakidou 1998, Farkas 1992). We can think of this as a perspectival view on truth, see also Harris and Potts 2009; for a recent discussion of the relevance of individual anchors to temporal interpretation see Merchant 2013. In an unembedded sentence, the crucial epistemic agent is the speaker.

A veridical modal space is homogenous, as we see, all worlds are p worlds, and there is no further ordering source or partition to allow doubt (not p worlds). The idea of non-homogeneous nonveridical modal space has also been expressed in terms of *diversity* (Condoravdi 2002). Unlike metaphysical (un)settledness, on the other hand, nonveridicality is defined on epistemic alternatives given the individual anchor, and the modal base does not include simply facts, but knowledge of the facts attributed to the anchor. This is typically the case with unembedded assertions such as *Ariadne is sick*. If we compare this sentence to the FUT version of it, we conclude that the speaker, though highly confident about the truth of p , in choosing FUT, is still not confident enough to exclude doubt as witnessed by the test below (from Giannakidou and Mari 2013):

- (13) a. I Ariadne ine arosti, #ala dhen ime ke endelos sigouri.
 ‘Ariadne is sick, #but I am not entirely sure.’
 b. I Ariadne tha ine arosti, ala dhen ime ke endelos sigouri.
 ‘Ariadne will/must be sick, but I am not entirely sure.’

FUT and modalization in general create nonveridical modal spaces, which are not homogeneous: they contain p and non- p worlds (Giannakidou 1998, 1999). Such spaces express weaker epistemic commitment (see also Smirnova’s 2012 analysis of the subjunctive mood in Bulgarian supporting this point; also Giannakidou, this volume). Weaker commitment explains why all modalized sentences, even with a necessity modal, are ‘weaker’ than a non-modalized assertion (pace von Stechow and Gilles 2010 who claim that *MUST* is strong): there are worlds in the modal base where p is not true, and the actual world may turn out to be one of those worlds.²

Just to make sure that we appreciate this point about the non veridicality of *must*, consider the following case. Context: Ariadne is sneezing, has a fever, watery eyes, etc.

- (14) a. Prepi na exi gripi.
 must subj have.3sg flu

²A useful recent discussion supporting the nonveridicality of *must* is found in Lassiter 2013. Lassiter offers examples like the following:

(i) Probably this must have been done before, *but I couldn’t find enough information* on this in the ISS docs.
 (ii) If the handgun was engraved or had some sort of fancier finish then *I figured he must be a pistolero. I might have been wrong but those were my initial impressions.*

The strength of speaker’s commitment with *must* here is governed by *I figured*, so these are clearly quite weak. There are plenty of similar examples in Lassiter 2013 confirming our view here that *must* is not veridical.

- b. Tha exi gripi.
must have.3sg flu
- c. Tha prepi na exi gripi.
FUT must subj. have.3sg flu
'She must have the flu.'
- d. Exi gripi.
She has the flu

The doctor is assessing, and given what he knows (the symptoms, his knowledge of what the symptoms mean, the time of the year, etc) he concludes, in c, that Ariadne has the flu. In all the worlds compatible with his knowledge/evidence, etc., this is his verdict, he is absolutely certain about it. However, if he chooses one of the modal versions, even with *s must* which can combine with *tha* (as we see in the c example), his modal base allows also for worlds in which Ariadne does not have the flu (non-p) but e.g. an allergy, or pneumonia. The doctor's judgment may be that these worlds are not the correct basis for forming his current diagnose, they are not best (in the sense of Portner 2009); but such non-p worlds are indeed in the modal base. The more of those non-p worlds the doctor allows the less certain he becomes. If the doctor wants to exclude non-p worlds, he must make the stronger statement without *must/ta/prepi*, that relies on a veridical epistemic space which is homogeneous: all worlds compatible with what he considers as the basis for his diagnose are p worlds.

Now, notice crucially that if the doctor is less confident about the diagnose, he will prefer to use the subjunctive particle *na* with the adverb *isos* 'perhaps/possibly'. In this case *tha* is impossible.

- (15) Isos na/*tha exis gripi.
Perhaps SUBJ/FUT have.2sg flu
'Maybe you have the flu.'

Note here the translation with 'maybe' rather than 'must' which is what we used for *tha*. In choosing to utter the sentence above rather than the *tha* version, the speaker wants to express a weaker judgment, akin to using a possibility modal; *Tha*, as we see, is impossible with *isos* 'maybe', suggesting a 'threshold' for *tha* (a point to which we return).

Tha typically co-occurs with high probability adverbs e.g. *malon* 'probably/most likely', and necessity *sigoura* 'certainly', *oposdhipote* 'definitely':

- (16) I Ariadne malon/profanos/sigoura tha ine jatros.
the Ariadne probably/obviously/certainly FUT be.3sg doctor
'Ariadne must probably/obviously/certainly be a doctor.'
- (17) I Ariadne isos/pithanon *tha ine jatros.
the Ariadne maybe/possibly FUT be.3sg doctor
'Maybe Ariadne is a doctor.'

Na is impossible with these high probability and necessity modals:

- (18) I Ariadne malon/profanos/sigoura *na ine jatros.
the Ariadne probably/obviously/certainly SUBJ be.3sg doctor
'Ariadne must probably/obviously/certainly be a doctor.'

These contrasts suggest that the force of the modality of *tha* is stronger than mere possibility. As far as Greek is concerned, the same pattern characterizes the necessity modal *prepi* as we see in the next section. So, Greek appears to have two strategies for epistemic weakening: one where the speaker has more confidence in his judgment (with *tha*) and one with less confidence (subjunctive). In both cases particles are used with adverb combinations. For more discussion of the Greek subjunctive and epistemic weakening, see Giannakidou, this volume.

In epistemic weakening, the future particle, as well as *must/will*, look a lot like the well known German discourse particles such as e.g. *ja, wohl* (Zimmermann 2011):

- (19) Max ist (ja) wohl auf See. (example from Zimmermann 2011)
 Max is prt at sea
 ‘John must be in the sea.’
 (For all I know) John will/must be in the sea.

Such particles can also appear in combinations (*ja wohl*). Zimmermann makes a claim very similar to the one we are making here: he says that with *wohl*, the epistemic commitment of the speaker is weakened. Here is a scenario that brings this about:

- (20) A: I can’t see Hein.
 Er ist wohl auf See.
 ‘He must/may be at sea.’
 (21) A: I know for sure:
 #Hein ist wohl auf See.
 Hein is prt at sea

These are exactly parallel to the *na* and *tha* versions in Greek we just observed. If I know for sure, i.e. if there are no non-p worlds in my epistemic space, I can’t utter *Tha inesti thalasa*. Giannakidou and Mari make a similar observation about direct evidence: e.g. while raining, I cannot utter FUT p:

- (22) Context: I am watching the rain through the window. I say:
 #Tha vrexì! Greek
 #Pioverà. Italian
 ‘#It must be raining.’ ‘#It will be raining.’

If we are directly evidencing the rain, then we know that the sentence ‘It is raining’ is true; the modalized statement is therefore an infelicitous choice, violating Gricean quantity by saying something weaker than what you know. In Giannakidou and Mari, we took this case to illustrate an evidential component, but generally we can take this to show incompatibility between the epistemic weakening function of *FUT, wohl, will, must, dovere*– which require that the speaker be in a nonveridical epistemic state that is compatible with both p and non-p– and the fact that in direct perception contexts the speaker in fact knows p. So, we can think of epistemic weakening as a presupposition that constrains the distribution of the expressions that have it.

Dutch *zullen* seems to also function as an epistemic weakener, as we see in the sentences below. The Dutch counterpart of *wohl* “wel”, can also combine with *zullen* (Giannakidou to appear):

- (23) A: I can't see Hein.
 Hein zal (wel) in de/op see zijn.
 'He may be at sea (swimming/on a boat).'
- (24) A: I know for sure:
 #Hein zal in de/op see zijn.
 'He may be at sea.'

(Many thanks to Jack Hoeksema for discussion of these examples.). We see again a combination *zullen wel*, just like in Greek and German. We can think of these then as cases of modal 'concord' (prima facie).

The Italian facts are parallel, unsurprising. When the speaker knows for sure (i.e. it modal space is veridical) modal statements are infelicitous.

- (25) A: I know for sure:
 #Deve essere al mare.
 #Sarà al mare
 'He may be at sea.'

However, and importantly, both FUT and the epistemic modal *dovere* are compatible with weak epistemic adverbs, such as *forse* (see Bertinetto, 1979; Mari, 2010, to appear). Scenario: Giacomo is absent. The teacher tries to figure out why he is absent. She has various options:

- (26) a. Sarà forse malato
 be-fut maybe sick
 b. Deve forse essere malato
 must maybe be sick
 c. Dovrà forse essere malato
 Must maybe be sick
 '(As far as I know), Giacomo must be sick'

The speaker has the choice of using the future (example a), the epistemic modal (example b) and a combination of the epistemic modal (c). Each can be combined with the possibility adverb *forse*. This shows that across languages modal expressions of the same category (MUST) support different degrees of non-veridicality: Greek *tha/prepi* are compatible only with necessity adverbs, whereas in Italian the range of epistemic adverbs compatible with the future/*dovere* is wider and includes weaker, possibility adverbs. Italian lacks the weaker commitment subjunctive version of weakening observed in Greek, and future/MUST cover the distributions of both *tha* and *na*. We argue in the next section that this leads us to refine the notion of 'modal concord' as a purely matching strategy.

In Giannakidou and Mari 2012, 2013 we take pains to show that both epistemic weakening and the predictive modality of FUT rely on knowledge of the speaker, so they are profoundly epistemic in this sense. But the purely epistemic reading doesn't make a prediction about the future. The important generalization about epistemic weakening here is that future words crosslinguistically, regardless of their status as bound morphemes (Italian), particles (Greek), or auxiliaries (English, Dutch) all seem to have purely epistemic uses without reference to the future. And in their function as epistemic weakeners the futures are similar to modal particles of Dutch and German, as well as *must* and its equivalents in Greek, Italian, and Dutch.

We now turn to considering the role of adverbs, and to our new proposal about ‘modal modulation’.

2.2 The force of FUT, and the role of adverbs: *modal modulation*

Now, recall some core examples in the epistemic use.

- (27) a. I Ariadne tha kimate (tora). (Greek)
 The Ariadne FUT sleep.INP.3sg now
 ‘Ariadne must be sleeping now.’
 b. I Ariadne tha ine giatros.
 The Ariadne FUT be.INP.3sg doctor
 ‘Ariadne must be a doctor.’
 c. I Ariadne tha pezi (tora).
 the Ariadne FUT play.INP.3sg now
 ‘Ariadne must be playing now.’
- (28) a. Giacomo dormirà (adesso).
 (Italian) Giacomo FUT-sleep (now)
 ‘Giacomo must be sleeping (now).’
 b. Giacomo sarà dottore.
 Giacomo FUT-be doctor.
 ‘Giacomo must be a doctor.’
 c. Giacomo giocherà (adesso).
 Giacomo FUT-play (now).
 ‘Giacomo must be playing (now).’

In all cases, the reading is inferential: I am considering information I have, and draw an inference based on that information. For example, with regard to the a examples, I know that Ariadne/Giacomo have the habit of taking a nap at 2pm, I also know that they always stick to schedule, and I also know that today has been a regular day. So at 2:10 pm, I utter the sentence expressing my relative certainty that Ariadne and Giacomo are, *for all I know*, asleep. Likewise, I know also that usually by 6 pm Ariadne is down at the yard playing with her friends. At any time after 6 pm then, I can utter (27-c) with the same degree of certainty. Finally, (27-b) expresses an inference based on evidence: I have witnessed Ariadne expressing opinion on medical matters, she cites reliable medical sources all the time etc., hence I am entitled to conclude (27-b).

In the examples above, notice the order FUT > non-past, especially visible in Greek, where the FUT is an independent particle preceding the tensed verb. We will assume that this order reflects the actual scope order. When scoping over PAST, FUT also has a similar epistemic interpretation, only now we are assessing a past event:

- (29) a. I Ariadne tha kimithike (prin apo dyo ores).
 the Ariadne FUT sleep.PP.3sg before two hours
 ‘Ariadne must have fallen asleep two hours ago.’
 b. I Ariadne tha milise (xthes).
 the Ariadne FUT talk.PP.3sg yesterday
 ‘Ariadne must have talked yesterday.’
- (30) Giacomo si sarà addormentato due ore fà.
 Giacomo reflexive FUT-be fallen-asleep two hours ago.

‘Giacomo must have been fallen asleep two hours ago.’

Again, knowing Giacomo’s or Ariadne’s habits allows me to infer *now* that at some point *two hours ago*, they fell asleep. The past adverbial ‘two hours ago’ functions as the time frame for the eventuality, taking scope below FUT.

Let us now turn to the combinations between the particle and the adverbs. These combinations not only further plea for considering the future a modal rather than a temporal operator, but also allow us to propose a new way of disentangling different contributions of epistemic expressions. The term ‘modal concord’, for the phenomena we are studying, is a misnomer because the relation between the adverb and FUT is not one of identity or even matching, as is understood from work on modal concord such as e.g. Huitink 2012.

As we already noted in the previous section, *tha* co-occurs with high probability adverbs e.g. *malon* ‘probably/most likely’, and necessity *sigoura* ‘certainly’, *oposdhipote* ‘definitely’ - but is bad with mere possibility adverbs such as *isos* ‘maybe/perhaps’ and *pithanon* ‘possibly’:

- (31) I Ariadne malon/profanos/sigoura tha ine jatros.
 the Ariadne probably/obviously/certainly FUT be.3sg doctor
 ‘Ariadne must probably/obviously/certainly be a doctor.’
- (32) I Ariadne isos/pithanon *tha ine jatros.
 the Ariadne maybe/possibly FUT be.3sg doctor
 ‘Maybe Ariadne is a doctor.’

With possibility adverbs, the weakening is done with the subjunctive, as we said. The incompatibility with possibility adverbs suggests that the force of the modality of *tha* is stronger than mere possibility. As far as Greek is concerned, the same pattern characterizes the necessity modal *prepi* (the only necessity modal verb in Greek), which combines with the same range of adverbs, but also with FUT itself:

- (33) I Ariadne malon/#isos tha prepi na efije.
 Ariadne probably/#possibly FUT must subj left.PNP.3sg
 ‘Ariadne ?probably/#possibly must have left.’
- (34) Ta pedia prepi oposdhipote na ine sto spiti.
 The children must definitely SUBJ be. 3pl in-the home
 Epistemic necessity: ‘The children must definitely be at home.’

(All complementation is finite in Greek, and modal verbs take subjunctive *na* complements). *Prepi* is compatible with adverbs above a certain threshold of high probability reaching to necessity - so indeed, in this case we can talk of matching modalities. *Prepi* is not so different from English *must* as is shown in the examples in Lassiter 2013; see also Giannakidou 2012 for more examples such as *You must probably think I am crazy*. This more flexible behavior of Greek and English MUST, along with Italian *dovere* (which appears to be even more flexible, as we saw) challenges the necessity of the Kratzerian distinction between *should* (weak necessity) and *must* (strong necessity). Natural languages MUSTs seem to be more flexible and typically convey both.

It would be helpful to see how these data fit with theories of gradable modality such as e.g. Lassiter 2011. Lassiter suggests that modal sentences get their truth values by comparing the position of their proposition on a relevant scale to a threshold value

(determined by context and the lexical semantics of the modal). In this assumption, MUST works as follows:

- (35) $[\phi \text{ must be the case}]^{M,w,g} = 1$ if and only if *must* (ϕ) is greater or equal to θ_{must}
(Lassiter 2011: (1.6))

We have here a measure for what counts as MUST - the threshold value θ_{must} . This threshold may differ from one language to another - recall that in English *must* is harder (though not impossible) with *probably*, but in Greek, combinations of *malon* with *prepi* and *tha* are common. So, the threshold for MUST in Greek is lower and includes weak necessity (or high probability). Modal concord, in this frame, can be restated as specifying subspaces on the measurement scale, a guide of where to look for the numerical value of *tha p*: e.g. on a scale from 0 to 1, with *malon*, we must look at values of high probability, say between .8-.9; with *oposdhipote*, we only look at .99. The adverbs therefore serve as probability restrictors (as argued in Giannakidou 2012). Our current view of the role of adverbs sections 3 and 4 will preserve this idea, but we will claim further that the adverbs do not compose syntactically with the modality but only have presuppositional content.³

As we said earlier, the Italian facts are parallel, yet not identical to Greek in that the Italian FUT is not categorically excluded with weak possibility modals like *forse* (Bertinetto, 1979; Mari, 2009,2010, to appear):

- (36) Forse Giacomo sarà un dottore.
Maybe Giacomo FUT-be a doctor.
'Giacomo may possibly be a doctor.'

This sentence expresses a degree of uncertainty in the assessment due to the weak adverb. The statement appears to be closer to the *na*-versions we discussed for Greek. So, we may want to say that though Greek has a threshold value for FUT, Italian doesn't. When predicting, even Greek removes the threshold (section 4).

Italian FUT is also good with stronger modals, just like in Greek, (Bertinetto, 1979, Mari 2010).

- (37) Probabilmente Giacomo sarà un dottore.
Probably Giacomo FUT-be a doctor
'Giacomo must probably be a doctor.'

But in Italian, unlike Greek, the future morpheme and the epistemic modal *dovere* are indeed compatible with weak epistemic adverbs, such as *forse*. So, again, the facts for the future and the epistemic verb are parallel in Italian, as both (as well as their combination) are compatible with weak epistemic adverbs. Scenario: Giacomo is absent. The teacher tries to figure out why he is absent. She has various options:

- (38) a. Sarà forse malato

³The adverbs could also be seen as degree modifiers, as entertained in Giannakidou 2012, following a suggestion by Dan Lassiter. If modal adverbs are probability degree modifiers, the differences in acceptability as we move down the range of epistemic modals (ordered by strength) become similar to the contrast between *slightly damp/wet/#soaking* or *somewhat large/#enormous* or *totally #ajar/open*. The modal-adverbial relation becomes thus parallel to the degree modifier-adjective relation in establishing permissible and non-permissible combinations that rely on the combinatorial restrictions of the modifiers as they 'match' (or do not match) the probability space established by the modal operator. This is very close to the view of the role of adverbs we have here.

- be-tut maybe sick
- b. Deve forse essere malato
must maybe be sick
- c. Dovrà forse essere malato
Must maybe be sick
'(As far as I know), Giacomo must be sick'

In Italian, FUT can also combine with *dovere*. This combination is in turn compatible with weak adverbials such as *forse*. Consider a context in which I suspect that my son has heard a secret conversation between me and my husband. I can utter:

- (39) Dovrà forse aver sentito tutto.
must-FUT have heard everything
He must have heard everything'

Indeed, the combinations *FUT dovere* are weaker in Italian, with an even higher flexibility than in Greek.

To summarize: we saw that Greek and Italian FUT have epistemic non-predictive readings. Typically, they associate with high confidence about the prejacent proposition, but in Italian they are more flexible and this flexibility leads to *modal modulation* rather than modal concord. Languages vary with respect to whether they place a threshold: Greek does, but Italian either has a lower threshold or no threshold at all, since necessity modals and FUT are supported by weak possibility adverbs. In our analysis in section 4, we make the role of adverbs and their relation to the modality more precise. Here we just want to emphasize that their active appearance with future morphemes, and the rich combinations we observe, clearly argue in favor of epistemic modality.

3 Predictive reading and gradable strength of prediction

Reference to a future event, which we call here the 'predictive reading' is done with the particular combination of FUT plus a lower non-past (which in Greek must be perfective).

- (40) O Janis tha ftasi stis 5 pm/avrio. (predictive reading)
The John FUT arrive.PNP.3sg at 5 pm/tomorrow.
'John will/#must arrive at 5 pm/tomorrow.'
- (41) Gianni arriverà alle 5 del pomeriggio. (predictive reading)
Gianni FUT-arrive at 5 pm.
Gianni will/#must arrive at 5 pm.

As we see, the paraphrase with *must* is pretty odd in this case.

Because of the adverb, the speaker has specific temporal information about where to place the eventuality. The future reading is forward shifting of the eventuality time due to the adverb scoping above the TP but lower than the FUT:

- (42) FUT > alle 5 del pomeriggio > arrive

Though non-veridical - at the time of knowledge/assessment, the event hasn't happened yet - the forward shifted, predictive reading of FUT obtained with a future adverb, does

seem to express some certainty that the event will happen. This might lead one to assume that the predictive reading is always strong, that it expresses always very high confidence about the future course of events. However, just like in the purely epistemic reading, FUT (including *will*) is compatible with adverbs of various strength, including some really weak ones:

- (43) Arriverà forse/probabilmente/certamente alle 4.
‘He will maybe/probably/certainly arrive at 4’
- (44) O Janis tha erthi sigoura/malon/isos stis 5.
‘John will definitely/probably/maybe arrive at 4’
John will definitely come at 4.
John will probably come at 4.
Maybe John will come at 4.
- (45) Gianni arriverà sicuramente/probabilmente/forse alle 4.
‘John will definitely/probably/maybe arrive at 4’

Recall from our earlier discussion that weak, existential modal adverbs such as *forse* are compatible with the non-predictive use in Italian but not in Greek. In the prediction, however, we notice more flexibility in Greek as well: *isos* ‘maybe’ is now OK. *Will* shows the same pattern, and can combine, just like the Greek and Italian futures, with something as weak as *maybe*. Things get even more ‘loose’ when we consider low-probability adverbials (like *10% chance*, *30% chance*):

- (46) Kata 10%, 30%, 90% O Janis tha erthi stis 5.
by 10% 30% the John FUT come at 5
There is 10% probability that John will come at 5.
There is 30% probability that John will come at 5.
There is 90% probability, that John will come at 5.
- (47) Ci sono 10%, 30%, 90% di chances che Gianni arrivi alle 5
There is 10% probability that John will arrive at 5.
There is 30% probability that John will arrive at 5.
There is 90% probability, that John will arrive at 5.

So, when we predict, we seem to be able to use probability measures of weak force to indicate the degree of confidence we have in our prediction. This is an important point to make, and to our knowledge it has not been noticed before. The indication of probability is highly sensitive to what the speaker knows or takes as a reliable information, and is suggestive of an epistemic layer, we will argue, even in the prediction.

What will happen in the future is objectively unsettled at the present time (Kaufmann 2005, Kaufmann et al. 2006) and therefore objectively non-veridical - since the future event hasn’t happened yet. However, the future is knowable in this way: speakers make informed predictions about the likelihood of propositions being true at a future time, based on what they know at the present time. The flexibility observed with adverbs allows us to say that the predictions fall generally into two categories: predictions of high confidence (based on adequate knowledge that allows such high confidence), and predictions based on low confidence (based on less adequate knowledge). One can think of such low confidence predictions as ‘guesses’. Speakers can of course also have average confidence. In our semantics next, we will try to capture these ideas in a precise way, by using the notion of reasonable future (Mari, 2013). Once we define that, we will claim

that the adverbs function as in the epistemic weakening case, measuring the speaker's confidence about the actual world to come being in the set of reasonable futures.

4 Analysis: modal adverbs as confidence modulators in the epistemic and the predictive reading

While we acknowledge the irreducible asymmetry between a fixed (settled) past and a non-settled futures, our semantics captures the role of adverbs as modulators uniformly in the epistemic and the predictive reading.

Let us start with the epistemic case, in which p is evaluated either in the present or in the past.

4.1 Analysis for the purely epistemic reading of the future

The background of our analysis is Giannakidou 2009, and Giannakidou and Mari, 2012a,b. An important premise that we adopt from these works is that the lower tense, and not FUT itself contributes the temporal information (past or nonpast). We saw in our earlier data in both Greek and Italian that the lower tense is responsible for locating the eventuality in the past or non-past.⁴

Giannakidou says that Greek perfective nonpast denotes an interval whose left boundary is a dependent (Giannakidou 1998) variable t (for a given time t , $[t, \infty)$ stands for the interval that starts at t and goes on to infinity).

$$(48) \quad [[\text{perfective non-past}]] = \lambda p \lambda t (P([t, \infty))$$

This meaning of the nonpast is close to Broekhuis and Verkuyl's 2013 analysis of extended present. In their theory, the conceptual 'present' is an extended interval that includes now but stretches after it. With the non-past (as opposed to a true present), the left boundary needs to be negotiated as now, and this requires additional structure, as Giannakidou argues. This structure is given by nonveridical particles in Greek, including *tha*, the optative *as* and the subjunctive *na*– all with prospective, future orientation (see Giannakidou 2009, this volume for discussion). In this analysis then, the particles, including *tha*, bring in the speech time, and this is a premise we adopt. The variable t in (48) can thus be set as being t_u when *tha* combines with the tensed proposition.

$$(49) \quad [[\text{tha}]] = t_u$$

One could also say that the additional particle structure triggers an "Insert PRES" rule– since every sentence is evaluated temporally wrt the speech time. So, the present in the particle nodes may be some kind of default contribution, common to all particles. *Tha*, semantically, is a modal, and indeed a universal one:

$$(50) \quad \text{For any world } w, \text{ conversational backgrounds } f, g \text{ and epistemic agent } i: \\ [\text{FUT}]^{w, f, g, i} = \lambda q \langle st \rangle . \forall w' \in \text{Best}_{g(w)}(\cap f(w)) : q(w') = 1 \\ \text{where } \text{Best}_{g(w)}(X) \text{ selects the most ideal worlds from } X, \text{ given the ordering } g(w) \\ \text{determined by } i$$

⁴For English, Condoravdi 2002 claims that modals are both temporal/modal and the lower tense does not contribute anything.

In previous work, we have shown that this analysis applies to Italian as well (Giannakidou and Mari, 2012a,b).

We assume the theory of modality in Kratzer (1981, 1991), Portner (2009), and Haegeman (2011), with two conversational backgrounds as arguments of a modal expression - the modal base and the ordering source. The modal base f is the factual background, and the ordering source g is a normative background. With FUT, in this non-predictive use, the modal base is epistemic; specifically, it is the set of propositions known by the agent i , i.e. the speaker in an unembedded context: $\cap f_{epistemic}(w) = \lambda w'.w'$ is compatible with what is known by i (the speaker) in w .

The ordering source $g(w)$, on the other hand, orders the worlds in $\cap f(w)$ according to normalcy assumptions, following Kratzer and Portner. Modal expressions of necessity quantify over those worlds *that adhere to the norms in the ordering source as much as possible*. We can call these worlds *Best* following (Portner, 2009). What we mean by normalcy conditions, is that *strange things do not happen* (see Portner, 1998 and discussion in section 4). For instance, if I have red cheeks and sneezing nose, then, under normal circumstances, I have the flu. However, circumstances are not necessarily normal. In such extraordinary circumstances these symptoms are secondary and indeed indicative of a potentially much worse disease. Typically the actual world tends to be non-extraordinary, but we also know that strange things happen. As a consequence, we do not claim that the epistemic agent actually knows that the actual world belongs to the set of best worlds. Given, on the other hand, that the accessibility relation is epistemic and therefore reflexive, it is ensured that the actual world is in the modal base. What it is not ensured, and depends on the ordering, is that the actual world is also in the set of best worlds.

Only in the Best worlds is p true, therefore the modal (universal or existential) is nonveridical: *the modal base is a non-homogenous space* containing p and $\neg p$ worlds. So, a modalized sentence, even with a necessity modal like FUT or *must* is ‘weaker’ than a non-modalized assertion: there are worlds in the modal base $\cap f(w)$ where p is not true, as we see, and we are not sure where the actual world is, i.e. in the best worlds or not.

Now, putting the temporal component of our analysis (that FUT makes reference to t_u) together with the modal gives us the following truth conditions, for the scopings FUT > nonpast and FUT > past respectively; $(\cap f(w, t_u))$ provides the alternatives available to the speaker at the utterance time, and $q(w', t')$ states that q is true in the projected alternatives at time t' that either coincides or follows the evaluation time t_u :

$$(51) \quad [\text{FUT non-past/tha PNP}]^{w,f,g,i} = 1 \text{ iff: } \forall w' \subset \text{Best}_g(w)(\cap f(w, t_u)) : \exists t' \in [t_u, \infty) \wedge q(w', t') = 1$$

where $\text{Best}_g(w)(X)$ selects the worlds that are ranked as best from X, given the ordering $g(w)$.

$$(52) \quad [\text{FUT past/tha PAST}]^{w,f,g} = 1 \text{ iff: } \forall w' \text{Best}_g(w)(\cap f(w, t_u)) : \exists t' \prec t_u \wedge q(w', t') = 1$$

where $\text{Best}_g(w)(X)$ selects the worlds that are ranked as best from X, given the ordering $g(w)$.

As we made clear earlier, this does not imply anything about the actual world belonging to the best worlds. This is where the adverbs come into play.

The first thing we will say is that the adverbs do not directly compose with p or $\text{FUT}p$. The reason we say this is rather practical: given the variability in force we saw, it is impossible to combine FUT (a universal) with the adverbs in a concord like manner. Even the most flexible theories of modal concord (such as Huitink 2012) would require

at least matching force. So, the adverb is forced to contribute at the non-at issue level, something consistent with the fact that modal adverbs are speaker oriented (Ernst 2009) and seem to ‘scope’ high in the sentence (Ernst therefore argued that they are positive polarity items).

We will claim that the modal adverbs contribute a presupposition that there is a measure of confidence in the assessment of the epistemic agent i which measures how confident i is that the actual world will be within the set of the best worlds. One could probably see this as a generalized contribution of epistemic modals - and perhaps even modals in general: they do not simply make a claim about the possible worlds, but bear relevance to whether an agent i thinks that the actual world is one that conforms to the best ordering, and to what degree. So here is how we put this all together:

Non-predictive use of FUT (= future for past and present)

- (53) FUT p asserts *necessarily* p , relative to an epistemic modal base and an epistemic agent i .

Presupposition: there is a measure function $\mu_{confidence}$ determined by i that measures how confident i is that the actual world will be within the set of the best worlds. The default value of $\mu_{confidence}$ will range above 70%.

Truth condition: p is true only in the best worlds, given the evidence: $\forall w' \in Best_{g(w)}(\cap f(w)) : p(w') = 1$.

As indicated in the presupposition, we will assume that bare FUT, with no adverb, contributes a default of high confidence. But with the use of adverbs, the value becomes more specific and can express higher or lower confidence. This captures the variability in the epistemic judgement between very high, middle, and low confidence.

Finally, and in support of this analysis, it is important to note that the confidence presupposition survives negation.

- (54) a. Gianni non arriverà mica
Gianni not FUT-arrive even
‘Gianni must not be arriving.’
- b. Gianni non sarà malato
Gianni not FUT-be sick
‘Gianni will not be sick / John must not be sick’

The speaker retains the default degree of high confidence that the actual world is not in the set of best worlds that make p true. And is also consistent with the observation that epistemic modals generally scope above negation (e.g. Cinque, 1999; Hacquard, 2006; Homer, 2010) and likewise modal-evidentials across languages, e.g., Japanese (McCready and Ogata 2007).

4.2 The predictive reading

4.2.1 The general picture

We have claimed that the future is an epistemic in both the non-predictive and the predictive use. However, in order to keep a parallel analysis for the non-predictive and the predictive readings, one would have to assume that on the latter reading also the modal base contains worlds in which some facts are true and these same facts are known

to be true by the speaker. However, since the future has not occurred yet, the modal base cannot be epistemic, in the sense that alternatives cannot be known by the speaker.

What is thus the role that knowledge plays in the predictive use?

The speaker, given what he knows at the utterance time, considers only a subset of available metaphysical future alternatives. Given the specific normality constraint that we will design (we will elaborate on the notion of normality here below), it turns out that the speaker knows, at the time of the utterance that, in these futures, p will be true. What it is inexorably *not known* is whether the actual-world-to-come will be in this restricted set of alternatives. We thus claim that a prediction is an assessment of the speaker's confidence that the actual-world-to-come will be one of the alternatives in which p comes out true.

Put it in other terms, we propose that, making a prediction means: (i) determining via present knowledge what are the metaphysical alternatives in which p comes out true; (ii) not knowing whether the actual world to come will be one of these metaphysical alternatives and (iii) believing or being convinced that the actual world to come will be one of these metaphysical alternatives.

This view contrasts with a possible position holding that a prediction involves quantification over doxastic alternatives (Mari, 2009, to appear), i.e. a view according to which the speaker has a present belief or knowledge about what the actual world will be. Such view would have two major shortcomings, one theoretical and a second one empirical.

At the theoretical level, one cannot hold that on the predictive reading the interpretation is epistemic in the same way as it is with the non-predictive reading. As we have explained, in the latter case facts *and* knowledge of facts is used. In the predictive reading neither facts nor knowledge of facts is available, as facts have not occurred yet and thus cannot be known (see Kaufman, 2005, Mari, 2013). Hence, the 'epistemic/doxastic' view would boil down to consideration of beliefs or preferences of the speaker about what the actual-world-to-come will be like, and that would make a very weak theory of prediction—as it would lose the connection between knowledge and facts, a connection that we want to maintain. At the empirical level, a doxastic view would thus be too weak and too strong at the same time: we would allow beliefs to determine outcomes (too weak), while being unable to explain the varying distributions of the adverbs (too strong).

4.2.2 Reasonable futures and the actual-world-to-come

What are the alternatives in which p is true in the future? As the future is not settled can these be known? Our answer is yes, and these are the *reasonable* futures (Mari, 2013).

What is a reasonable future? Following Mari (*ibid.*), a reasonable future determined at time t is such that the rules that hold at t are maintained. As FUT sets the time of the perspective at present, the time at which reasonable futures are considered is the time of the utterance. Rules can be social (determined by convention), natural (the laws of nature), or moral (laws that conform to the commonly admitted accepted moral behavior). They also include habits (i.e. behavior patterns). Rules, especially social ones, can be restricted to very specific contexts as well (e.g., rules that hold in my office, my home, and my building). Consider (55).

- (55) Gianni arriverà a Roma con la macchina alle 4pm
John will arrive in Rome by car at 4pm

The rule that matters when interpreting the sentence can be summarized as, ‘if you use a car, you reach the intended destination in a certain amount of time’. When evaluating this sentence, one disregards those futures in which accidents, breaking of the car and similar aberrant events occur (see also Dowty’s 1979 notion of *inertia*), which would cause the car not to reach the destination.

Note that, because social, moral and even natural aberrations occur very often (see discussion in Landman, 1992), the world that will become the actual world could never belong to the set of reasonable futures of any time. When evaluating sentence (55), those aberrations that would affect the individuals in the reference set are not considered (e.g., when interpreting (55), one does not consider an earthquake occurring in Asia, as this, presumably, would not affect a travel to Rome).

Moreover, when interpreting (55), one also disregards futures in which aberrations (such as attacks and earthquakes) do not occur but in which the rules that hold at the time at which reasonable futures are considered are nonetheless modified. For example, when evaluating (55) at time t_0 , one disregards those futures in which the driver decides to stop in a different city and remains there for three days.

Reasonable futures are such that also habits and behaviors do not change there. Of course habits can change. However, those futures in which they change are discarded (see also discussion in Portner, 1988⁵).

In our account, we consider time-world coordinates and use sets of times and worlds. We assume that, for any given time, the past of a world at that time is unique, whereas the not-yet-realized-future of that world at that time, is one of the options available at t (Thomason, 1984; Condoravdi, 2002; Kaufman, 2005).⁶ In particular, considering the utterance time t_0 , we assume that the actual world up to and including t_0 is unique but that there is not yet an actual world after t_0 and that a variety of options are available. For any time t , we call a ‘reasonable world-to-come’ at t , a ‘reasonable future’ fixed at t . In our framework, the time t at which reasonable futures are considered can either coincide with or precede the utterance time. It is possible that the actual world-to-come at t belongs to the set of reasonable futures fixed at time t .

Along the lines of Mari (*ibid.*), we now elaborate the modal framework that we employ (for an extended discussion, see Mari, *ibid.*).

We use a $W \times T$ forward-branching structure (Thomason, 1984). A three-place relation \simeq on $T \times W \times W$ is defined such that (i) for all $t \in T$, \simeq_t is an equivalence relation; (ii) for any $w, w' \in W$ and $t, t' \in T$, if $w' \simeq_{t'} w$ and t precedes t' , then $w' \simeq_t w$ (we use the symbols \prec and \succ for temporal precedence and succession, respectively). In words, w and w' are historical alternatives at least up to t' and thus differ only, if at all, in what is future to t' .

For any given time, a world belongs to an equivalence class comprising worlds with identical pasts but different futures.

For any time $t \in T$, we define the *common ground* $cg(t)$ as the set of worlds that are identical to the actual world w_0 at least up to and including t .⁷

$$(56) \quad cg(t) := \{w \mid w \simeq_t w_0\}$$

So defined, the common ground includes any world branching from the actual world at

⁵We do not use Portner’s framework, as unlike the author, we do not use events in our account, and the notion of reasonableness is relativized to events in Portner’s theory.

⁶We present the formal framework of branching time in section ??.

⁷See also Condoravdi, 2002 .

a time equal to or after t , including those worlds that are highly different in their causal laws from the actual world as well as those worlds in which current causal and social laws malfunction.

In this framework, Mari (2013) defines ‘reasonable futures’ as in (57). For any $t \in T$,

$$(57) \quad \text{ReasFut}(t) := \{w_i \in cg(t) \mid w_i \text{ is such that the set of rules fixed at } t \text{ continue to hold in } w_i\}$$

The set of reasonable worlds determined at a certain time t is different according to different epistemic agents, and the facts that they take into account at the time of the utterance. Hence, amending (57), we define (58), where epistemic agents are added as parameters.

$$(58) \quad \text{Given the epistemic agent } i, \text{ ReasFut}(t) := \{w_i \in cg(t) \mid w_i \text{ is such that the set of rules fixed at } t \text{ and considered by } i \text{ continue to hold in } w_i\}$$

Let us note here, the actual world w_0 is not an already existing complete history (see Mari, 2013 for a more detailed discussion). Let us consider the utterance time t_u . At t_u , one can state what the reasonable futures of time t_u are, however, one cannot state whether the actual-world-to-come belongs to the set of reasonable possibilities, since the actual-world-to-come does not exist yet at t_u .

Reasonable futures are not a projection of speakers’ preferences and beliefs; *they are metaphysical alternatives* that do not exist yet at the time of the utterance.

Moreover, as we have explained, one cannot state at the time of the utterance whether the actual-world to come will be reasonable or not. At the utterance time, we know whether the actual world is reasonable or not until the utterance time, but we do not know whether the actual-world-to-come will be reasonable after the utterance time.

We claim that, when stating a future sentence, on the predictive reading the speaker chooses to consider, based of its present knowledge, only reasonable futures on the, a subset of the common ground. This does not mean that he knows that the actual world-to-come will be reasonable, as the actual world to come is not there yet, and therefore, cannot be known. However, the speaker has confidence that the actual world to come will be a reasonable one. In the bare case (*John will come at 4pm*), the assumption that the actual world to come will coincide with a reasonable future at 4pm is ranked very highly, which means, associated with a high degree of confidence. This means that FUT itself must carry by default high confidence, consistent with what we observed with the non-predictive reading. On the other hand, when we have an overt *adverb*, *it is the adverb that provides the measure of confidence that the actual world to come will be reasonable* (i.e. will be in $\text{ReasFut}(t_u)$). For instance, if the adverb is *probably*, and the measure interval is between 1 and 100, then *probably*(FUT(p)) says that, according to the speaker, the probability of the actual world to be a reasonable future where p is true is between 85 and 100 percent.

We are now ready to provide an analysis for the predictive use of the future, which is in (59):

$$(59) \quad \text{FUT(NON-PAST}(p)) = 1 \text{ iff } \forall w' \in \text{ReasFut}(t_u) : \exists t' \in [t_u, \infty) (\wedge p(w't'))$$

Presupposition: There is a measure function that measures the speaker’s confidence that the actual-world-to-come will be in $\text{ReasFut}(t_u)$. The default value of the adverb is above 70%.

Truth condition: p is true only in the the reasonable futures, given the evidence:
 $\forall w' \in Best_{g(w)}(\cap f(w)) : p(w') = 1$. All reasonable futures are p futures.

To sum up: in the purely epistemic reading, the future morphemes operate on epistemic alternatives, and have the expected ordering that comes with epistemic modals. So in all respects, they behave like epistemic modals. In our predictive analysis, we used metaphysical, not epistemic alternatives. The epistemic layer here is detected in the contribution of adverbs, which will now measure how confident the epistemic agent is that the actual world to come will be a reasonable one. So this epistemic presupposition is what unifies both uses of the future.

5 Conclusions

The major lessons in the present paper are two. First, future particles and verbs, as well as epistemic modals such as MUST are used systematically in a number of languages (Greek, Italian, English, Dutch) as *epistemic weakeners*, to express weaker epistemic commitment of the speaker towards the propositional content. As a class then, MUST and futures in this function are non veridical (pace von Stechow and Gilies 2010, and in support of Karttunen’s original weak analysis, and Giannakidou’s nonveridicality thesis 1998, 1999). The second lesson is that in both predictive and epistemic uses of the future morphemes, the modal adverbs contribute a presupposition that there is a measure of confidence in the assessment of the individual anchor i which measures how confident i is that the actual world will be within the set of the best, or more reasonable worlds. This insight, we would like to suggest, probably describes a generalized ingredient of epistemic modals: they do not simply make a claim about the possible worlds, but bear relevance to whether an agent i thinks that the actual world is one that conforms to the best ordering, and to what degree. In the predictive reading, we argued that both epistemic and metaphysical dimensions are needed. The epistemic dimension again is revealed by the role of modal adverbs. In both uses, the adverbs come about as modulators of the speaker’s confidence, which seems to be the ubiquitous epistemic ingredient of the future.

References

- Bertinetto, P.M. 1979. Alcune Ipotesi sul nostro futuro (con alcune osservazioni su potere e dovere), *Rivista di grammatica generativa* 4: 77-138.
- Broekhuis, H. and Verkuyl, H. (to appear). Binary Tense and Modality. *Natural Language and Linguistic Theory*.
- Blaszack, J. and Dorota Klimek-Jankowska] 2012. Futures in Polish and Slovenian from the perspective of a force-dynamic model. In Aguilar-Guevara, A., A. Chernilovskaya, and R. Nouwen (eds.), *Proceedings of Sinn und Bedeutung 16: The Utrecht Meeting, 2011*. (MIT Working Papers in Linguistics). Cambridge, MA: MIT Press, 85-98.
- Chiou, Michael. 2012. The interpretation of Greek future: a pragmatic approach. Ms.
- Cinque, G. 1999. *Adverbs and Functional Heads*. Oxford: OUP.
- Condoravdi, C. 2002. Temporal interpretation of modals: modals for the present and for the past. In *The Construction of Meaning*, eds D. Beaver, Luis D. Cassillas Maritinez, Brady Z. Clark, S. Kaufmann.

- Copley, B. 2002. The semantics of the future, PhD MIT.
- Dowty, David 1979. *Word Meaning and Montague Grammar*. Dordrecht: Kluwer Academic Publishers.
- Ernst, Thomas 2009. Speaker oriented adverbs. *Natural Language and Linguistic Theory* 27, 497-544.
- Faller, M. 2002. Semantics and pragmatics of evidentials in Cuzco Quechua. PhD thesis, Stanford University.
- Farkas, D. 1992. On the Semantics of Subjunctive Complements, in P. Hirschbühler (ed.), *Romance Languages and Modern Linguistic Theory*, John Benjamins, pp. 69-105.
- von Fintel, K. and Gillies, A. 2010. Must...stay... strong ! *Nat. Language Semantics* 18: 351-383.
- von Fintel, K. and Heim, I. 2007. Intensionality. Ms. MIT.
- von Fintel, K. and Iatridou, S. 2006. How to Say Ought in Foreign: The Composition of Weak Necessity Modals. Ms. MIT.
- Giannakidou, A. 1998. *Polarity Sensitivity as (Non)veridical Dependency*. John Benjamins. Amsterdam.
- Giannakidou, A. 1999. Affective dependencies. *Linguistics and Philosophy* 22: 367-421.
- Giannakidou, A. 2009. The dependency of the subjunctive revisited: temporal semantics and polarity. *Lingua* 120: 1883-1908.
- Giannakidou, A. 2012. The Greek future as an epistemic modal. In the *Proceedings of ICGL 10*.
- Giannakidou, A. to appear. The modality of the present and the future: Greek, Dutch, and beyond. To appear in *Natural Language and Linguistic Theory*.
- Giannakidou, this volume. The landscape of subjunctive: epistemic and evaluative dimensions. Giannakidou, A. & Mari, A. 2012a. Italian and Greek futures as epistemic operators. to appear in *CLS* 48.
- Giannakidou, A. & Mari, A. 2012b. Italian and Greek futures as evidentials operators. to appear in *Proceedings of Sinn und Bedeutung* 17.
- Giannakidou, A. & Yoon, S. 2011. The subjective mode of comparison: metalinguistic comparatives in Greek and Korean. *Natural Language and Linguistic Theory* 29:621-655.
- Hacquard, V. 2006. Aspects of Modality. PhD MIT.
- Hacquard, V. 2011. Modality. In C. Maienborn, K. von Stechow, and P. Portner (eds.) *Semantics: An International Handbook of Natural Language Meaning*. HSK 33.2 Berlin: Mouton de Gruyter, pp. 1484-1515.
- Harris, Jesse A. and Christopher Potts. 2009. Perspective-shifting with appositives and expressives. *Linguistics and Philosophy* 32(6):523-552
- Huitink, J. 2012. Modal concord. A case study in Dutch. *Journal of Semantics* 29(3): 403-437.
- Homer, V. (2010). Epistemic Modals: High ma non troppo. *Proceedings of NELS* 40.
- Kaufmann, S. 2005. Conditional Truth and Future Reference. *Journal of Semantics*. doi: 10.1093/jos/ffh025
- Kaufmann, S., Condoravdi, C. Valentina Harizanov, V. 2006. Formal approaches to modality. In W. Frawley (ed.), *The Expression of Modality*, Mouton de Gruyter., 71-106.
- Kissine, M. 2008. From predictions to promises. *Pragmatics and Cognition* 16:169-189. K
- Kratzer, Angelika. 1981. The Notional Category of Modality. In *Words, Worlds, and Contexts. New Approaches in Word Semantics*, ed. By H. J. Eikmeyer & H. Rieser, 38?

74. Berlin: de Gruyter.

Kratzer, A. 1991. Modality. In *Semantics: An International Handbook of Contemporary Research*, ed. By A. von Stechow & D. Wunderlich, 639-650. Berlin: de Gruyter.

Lassiter, D. 2011. *Measurement and Modality: the Scalar Basis for Modal Semantics*. PhD thesis, NYU.

Lassiter, D. 2013. On the weakness of must: in defense of the mantra. Paper presented at the CSLI workshop Perspectives on Modality. Stanford University.

Matthweson, L. 2010. Crosslinguistic variation in modality systems: the role of mood. *Semantics and Pragmatics 3*: 1-74.

Mari, A. 2009. Disambiguating the Italian Future. In *Proceedings of Generative Lexicon*, 209-216.

Mari, A. 2010. On the evidential nature of the Italian future. Ms. IJN http://jeannicod.ccsd.cnrs.fr/docs/00/67/85/49/PDF/Evidential_Future_Italian.pdf

Mari, A. 2013. *Each other*, asymmetry and reasonable futures. *Journal of Semantics*. doi: 10.1093/jos/fft003

Mari, A. to appear. On the modal meaning of Italian future tense. *Lingvisticae Investigationes*.

McCready, E. and N. Ogata. 2007. Evidentiality, modality, and probability. *Linguistics and Philosophy 30*:147-206.

Merchant, Jason. 2013. Individual anchors for tenses; how Keats learned to read before Shakespeare. *Linguistic Analysis 38*. Murray, Sarah. 2010. Evidentiality and the Structure of Speech Acts. PhD thesis, Rutgers.

Palmer, F.R. 1987. *Mood and Modality*. Cambridge UP.

Portner, Paul 1998. The Progressive in Modal Semantics. *Language 74*(4): 760-87

Portner, P. 2009. *Modality*. Oxford University Press.

Prior, A. 1957. *Time and Modality*. Oxford: Oxford University Press.

Smirnova, A. 2012. Mood in Bulgarian. To appear in CLS 48.

Squartini, M. 2004. Disentangling evidentiality and epistemic modality in Romance. *Lingua, 114*: 873-895.

Thomason, R. 1984. Combination of Tense and Modality, in D. Gabbay; F. Guenther (eds.), *Handbook of Philosophical Logic: Extensions of Classical Logic*, Dordrecht: Reidel, 135-165.

Tsangelidis, Anastasios. 1998. *Will and tha: a Comparative Study of the Category Future*. Thessaloniki: University Studio Press.