A unified analysis of the future as epistemic modality: the view from Greek and Italian

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Abstract

We offer an analysis of the Greek and Italian future morphemes as epistemic modal operators. The main empirical motivation comes from the fact that future morphemes have systematic purely epistemic readings crosslinguistically— in Dutch, German, Greek and Italian, as well as with English *will*. The existence of epistemic readings suggests that the future expressions quantify over epistemic, not metaphysical alternatives. We provide a unified analysis for epistemic and predictive readings as epistemic necessity, and the shift between the two is determined compositionally by the lower tense. Our account thus acknowledges a systematic interaction between modality and tense— but the future itself is a pure modal, not a mixed temporal/modal operator We show that the modal base of the future is nonveridical, i.e. it includes p and $\neg p$ worlds, parallel to epistemic modals such as *must*, and present further arguments showing that future morphemes have much in common with epistemic modals, most centrally in receiving a truth value relative to an individual anchor.

1 The future: what is the nature of prediction?

The future, as a notional category in language, has puzzled theorists since Aristotle's famous sea battle examples (*De Interpretatione*, Book IX). Aristotle offers what can be thought of as the first non-deterministic analysis. He posits that, while the truth or falsity of a future sentence will be determined by how things will turn out, at the speech time the future is open. This openness of the future is both metaphysical (a future event may or may not happen), and epistemic, in the sense that one cannot *know* a future event because it hasn't happened, in contrast to past or present events.

In the literature on tense, on the other hand, future sometimes features as the dual of past tense (Prior 1967). Kissine 2008, more recently, defends a temporal analysis of *will*; but it is not at all obvious that *will* is a tense. Huddleston and Pullum 2002, in their comprehensive *Cambridge Grammar of the English Language* argue that: "our knowledge of the future is inevitably much more limited than our knowledge about the past and the present, and what we say about the future will typically be perceived as having the character of *prediction* rather than an unqualified factual assertion." (Huddleston and Pullum 2002: 190). Huddleston and Pullum therefore treat *will* not as a tense but as a modal, and highlight that *will* is a member of the class of English modal verbs. Earlier advocates of modality of *will* are Palmer 1987, Coates 1983 and Enç 1996.

Enç 1996, in addition, points out that regular tenses, present and past, are deictic (Partee 1984, Heim 1994, among many others), while the future is not. The past tense in *Ariadne finished her homework*, for instance, denotes a contextually salient time in the past where Ariadne finished her homework, but *Ariadne will finish her homework* does not refer to a time. As Aristotle points out, there may, or *may not*, be a future time t at which Ariadne finishes her work in the actual world. This is a significant asymmetry between past and future that prevents characterization of future as tense; Enç (*ibid.*) offers a number of additional asymmetries in defense of her position that *will* is a modal; see also Klecha 2013 for more recent discussion and tests.

Cross-linguistically too future expressions are known to convey modality (see e.g. Bertinetto 1979; Copley 2002; Pietrandrea 2005; Mari 2009,2015b; Giannakidou 2012; Giannakidou and Mari 2013a,b,to appear; Broekhuis and Verkuyl, 2014). It therefore appears reasonable to assume that prediction involves modality. The question then becomes: what kind of modality is prediction? The Aristotelian position is that prediction involves indeterminacy: the future sentence FUT p is metaphysically unsettled or *objectively nonveridical*, in the sense that it is not true at the time of utterance;[1] and it remains to be seen if the prejacent p will be true at a future time (Giannakidou 1998, 2013a; Giannakidou and Zwarts 1999; Condoravdi 2002; Copley 2002; Kaufmann 2005; McFarlane 2005; Kaufman et al. 2006; Bonomi and Del Prete 2008, Cariani and Santorio 2015, Todd forthcoming). Besides objective unsettledenss and nonveridicality, the future sentence is also epistemically unsettled: the speaker does not, and cannot, know whether there will be a future time t at which the prejacent will be true in the actual world.[2] In other words, there are two dimensions of modality that seem like candidates for the modality of prediction: metaphysical and epistemic modality. How do we chose?

In this paper, we focus on the Greek and Italian future morphemes, and argue that the study of these futures allow us to make a good argument that the modality of prediction is epistemic and *not* metaphysical. To our knowledge, there is no detailed formal analysis of prediction as epistemic modality, and we are set to present such an analysis here. At the time of prediction, the speaker has knowledge that determines what she predicts, and this knowledge is the foundation (i.e. the modal base) for prediction. Crucially, in case knowledge or beliefs of the speaker conflict with what is the case, the prediction relies not on what is the case but on what the speaker believes to be the case.

The discussion proceeds as follows. In section 2, we show that future morphemes crosslinguistically can be used with present or past tenses receiving purely epistemic readings. This presents our first and most central argument that future morphemes function as epistemic operators, i.e. akin to *must*. If epistemic modality is needed for epistemic future anyway, then the null hypothesis is that the predictive reading is also epistemic. In section 3, we offer the formal framework of modality that we will use, including the notion of *subjective veridicality* that is needed for truth relativized to individuals. In section 4, we consider and reject the metaphysical analysis of the future, offering additional arguments for a strong parallelism between prediction and epistemic *must*. We also show

[1] We use FUT in this article to refer to expressions of future crosslinguistically, i.e. English *will* and Greek *tha* are FUT. We also use FUT to indicate the semantic function: FUT in various languages are realizations of the operator FUT in this sense. In the text, it is easy to see which sense is intended, but we also clarify when necessary.

[2] There is also a deterministic view: no unsettledness, just one future but we lack knowledge of it (Kissine 2008). That would render future morphemes tense operators. A mixed position could also be conceived, namely that future morphemes are ambiguous between modals and tenses. Such a view would stumble upon the fact that the temporal information correlates with lower tense, as we shall see. The possibility for modal and temporal ambiguity in any case should be dispreferred if an unambiguous analysis succeeds.

that metaphysical modality is often not relevant, or makes the wrong predictions. We then lay out our epistemic analysis of prediction. In section 5, we address the role of tense in determining which reading will emerge, and we focus on how the non-past produces the predictive reading. We give a fully explicit syntax-semantics of the Greek and Italian structures containing future. In section 6, we compare our analysis to the idea of *will* as a bouletic modal, and offer more cross linguistic predictions. In our discussion, it becomes clear that *will* can also be treated as epistemic future, but of the particular kind we call *ratificational*, following Mari (2015b).

2 Epistemic future as an epistemic modal

A major argument for the role of epistemic modality in the future is the existence of *epistemic future* (Giannakidou and Mari 2013a,b, 2016). Epistemic future arises when future expressions are used with lower present or past tenses purely epistemically, without making a prediction. This should not happen if future expressions were simply future tenses. Epistemic future is observed in Greek and Italian, but also in Dutch, German, English, and many other languages (see Comrie 1985, Haegeman 1983, Palmer 1987, Kush, 2011, Matthewson, 2012).[3] We start with the following, well-known, English data:

(1) a. That will be the postman.
b. The French will be on holiday this week. (Palmer 1987)

These sentences do not make predictions. They make no reference to a future time. Rather they seem to convey epistemic modality: given what I know and general stereotypical assumptions, the French are on holiday this week (see Palmer 1987 and the references above for more data and nuances). The tense of the infinitive is a non-past, which in this case is understood as a present since the statements are about what currently is the case.

Likewise, Dutch and German futures have been reported to have purely epistemic present uses (examples from Broekhuis and Verkuyl 2014 for Dutch, Giannakidou 2014a for Dutch; Lederer 1969 for German; Tasmowski and Dendale 1989; de Saussure and Morency, 2011, Mari 2015b for French).

(2) Context: I can't see Hein.
Hein zal (wel) in de/op see zijn. (Dutch)
Hein FUT particle in the/on sea be.
'Hein must be at sea (swimming/on a boat).'

(3) Context: the speaker is wondering about the time, there is no watch:
a. Es wird jetzt 5 uur sein. (German)
it FUT now 5 hour be.
b. Het zal nu 5 uur zijn. (Dutch)
it FUT now 5 hour be.
'It must be now 5 o' clock.'

[3]Pietrandrea (2005) uses the term 'epistemic future' for the first time for Italian future, but only for the epistemic use of the future. We thank Fabio Del Prete for bringing this point to our attention.

As indicated, the Dutch and German future words *zal, wird* are used as epistemic modals equivalent to *must*. The *must* statement is epistemically weaker than an umodalized assertion (an idea that we further elaborate on this paper, and which goes back to Karttunen 1972; von Fintel and Gillies 2010 call it the *Mantra*). As Huddleston and Pullum put it, the knowledge grounding the future sentence "is more limited" than knowledge grounding a sentence with a simple present or past. Modal particles such as *wel, wohl* can also be used with the future; when alone in Dutch and German, they have a similar *must* equivalent use and produce epistemically weaker statements (Zimmermann 2011; Giannakidou 2014a):

(4) a. Max ist wohl auf See. (German; example from Zimmermann 2011)
Max is particle on sea.
b. Max is wohl on See. (Dutch)
Max is particle on sea.
'Max must be in the sea.'

Zimmermann says that with *wohl*, the epistemic commitment of the speaker is *weakened* compared to the plain sentence, while also conveying a confidence that the proposition is likely to hold. This is the typical reading of the *must* sentence— and the take-home message is that we find it with the modal particles, the words MUST, and the future words.

Broekhuis and Verkuyl 2014 treat the Dutch *zal* as an epistemic modal expressing that the prejacent proposition is the result of reasoning based on information judged as 'reliable and well-founded', and Giannakidou 2014b (attributing the example to J. Hoeksema) further shows that *zal* receives purely epistemic reading with past, as in (5):

(5) A: He is so grumpy. Hij *zal* wel slecht geslapen hebben! (Dutch)
A: he is so grumpy. He FUT particle bad slept have.
'He must have slept really bad!'

(6) Ich habe meinem Freund letzte Woche einen Brief geschrieben; er *wird* ihn sicher schon bekommen haben. (German)
'I wrote a letter to my friend last week; he must surely have already received it.' (Lederer 1969, p.98, ex. 584).

Morphologically, a present perfect appears in Dutch and German, just as in English *must have slept*, and not a simple past **must slept*. The simple past is excluded because the modal verb takes an infinitival complement, and this necessitates the use of the auxiliary, resulting in an apparent present perfect. Greek, on the other hand, lacks infinitives and the modal embeds a tensed clause; a simple past is therefore fine (ex. (13), (14) next).[4] The sentences above, in any case, show that a future morpheme can combine with lower PAST, and when this happens the interpretation is a modality about a past event; there is no predictive reading. These are purely epistemic statements that the speaker makes about a past situation that she considers likely based on her knowledge.

There appears to be a generalization, then, that future morphemes crosslingusitically are not used just to make predictions, but are also used to make epistemic *must*-like statements about the

[4]The perfect after MUST, importantly, does not seem to convey properties associated with unembedded present perfect in English: for instance, it is compatible with definite adverbials, unlike the unembedded perfect. Compare: *Max must have visited the museum in 1961* vs. the odd # *Max has visited the museum in 1961*. In section 5, we analyze the apparent perfect under FUT as a combination of PAST and perfective.

present or the past. Common to the epistemic and the predictive reading is that the speaker, in order to felicitously use the future word, does not *know* that p is true. If she knows that p is true, she cannot use a modal at all, and this holds also for MUST (as we argue further in section 3).

For Greek and Italian, epistemic future has been known for quite a while (Bertinetto 1979, Rocci 2001, Squartini 2004, Pietrandrea 2005, Mari 2009a,b,c,2015a for Italian; Tsangalidis 1998, Giannakidou 2012, Chiou 2014 for Greek), but the data have unfortunately not featured significantly in formal theories of the future, which tend to focus on *will*. Unlike *will*, which is a modal verb, the future markers in Italian and Greek are a bound morpheme and a particle (*tha*) respectively. In Greek, the future *tha* is followed always by a tensed verbal form (TP), just like the subjunctive particle *na* and other modal particles. A similar pattern exists in Italian (more in section 5.3).

To understand the patterns, it is important to note that tense and aspect are always reflected morphologically on the Greek verb. The grammars describe the temporal opposition as one between past and non-past, and the aspectual distinction is perfective vs. imperfective. The morphological combinations create three semantic tenses (Giannakidou 2009, 2014)— PRES, a simple past, and a nonpast, which is the form used for prediction. We illustrate these combinations below:

(7) graf- -o. (Greek Imperfective non-past: PRES)
write.IMPERF -1SG.NONPAST.
I am writing (right now).
'Write' (generally).

The morphological imperfective non-past is semantically the present tense (PRES) in Greek (Giannakidou 2009, 2014), comparable to English simple present and progressive. The perfective non-past, on the other hand, is a dependent form, *ungrammatical* by itself:

(8) *grap- s- o (Greek perfective non-past: verbal *dependent*)
write- PERF 1SG.NONPAST.
(no English equivalent; * on its own)

The perfective non-past has no English equivalent, and is ungrammatical by itself, as indicated. It is quite rare to find grammatical perfective non-pasts in languages (Giorgi and Pianesi 1997):

(9) *grapsi i Ariadne. (Greek)
write.PERF.NON-PAST.3SG the Ariadne.

Holton et al. 1997 and Giannakidou 2009 call this form the *verbal dependent*. The form is used with the future for prediction, subjunctive and other modal particles. We offer an analysis of this form as a semantic nonpast in section 5.

The past is marked in Greek with the presence of e-, and we have again two options, perfective and imperfective. The imperfective past is the typical preterite as in, e.g., Romance languages. The perfective past, on the other hand, is called the *aorist* and denotes a single (usually completed) event in the past. It is interpreted as a default simple past in English:

(10) e- graf- a. (Greek Imperfective past)
PAST- write.IMPERF- 1SG.PAST.
'I used to write.'
'I was writing.'

(11) e- grap- s- a. (Greek perfective past (aorist))
PAST- write- PERF- 1SG.PAST.
I wrote.

Future *tha* combines with all of the above tenses. Notice first the combinations of FUT with the PRES (gerund plus stative) in Italian.

(12) a. I Ariadne tha troi tora. (Greek)
the Ariadne FUT eat.PRES.3SG now.
'Ariadne must be eating now.'
b. Giacomo ora starà mangiando. (Italian)
Giacomo now be.3SG.FUT eat.GERUND.
'Giacomo must be eating now.'

(13) a. I Ariadne tha ine arrosti (ji'afto dhen ine edo). (Greek)
the Ariadne FUT be.3SG.PRES ill (for-this not is here).
'Giovanni must/#will be ill (that's why she's not here).'
b. Giovanni sarà malato (per questo non è qui). (Italian)
Giovanni be.3SG.FUT ill (for this not is here).
'Giovanni must/#will be ill (that's why he's not here).'

FUT plus PRES does not have a predictive reading. In Italian, as we discuss later, Aktionsart plays the role that aspect plays in Greek.[5] The examples above lack a predictive reading. The same holds with combinations of FUT with a lower past (an aorist in Greek, a stative or gerundival past in Italian), which receives epistemic non-predictive readings:

(14) a. I Ariadne tha itan arrosti xthes (ji'afto dhen irthe). (Greek)
the Ariadne FUT be.3SG.PAST ill yesterday (for-this not came.3sg.
'Ariadne must/#will have been ill yesterday (that's why she didn't come).'
b. Giovanni sarà stato malato ieri (per questo non é venuto). (Italian)
Giovanni be.3SG.FUT been ill yesterday (for this not has come).
'Giovanni must/#will have been ill yesterday (that why he didn't come).'

(15) a. I Ariadne tha efige xthes. (Greek)
the Ariadne FUT leave.3SG.PAST yesterday.
'Ariadne must have left yesterday.'
b. Gianni avrà parlato ieri. (Italian)
Gianni have.3SG.FUT spoken yesterday.
'Gianni must/ #will have spoken yesterday.'

With present and past forms, then, Greek and Italian futures (like the Dutch, German, and English) receive epistemic non-predictive readings.[6] We revisit the interaction with the tenses later. The important observation here is that the Greek and Italian futures, in combinations with PRES and PAST, lack predictive readings and are purely epistemic. These uses, crucially, are quite common and do not feel in any way marked or exceptional.

[5]The role of Aktionsart in connection with modal interpretation has been largely studied across languages and categories, see Condoravdi, 2002; Laca, 2008; Copley, 2009. See *infra* for discussion.

[6]Epistemic *will* with the past is odd, as indicated. We suggest why this is so in our discussion of *will* in section 6.3.

Importantly, when combined with PAST, we do not obtain a future of a past reading in either language. To obtain a future of a past, Italian uses the conditional, and Greek the imperfective past which is treated as a conditional mood, as we said earlier (Iatridou 2000, Giannakidou 2012: (21)):

(16) Gianni sarebbe arrivato più tardi.
Gianni be.COND arrived more late.
'Gianni would arrive later.'

(17) I Ariadne tha efevge argotera.
the Ariadne FUT leave.imperfective.past.3sg later
Ariadne would leave later.

Following Iatridou and Giannakidou, we will treat [*tha* imperfective past] as the conditional in Greek, and will therefore not discuss this form further.

Mari 2009a,b,c, Giannakidou and Mari 2013a,b, 2016 observe that epistemic futures, like epistemic necessity modals, cannot be used if the speaker knows p. This has been treated as an evidentiality constraint on MUST (Karttunen 1972, von Fintel and Gillies 2010, Giannakidou and Mari 2016). As we see, FUT is akin to MUST, and can even co-occur with it:

(18) *Context: Direct visual perception of rain.*

a. #It must be raining.
b. #Tha vrexi. (Greek)
FUT rain.PRES.3sg.
c. #Starà piovendo. (Italian)
be.3SG.FUT rain.gerund.
d. #Tha prepi na vrexi. (Greek)
FUT must SUBJ PRES.3sg.
e. #Dovrà star piovendo. (Italian)
Must.3SG.FUT be rain.gerund.

(19) I see a wet umbrella.

a. It must be raining.
b. (Tha) Prepi na vrexi. (Greek)
FUT/Must subjunctive rain.PRES.3sg
c. Deve star piovendo. (Italian)
Must.3SG.PRES be rain.gerund.
It must be raining.
d. Starà piovendo. (Italian)
be.3SG.FUT rain.GERUND.
It must be raining.

Sensitivity to knowledge is expected by epistemic operators, and as we see epistemic futures are fully equivalent to *must* and the respective epistemic necessity modals in Greek and Italian. Giannakidou and Mari (2016) propose further that it is not indirectness of knowledge but rather partiality that regulates evidentiality with MUST/FUT, but this is not of relevance here. The crucial point is that future and epistemic necessity modals pattern on a par, and are not compatible with knowledge of p that direct evidence provides. (FUT co-exists with MUST in (18-d)-(18-e) and (19), and we

come back to what this may mean in the conclusions).

The predictive reading emerges with perfective nonpast in Greek, and eventives in Italian:

(20) O Janis tha ftasi avrio. (Greek)
The John FUT arrive.NONPAST.PERF.3SG tomorrow.
'John will arrive at 5pm/tomorrow.'

(21) Gianni arriverà domani. (Italian)
John arrive.3SG.FUT tomorrow.
'John will arrive tomorrow.'

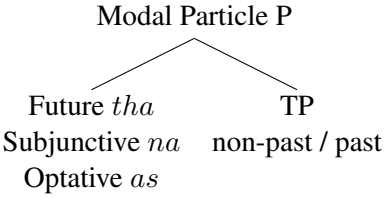
As said earlier, this form appears with other modal particles such as the subjunctive and the optative, again with future orientation. Crucially, as shown earlier (ex. (8)), it is ungrammatical on its own:

(22) Thelo na ftasi noris o Janis. (Greek)
I-want SUBJ arrive.NONPAST.PERF.3SG early the John.
I want John to arrive early.

(23) As ftasi noris o Janis! (Greek)
OPT arrive.NONPAST.PERF.3SG early the John.
Let John arrive early!

Giannakidou 2009 treats this form as a semantic nonpast, and we address its role in section 5. The syntax we adopt, following Giannakidou (*ibid.*), is the following:

(24)



We assume that Italian has the same abstract structure, but relies on Aktionsart below TP. Greek and Italian look similar to languages such as Gitksan (with prospective aspect under their modal; Matthewson, 2012), and Hindi (Kush 2011)– more discussion in section 5. In the rest of the paper, our goal is to give an adequate characterization of the meaning of the future markers *tha* and Italian *futuro*. Given the basic sample of data presented here, the following generalizations emerge:

1. *Tha* and *futuro* are not used just for prediction.
2. They have purely epistemic readings with present and past forms (which we call PAST, and includes present perfects in Germanic languages and past participles in Italian).
3. The lower tense fully determines the type of reading. The predictive reading arises with lower nonpast.

Given the above, it becomes clear that *tha* and *futuro* are neither temporal nor purely predictive operators. (And given what we see in typological works (e.g. Palmer, 1987), purely predictive future markers without any epistemic uses are simply hard to find.). Mari 2009a,b,c and Giannakidou and Mari 2013a,b, 2016 offer an analysis of *tha* and *futuro*, in the non-predictive use, as epistemic modals equivalent to *must*. If indeed *tha* and *futuro* are epistemic in the non-predictive use, then the

null hypothesis is that they are epistemic also in the prediction. Such a simple unified theory should be preferred over an ambiguity account that would distinguish between epistemic vs. metaphysical *tha* and *futuro* (as we did in Giannakidou and Mari 2013b).

We will propose that the interaction with tense determines the type of reading; but unlike Condoravdi 2002, (a) *tha* and *futuro* are not mixed modal/temporal operators, and (b) the tense doesn't change the modality (i.e. the type of modal base), which remains epistemic. Prediction is epistemic reasoning, i.e. a conjecture, about an event that is not located in the present or past.

In the epistemic analysis, *tha* and *futuro* are the duals of epistemic modals such as *might*, which also make predictions with non-past forms (see Enç 1996):

(25) Ariadne might see the movie tomorrow.

What the speaker knows at present allows her to predict that it is possible that there will be a time t tomorrow when Ariadne sees the movie. This is a predictive reading, albeit weaker than the version with the future modal:

(26) Ariadne will see the movie tomorrow.

The contrast is due to the fact that the future modal *will* is a necessity operator, but *might* is mere possibility. Let us now give the analysis of epistemic future. This will allow us to elaborate on the notions on nonveridicality and relative truth that appear to be crucial for epistemic modals, including of course, the future.

3 Epistemic modality, (non)veridicality, and truth

We assume a Kratzerian semantics where modals take modal bases and ordering sources, We add two ingredients, following Giannakidou 1998, 2012, 2013b, Mari 2009a,b and Giannakidou and Mari 2013a,b, 2016: the first one is the *Nonveridicality Axiom* that all modal bases triggered by modals are nonveridical (see also Beaver and Frazee 2011 for nonveridicality as a defining property of the category modality). The second addition concerns the nature of the veridicality judgement. We will talk about objective and subjective truth, the latter being truth relative to an individual's knowledge and beliefs.

3.1 Objective Veridicality and Nonveridicality

Montague 1969 uses 'veridicality' to characterize sentences with direct perception verbs such as *see*. Giannakidou's earlier work and Zwarts 1995 define veridicality in terms of truth entailment:[7]

(27) Veridicality; nonveridicality; antiveridicality (modifying Zwarts 1995, Giannakidou 1997, 1998, 1999). Let F be a unary sentential operator. The following statements hold:
(i) F is veridical iff F$p \rightarrow p$ is logically valid;
(ii) F is nonveridical iff F$p \nrightarrow p$;
(iii) F is antiveridical iff F$p \rightarrow \neg p$.

[7] See Giannakidou 2013a for a formal connection between truth and existence.

Operators, or more broadly, functions F that have veridicality and nonveridicality are propositional.[8] F is veridical iff Fp entails p, i.e. if whenever Fp is true, p is true too. F is nonveridical if Fp does not entail p, i.e. if when Fp is true, p may or may not be true. The contrast is illustrated below with the adverbs *yesterday* and *allegedly*:

(28) Yesterday, John flew to Paris.

(29) Allegedly, John flew to Paris.

Yesterday is a veridical adverb because *yesterday (John flew to Paris)* entails that John flew to Paris. But *allegedly* is nonveridical because *allegedly (John flew to Paris)* doesn't entail that John flew to Paris. Likewise, modal adverbs appear to be nonveridical:[9]

(30) *Probably, Possibly, Maybe, Perhaps*, John flew to Paris.

Note that nonveridical operators do not entail the falsity of p; this is a property of a subset of nonveridical operators such as negation which is *antiveridical*. Antiveridical operators are also nonveridical, since for them too the veridicality schema is not valid: $\neg p$ does not entail p.[10]

Thus far, (27) defines veridicality *objectively*— or extensively, i.e, as a truth entailment about what is the case in the real world without reference to subjective parameters such as what individuals know or believe. Nonveridicality is the absence of such truth entailment. In this objective sense, veridicality and anti-veridicality correspond to metaphysical settledness: if a function F is veridical, p in Fp is metaphysically settled; $\neg p$ is also metaphysically settled. Under a nonveridical operator, on the other hand, p is metaphysically unsettled. Besides modal adverbs, modal verbs too are nonveridical and metaphysically unsettled.

The sentences under the veridical or nonveridical operator can be called veridical and nonveridical too. Another way to phrase the above is to say that an objectively veridical sentence refers to a fact, while a non-veridical sentence does not refer to a fact. Consider now the modal verbs:

(31) Nicholas might/must bring dessert.

(32) Nicholas might/must have brought dessert.

We just saw that modal adverbs are nonveridical. The same holds for modal verbs. Since MIGHT $p \rightarrow p$ is not logically valid, *might* is nonveridical. *Must* is also nonveridical, since MUST $p \rightarrow p$ is also not logically valid. (In other words, the principle T of modal logic is not validated, see Zwarts 1995, Giannakidou 1998, 1999). Modal functions, then, as a class (possibility as well as necessity modals, modal adverbs) are nonveridical in that they do not entail the truth of the prejacent proposition in the actual world; p is not metaphysically settled under a modal, it is not a fact.

We move on to discuss next *subjective* (non)veridicality, which is the notion we need in order to talk about relativized truth and speaker commitment.

[8] See Bernardi 2002 for type-flexible definitions

[9] An anonymous reviewer points out *evidently, clearly, unfortunately*, which could be seen as veridical. But these are factive adverbs, indeed veridical. Our point above is that *modal* adverbs are nonveridical, not *all* adverbs.

[10] Negation is the prototypical antiveridical operator, responsible for licensing negative polarity items (Giannakidou 1998, 1999, 2013b). Of the other logical connectives, disjunction is also nonveridical whereas conjunction is veridical.

3.2 Subjective (non)veridicality: relative and objective truth

In objective terms, we talk about sentences being true or false in the world irrespective of the individuals asserting them. This may be adequate for textbook purposes, but the truth judgement often appears to be more complex, and it is done not in isolation but relative to the speaker and hearer, who assess whether a sentence is true or not given what they know or what they believe (Giannakidou 1994, 1998, 1999, 2009; Harris and Potts 2009; de Marneffe et al. 2012). That such relativization is needed becomes particularly visible when we discuss propositional attitude verbs (*know, believe, imagine*, etc) and their complements (Farkas 1992, Giannakidou 1994, 1998, Mari 2016); but the role of the individual in assessing truth is apparent even in unembedded sentences (as expressed also very lucidly in Harris and Potts (2009) recent assertion that *all* sentences are perspectival).

When a speaker asserts a positive unmodalized sentence in the present or past, unless she is lying, she asserts p because she knows or believes that p is true; but when a speaker uses a modal verb, she may think that p is possible or even likely, but she doesn't know for sure that p is true. When speakers make assertions or assess assertions of others, they make *veridicality judgments* about the truth of the sentence— and the veridicality judgement is more complex than truth assignment objectively because it depends on what speakers know and how they extract information from context (see Giannakidou 1998, 2013a, Mari 2005a,b, Giannakidou and Mari 2016; de Marneffe et al. 2012 confirm this complexity with corpus data).

It makes sense, then, to talk about **objective** and **relative** truth and veridicality for all sentences;[11] for some sentences, in fact, we can only have relative truth, i.e. for sentences with predicates of personal taste (Lasersohn, 2005; Stephenson, 2007). In relative veridicality, the individual making the judgement is the *individual anchor* (Farkas 1992, Giannakidou 1994, 1998, et sequ.), or the *judge* (Lasersohn 2005), and p is assertable if the speaker knows or believes p. Another way to phrase this is to say that the speaker is committed to p. If the speaker doesn't know or believe p, she is said to not be committed to p. Moore paradoxical sentences *#p and I do not know that* p are thought to be infelicitous because the assertion of p requires that the speaker knows that p (see also Smirnova's 2013 notion of *epistemic commitment*). In this framework, objective truth is truth irrespective of the individual anchor, relative truth is truth relative to the anchor.

Giannakidou (*ibid.*) relativizes truth by making the veridicality judgement relative to individual anchors and their epistemic states. The truth of a sentence is now anchored to the individual asserting it. In main clauses the anchor is by default the speaker.[12] *Models of evaluation* are defined to describe the information states of anchors (see Giannakidou 2013a for updated discussion). These models are sets of worlds, relative to i, corresponding to what i believes or knows.[13] We call these models epistemic states in our definition below:

(33) *Epistemic state of an individual anchor* i (Giannakidou 1999: (45))

[11] We are grateful to the reviewers of this paper for prompting questions to this end.

[12] Individual anchoring of truth should be seen on a par with other kinds of anchoring of propositional content, i.e. temporal anchoring, or event anchoring (e.g. Hacquard 2006, 2010).

[13] The difference between knowledge and belief is not important for our purposes here, and in many other cases, e.g. for mood choice, it doesn't matter either—- as verbs of knowledge and belief both select the indicative in many languages (*a contrario*, see Mari 2016). Belief makes a difference for an agent typically when it is contrasted with knowledge, i.e. when the agent is aware that she doesn't have enough information to support a proposition. In this case, we can say that we have semantic narrowing (Geurts and van Tiel 2013).

An epistemic state M(i) is a set of worlds associated with an individual i representing worlds compatible with what i knows or believes.

We use the term **correct** to indicate a matching relation between the truth value of p subjectively, i.e. wrt an epistemic state, and objectively. i is correct if the value of p subjectively in M(i) is the same as the valuation of p objectively. i is said to be wrong if the value of p in M(i) is not the same as the valuation of p objectively. These will be useful when we consider the judgments about future sentences and epistemic modals in section 4.

Given M(i), we can now identify (non)veridicality subjectively as a property of functions F as follows:

(34) *Subjective veridicality* (for functions)
A function F that takes a proposition p as its argument is subjectively veridical with respect to an individual anchor i and an epistemic state M(i) iff Fp entails that i knows or believes p: iff $\forall w'[w' \in \mathrm{M}(i) \rightarrow p(w')]$.

Subjective veridicality reflects knowledge (see e.g. the classical treatment of Hintikka 1969). Crucially, believe and fiction verbs also denote subjectively veridical functions because their main clause subject (the believer) is in an epistemic state that fully supports p, regardless of whether p is actually (i.e. objectively) true. For instance, *Nicholas believes that Ariadne is a doctor* requires a veridical epistemic state, but the sentence *Ariadne is a doctor* can be objectively false.

(35) $[\![$Nicholas believes that $p]\!]$ is true in w with respect to M($Nicholas$) iff:
$\forall w'[w' \in \mathrm{M}(Nicholas) \rightarrow p(w')]$

The truth condition of the *believe* sentence does not entail actual truth, but *believe* is subjectively veridical, because the whole M($Nicholas$) supports p:

(36) *Support of a proposition p*
Let X be a set of worlds. X supports a proposition p iff all worlds in X are p-worlds.

When all worlds in M(i) are p worlds, p is *epistemically* settled in M(i). This is a state of full epistemic commitment: the epistemic state is a homogenous p-space. In an unembedded sentence, subjective veridicality and epistemic settledness are conditions on the assertability of the sentence:

(37) *Flavio is a doctor* is true wrt the speaker i iff $\forall w'[w' \in \mathrm{M}(i) \rightarrow doctor(Flavio)(w')]$.

In other words, an unmodalized, unembedded sentence epistemically expresses the speaker's belief or knowledge that p. A negative epistemic state, likewise, is also epistemically settled, i.e., a homogenous space of $\neg p$ worlds:

(38) *Flavio is not a doctor* is true wrt the speaker i iff $\forall w'[w' \in \mathrm{M}(i) \rightarrow \neg doctor(Flavio)(w')]$.

Hence, we can define epistemic settledness as follows:

(39) *Epistemic settledness*
M(i) is epistemically settled about p iff $(\forall w' \in \mathrm{M}(i)p(w')) \vee (\forall w' \in \mathrm{M}(i)\neg p(w'))$

A settled epistemic state is homogeneous and contains either only p worlds (the state is positively

epistemically settled) or only $\neg p$ worlds (the state is negatively epistemically settled).

Moving from subjective veridicality as a property of functions to subjective veridicality as a property of states, we define them as follows:

(40) *Subjective veridicality and antiveridicality (as properties of states).*

a. An epistemic state M(i) is subjectively veridical about p iff it is positively epistemically settled: i.e $\forall w' \in \mathrm{M}(i) : p(w'))$

b. An epistemic state M(i) is subjectively antiveridical about p iff it is negatively epistemically settled: i.e $\forall w' \in \mathrm{M}(i) : \neg p(w'))$

Subjectively nonveridicality, on the other hand, imposes non-homogeneity on M(i).

(41) *Subjective nonveridicality* (for functions)
A function F that takes a proposition p as its argument is subjectively nonveridical with respect to an individual anchor i an epistemic state $M(i)$ iff Fp does not entail that i knows or believes p: iff $\exists w' \in \mathrm{M}(i) : \neg p(w') \wedge \exists w'' \in \mathrm{M}(i) : p(w'')$.

A subjectively nonveridical function creates epistemic unsettledness in M(i). i does not know that p, and does not know that $not\ p$ either. We can once again move from nonveridicality as a property of functions to nonveridicality as a property of states.

(42) *Epistemic unsettledness*
M(i) is epistemically unsettled about p iff $\exists w' \in \mathrm{M}(i) : \neg p(w') \wedge \exists w'' \in \mathrm{M}(i) : p(w'')$

(43) *Subjective nonveridicality* (as property of states).
An epistemic state M(i) is subjectively nonveridical about p iff it is epistemically unsettled.

With subjective nonveridicality, M(i) as a whole does not support p: there is a subset of M(i) that supports p, maybe the subset that best complies with knowledge or evidence of i, but there is a complement set that doesn't support p. Nonveridical epistemic states are thus *weaker* than veridical ones because veridical states fully support p but nonveridical states only partially do so.

Modal verbs cannot be used when the speaker knows p, they reflect nonveridical states:

(44) Epistemic modal verbs are subjectively nonveridical
MAY/MUST p can be defined relative to an epistemic state $M(i)$ if and only if $\exists w' \in \mathrm{M}(i) : \neg p(w') \wedge \exists w'' \in \mathrm{M}(i) : p(w'')$.

With modal verbs generally, and epistemic modals in particular, M(i) is partitioned. Modal statements are therefore epistemically weaker (Giannakidou 1994, Giannakidou and Mari 2016) than unmodalized assertions. This explains why when the speaker knows p (as in the earlier context of direct perception of rain), it is not felicitous to modalize the sentence.

In other words, modal sentences are weaker than unmodalized sentences objectively– but even if we relativize truth, there is still a clear distinction between an unmodalized past and present sentence, which imposes epistemic states fully supporting p (or $\neg p$ if the sentence is negative), and modal sentences which are subjectively nonveridical and only partially support p. [14] Modalization creates always a weaker sentence and judgement, revealing a non-veridical epistemic state, which

[14] We thank two anonymous reviewers for their questions and insights that led to this discussion.

is a space partitioned into p and $\neg p$ worlds.

Here are, finally, veridicality and nonveridicality as properties of modal spaces— as might be needed also for modal bases of non-epistemic modals:

(45) *Veridical, nonveridical modal spaces (sets of worlds)*

a. A modal space M is *veridical* with respect to a proposition p iff $\forall w'(w' \in M \rightarrow p(w'))$

b. A modal space M is *nonveridical* with respect to a proposition p iff $\exists w', w'' \in M(w' \neq w'' \wedge (p(w') \wedge \neg p(w''))$

c. A modal space M is *antiveridical* with respect to a proposition p iff $M \cap p = \emptyset$.

It becomes obvious that modal bases in a Kratzerian semantics are nonveridical spaces, or as Condoravdi 2002 puts it, diverse. Necessity modals, as we will elaborate further below, have nonveridical bases due to their ordering. We propose that nonveridicality be a precondition on modalities, as can be seen in *Nonveridicality Axiom* below:

(46) *Nonveridicality Axiom of modals*
MODAL (M) (p) can be defined only if the modal base M is nonveridical, i.e. only if M contains p and non-p worlds.

In other words, nonveridicality is a presupposition of all modals. The nonveridicality axiom guarantees that the modal base M be partitioned into a set of worlds where p is true (the positive set) and its complement where p is not true (the negative set). This partition is crucial: MODAL p will not entail p since there are $\neg p$ worlds in M, and the actual world may be a $\neg p$ world. All modals (possibility and necessity) in various flavors (epistemic, deontic, bouletic, etc) obey this principle, and therefore come with partitioned modal bases; consequently, they do not entail p.[15]

3.3 Epistemic future as epistemic *must*

For the analysis of epistemic future, Giannakidou and Mari (2016) adopt the analysis of epistemic *must* (Kratzer 1991; Giorgi and Pianesi 1997, Portner 2009). Like Italian *dovere* and Greek *prepi*, *tha* and *futuro* associate with an epistemic modal base M(i) which is the set of propositions known by the speaker i at t_u (the utterance time). w_0 is the world of evaluation.

(47) M(i) (t_u) = $\lambda w.'w'$ is compatible with what is known by the speaker i in w_0 at t_u.[16]

The epistemic modality is by default *subjective* (Lyons 1977). It is important to note that knowledge changes with time. Epistemic modality is therefore parametric to knowledge at t_u, as is often

[15]There are two exceptions to the Nonveridicality axiom, and both result in trivialization of modality. The first one is the ability modal when it gives rise to the actuality entailment, where only p worlds are found in the modal base, and the modal is trivialized (see Mari to appear-a). The second is with aleithic modality, as in *1 + 1 must equal 2*. Giannakidou and Mari (2016) treat deductive contexts with $must$ as involving aleithic modality, thus maintaining the nonveridicality presupposition (and therefore the so-called weakness in line with Karttunen (1972), Lassiter (2014) and Kratzer (1991). With both aleithic modality and actuality entailment, the distinction between modal and non modal statement is lost.

[16]It should be clear that our notation M(i) corresponds to the Kratzerian notation using set intersection $\cap f_{epistemic}(w_0, i)$, where this returns the set of worlds compatible with what it is known in w_0 by i.

acknowledged in the literature on epistemic modality (see Portner (2009), Hacquard (2006,2010)). For us here, t_u is a parameter of evaluation for FUT/MUST, and this has implications that we discuss further in section 5.

Given what the speaker knows, the modal base of epistemic FUT and MUST is nonveridical and contains both p and $\neg p$ worlds. p is true in the subset of M(i) that complies with the ordering source. We use a normative ordering source $\mathcal{S}$. Normality conditions have most notably been discussed in relation with genericity (see Asher and Morreau 1995) and progressives (Dowty 1979; Landman 1992; Portner 1998)— and are known under the term normality (Asher and Morreau, *ibid.*), inertia (Dowty, *ibid.*) stereotypicality (Portner, 2009) reasonability (Landman *ibid.*, Portner 1998; Mari 2014). Our ordering source $\mathcal{S}$ here ranks as Best those worlds in which *strange things do not happen*, and is stereotypical (à la Portner 2009). The output Best$_{\mathcal{S}}$ is a subset of the modal base. Consider (48), for instance. If I have red cheeks and sneezing nose, then, under stereotypical circumstances, I have the flu. However, circumstances are not necessarily stereotypical. In such non-stereotypical circumstances these symptoms are indicative of a potentially worse disease.

(48) Avrò l'influenza. (Italian)
Have.1SG.FUT the-flu.
'I must have the flu.'

The modal base is partitioned into a positive set (p worlds) and a negative set ($\neg p$ worlds); FUT universally quantifies over BEST worlds (its restrictor) and relates the worlds in the Best set to p (the nuclear scope). The positive set relates to Portner's (2009) Best. The Best worlds are the ideal worlds, the ones best conforming to knowledge, rules, or goals (depending on the nature of modality). Ordering of worlds is defined in (49):

(49) *Ordering of worlds* - Portner, 2009, p.65.
For any set of propositions X and any worlds $w, v : w \leqslant_X v$ iff for all $p \in X$, if $v \in p$, then $w \in p$.

Given an epistemic modal base M(i)(t_u), we can rewrite Best as a function over M(i)(t_u), still in the spirit of Portner 2009. let $\mathcal{S}$ be the normative ordering source.

(50) Best$_{\mathcal{S}}$ (M(i)(t_u)) = $\{w' \in \text{M}(i)(t_u) : \forall q \in \mathcal{S}(w' \in q)\}$

So defined, Best$_{\mathcal{S}}$ delivers the worlds in the epistemic modal base in which all the propositions in $\mathcal{S}$ are true.[17] What the quantifier demands is that those worlds are in the support set of p in M(i). The set Best$_{\mathcal{S}}$ is also parametric to time. Unless otherwise stated, we consider that Best$_{\mathcal{S}}$ is determined at the utterance time (this will be indeed always the case in the reminder of the paper).

The truth conditions are as follows:

(51) $[\![$FUT/*tha/futuro*/MUST (PRES (p))$]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base M(i)(t_u) is nonveridical; if defined,
$[\![$FUT/*tha/futuro*/MUST (PRES (p))$]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff $\forall w' \in$ Best$_{\mathcal{S}}$ $p(w', t_u)$

[17] Since only those worlds are considered in which *all* the propositions in $\mathcal{S}$ are true, the function Best determines a cut-off point.

The Greek future marker *tha*, the Italian *futuro*, and the English modal *must* have the same denotation above in the epistemic present reading. When combined with PAST, as we mentioned earlier, FUT takes high scope, and we do not obtain a future in the past but an epistemic interpretation:

(52) I Ariadne tha ixe gripi (Greek)
the Ariadne FUT have.PAST.3sg flu.
'Ariadne must have had the flu.'

(53) Giacomo avrà avuto l'influenza. (Italian)
Giacomo have.3sg.FUT have.past.part the-flu.
'Giacomo must have had the flu.'

(54) $[\![$FUT/*tha*/*futuro*/MUST (PAST $(p))]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base M$(i)(t_u)$ is nonveridical; if defined,
$[\![$FUT/*tha*/*futuro*/MUST (PAST $(p))]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff $\forall w' \in \text{Best}_{\mathcal{S}} : \exists t' \prec t_u \wedge p(w', t')$

The truth conditions derive both objective and subjective nonveridicality: FUT/MUST (PAST p) and FUT/MUST (PRES p) do not entail p, or that i knows p. FUT/MUST, in this analysis, are both strong (because of quantification over a homogeneous space of worlds ranked as Best) and epistemically weaker (because of nonveridicality) than unmodalized positive assertions in the simple past or present, which convey veridical epistemic states. [18]

We proceed now to the predictive reading. Given the epistemic analysis of *tha* and *futuro*, the null hypothesis is to extend it to prediction. However, recent analyses (including our own Giannakidou and Mari 2013a,b) use metaphysical modality, we will thus first consider this option.

4 Prediction as epistemic modality with *tha* and futuro

The existence of epistemic future by itself, as we said at the beginning, is a major challenge to a metaphysical view of the future. If FUT is an epistemic modal in this use already, the simplest thing to assume is that FUT is also epistemic in the predictive use— any other assumption would be essentially an ambiguity analysis. In this section, we present specific challenges for the metaphysical view illustrating that (a) prediction does not depend on what will actually be the case, and (b) the predictive reading of the future is parallel to epistemic modals.

4.1 A shot at the metaphysical analysis: the future criterion

The metaphysical unsettledness of the future is typically captured with branching time models (Thomason, 1984). Thomason himself provides a supervaluationist theory, according to which a

[18] Our account thus differs from von Fintel and Gillies (2010). For them, a kernel K is a set of worlds representing the privileged information, and 'direct unsettledeness' holds in the kernel:

(55) ("strong" must + evidentiality) Fix a c-relevant kernel K
a. [[$must\phi$]]^{c,w} is defined only if K does not directly settle [[ϕ]]^c
b. If defined, [[$must\phi$]]^{c,w} = 1 iff $B_K \subseteq$ [[ϕ]]^c

(a) is akin to our nonveridicality requirement, posited not on the modal base but on the kernel. Von Fintel and Gillies say that K can *fail* to directly settle whether P even though K *entails* whether P (von Fintel and Gillies 2010: 372).

future sentence is true if and only if in all branches opening up at the time of the utterance there is a time at which p is true, and it is false if and only if in all branches opening up at the time of the utterance there is a time at which p is false. Put this way, a negative future sentence like *There won't be a sea battle tomorrow* does not mean that not all the worlds are sea-battle worlds, but that all worlds are non-sea battle worlds. Copley 2002 asks the question of how we can be so certain when we talk about the future while the future is open. She adds ordering sources. It is possible then, to defend an account of metaphysical alternatives with epistemic ordering sources added. Here is what such an analysis of *tha* and *futuro* could look like (see Giannakidou and Mari, 2013b).

Let us start with the standard $W \times T$ forward-branching structure. 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 possibly different futures. Let w_0 be the actual world.

For any time $t \in T$, we define the set of historical alternatives ($\mathcal{I}$) as the set of worlds that are identical to the actual world w_0 at least up to and including t (Thomason, 1984).

(56) $\mathcal{I}(t) := \{w \mid w \simeq_t w_0\}$

In the case depicted in Figure 1, the set of historical alternatives at t is the set given in (57).

(57) $\mathcal{I}(t) = \{w_1, w_2, w_0, w_3, w_4\}$

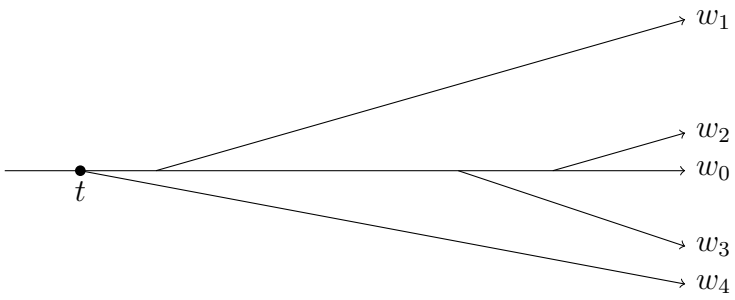


Figure 1: *$\mathcal{I}(t)$*

$\mathcal{I}(t)$ represents the modal base fixed at t. One can impose that the modal base be non-veridical, and thus require that it be partitioned into p and $\neg p$ worlds.

(58) For any time t, $\mathcal{I}(t)$ is nonveridical.

Now, given this metaphysical structure, what a speaker knows or believes at the time of prediction still plays a key role: two different people can make different predictions, depending on what they know. Consider the case in which Mary and Susan are waiting for Gianni. Mary utters (59):

(59) Gianni arriverà alle 4. (Italian)
John arrive.3SG.FUT at 4.

'John will arrive at 4.'

(60) O Janis tha ftasi stis 4. (Greek)
the John FUT arrive.NONPAST.3SG at 4.
'John will arrive at 4.'

In making the prediction, Mary is using her knowledge. She knows facts as well as generalizations based on personal experience, and rules of thumb about traffic conditions. She knows that around 4 pm it is typically not yet rush hour, that the traffic is easy outside rush hour. She also knows that if you travel outside rush hour the trip from Hyde Park to Lakeview will take 20 minutes. We will call the set of propositions, following Giannakidou and Mari 2013b, the *future criterion*, and use $\mathcal{E}$ to refer to it. Mary's future criterion is the following set of propositions:

(61) Mary's future criterion $\mathcal{E}_{Mary}$ = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde Park to Lakeview will be take 20 minutes'}

Now, imagine that Susan knows something more. Her future criterion includes the set Mary's does, but also the proposition that there is construction going on that day on the Lake Shore Drive.

(62) Susan's future criterion $\mathcal{E}_{Susan}$ = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde park to Lakeview will be take 20 minutes', 'there is construction going on on the Lake Shore Drive', 'when there is construction on the road, traffic slows down'}

Given (62), Susan disagrees with Mary and utters (63).

(63) No. Gianni arriverà alle 5. (Italian)
No John arrive.3SG.FUT at 5.
'No; John will arrive at 5.'

(64) Oxi. O Janis tha ftasi stis 5. (Greek)
No. the John FUT arrive.NON-PAST.3SG at 5.
'No. John will arrive at 5.'

Because $\mathcal{E}_{Susan}$ contains the construction information, her prediction about Gianni's arrival is for a later time, differing from Mary's prediction. Clearly, then, what one knows affects what one predicts. Susan and Mary are in a state of disagreement, reminiscent of what we observe with epistemic modals (a.o. Lasersohn, 2005; Stephenson, 2007; Papafragou, 2009). The prediction is therefore subjective, anchored to the knowledge of the individual making it.

One could use the future criterion as an ordering source, and the more propositions a world satisfies, the better it is. We could then define the set Best, relatively to the ordering $\mathcal{E}_i$.

(65) Best worlds as per $\mathcal{E}_i$.
Best$_{\mathcal{E}_i}$: $\{w' \in \mathcal{I}(t_u) : \forall q \in \mathcal{E}_i(w' \in q)\}$.

On top of this, one must add stereotypicality conditions— and this would complicate the matter rendering FUT a modal with two ordering sources. As we show next, however, no matter how many and which ordering sources are added, the metaphysical modal base is simply not appropriate

to begin with.

The future criterion, in any case, would end up carving the space of metaphysical possibilities into those that are p worlds and those that are not, and FUT would then be a universal quantifier over the Best set returned by the future criterion. That would look like the following:

(66) Truth conditions for predictive FUT with a metaphysical modal bese (to be rejected)
$[\![$FUT/*tha/futuro* (NON-PAST $(p))]\!]^{\mathcal{I},\mathcal{E},i,t_u}$ will be defined only if the metaphysical modal base $\mathcal{I}(t_u)$ is nonveridical; if defined,
$[\![$FUT/*tha/futuro* (NON-PAST $(p))]\!]^{\mathcal{I},\mathcal{E},i,t_u}$ is 1 iff $\forall w' \in Best_{\mathcal{E}i}$: $\exists t' \in (t_u, \infty) \wedge p(w', t')$

This analysis says that p is true only in the metaphysical alternatives that are consistent with current knowledge of i. The worlds are metaphysical, i.e. they are versions of reality out there, and we expect that p is true in a non-singleton subset of them.

4.2 FUT and epistemic modals: problems with the metaphysical view

The main problem with the metaphysical truth conditions above is that the FUT p can be true even if the metaphysical space $\mathcal{I}(t_u)$ is anti-veridical, showing that metaphysics is irrelevant for the truth of prediction, which seems to rely solely on what the speaker knows or believes at the time of making it.[19] This conclusion is further supported by parallelisms between FUT in the predictive reading and epistemic modals— and which, to our knowledge, have not been discussed before. In addition, we highlight the category *indeterminate* predictions, also hardly featured in the relevant literature. It becomes clear that we pursue a relativistic stance on the epistemic nature of predictions.

4.2.1 Predictive future, epistemic modality and relative truth

A speaker i can make a prediction about p even if there are *no* metaphysical branches that make p true. We call this an antiveridical metaphysical modal base. Imagine that, sadly, Susan had car accident and died on the spot. Mary does not know that Susan died, and utters (67):

(67) Incontrerò Susan domani. (Italian)
Meet.1SG.FUT Susan tomorrow.
'I will meet Susan tomorrow.'

(68) Tha dho ti Susan avrio. (Greek)
FUT meet.NONPAST.1SG the Susan tomorrow.
'I will meet Susan tomorrow.'

Mary makes a prediction (FUT p) based on her state of knowledge. The fact that objectively the proposition *Susan meets Mary tomorrow* cannot be true appears to be irrelevant for FUT p. This means that Mary's prediction is true or false in a relativistic manner (see Lasersohn, 2005; Stephenson, 2007). Given what she knows (e.g. that Susan called her yesterday providing a place and time for the meeting), Mary will meet Susan tomorrow. The prediction FUT p thus solely depends on what Mary knows, and this holds for all three languages— Greek, Italian, and English.

[19] We are grateful to the reviewers for their useful feedback on these very central points in tis section.

It is helpful at this point to offer some comments on what it means for a prediction to be true relativistically, from now on *true*$_i$. A true$_i$ prediction, as we just showed, is relative to i making it, and in our system of subjective veridicality (section 3), the speaker is always a parameter of evaluation akin to Lasersohn's judge (see also Stephenson *ibid.*). The similarity with predicates of personal taste and epistemic modality is immediate:

(69) a. Mary: Fish is tasty.
b. Susan: No, fish is not tasty.

The proposition *Fish is tasty* is true$_i$ for Mary but false$_i$ for Susan, the two are in what is by now considered a classic case of faultless disagreement. Importantly, with predicates of personal taste this disagreement can never be objectively resolved, since there is no matter of fact that fish is or is not tasty (see Stephenson, *ibid.*). The truth is therefore fully determined by the individual anchor only; predicates of personal taste only have relative truth.[20]

With predictions, as we see above, the individual anchor is crucial in determining the basis of knowledge for forming the prediction— but as Aristotle already noted (see also McFarlane, 2005), there *will* be a matter of fact for p. Setting aside for a moment the case in which we have an antiveridical metaphysics, in the other cases, the predicted sentence p will receive a truth value objectively (true$_o$ or false$_o$), albeit at a later time. Hence, objectively, the complement sentence p of FUT, unlike a sentence with a predicate of personal taste, indeed gets resolved.[21] However, just as with personal taste, the matter is not resolved at the time of the prediction.

Notice also the parallelism with epistemic modals in present and past:

(70) a. For all I know, Mary must be at home right now.
b. For all I know, Mary must have been at home this morning.

Just as with predictions, the individual anchor determines the basis of knowledge for epistemic MUST p (see also Papafragou, 2006). Unlike with predicates of personal taste, with epistemic modals there is a matter of fact (Stephenson, *ibid.*): p is/was or is not/was not true. With epistemic modals the matter is settled at t_u— but with predictions, aside from the cases of antiveridical metaphysics, it will be settled at a later time. In this respect, predictions stand in between predicates of personal taste and epistemic modals: p may be objectively settled (as with epistemic modals), but it is not yet objectively settled at the time of utterance (as with predicates of personal taste).

In the specific case of predictions and antiveridical metaphysics, the matter is settled at the time of utterance, and the parallelism with epistemic modality is even more prominent. Given that Susan is dead, the sentence *Susan meets Mary tomorrow* is objectively false at the time of the utterance. In other words, FUT p (the prediction) is true relative to the speaker, but p is false objectively.

No matter whether the matter can be objectively settled or not, sentences with predicates of personal taste and epistemic modals have been claimed to be true$_i$/false$_i$ at the time of utterance (Lasersohn, *ibid*, Stephenson, *ibid.*), regardless of the objective status of p, if any. Our claim here is that predictions are also equally true$_i$/false$_i$ at the time of utterance, regardless of whether p will

[20]The individual anchor for us is always a parameter of evaluation, and may (embedding with propositional attitudes) or may not be syntactically present (as in unembedded sentences).

[21]Note that, for McFarlane (2005) the future sentences cannot be assigned a truth value at the time of utterance. For us, it is assigned a truth value, it is true/false, parametrically to i.

turn out to be objectively true or false.[22]

As we just saw, with epistemic modals, objectively, p has a truth value; but for the MUST p sentence to be true, the objective value of p is irrelevant. It may be the case that I have the wrong information and Mary is/was not in fact home. My information at the time of utterance was such that it supported p in the Best worlds, and this forms the sole basis for my assessment. I therefore made a true$_i$ assessment given my knowledge. In other words, the epistemic assessment (MUST p) is true relative to the speaker, but the prejacent p may turn out to be false objectively. Likewise, FUT p is true in a relativistic manner. At the time of utterance the assessment is not false$_i$ if p is false unbeknownst to the speaker. MUST p is false$_i$ if the speaker knows that p is not true and still asserts MUST p. Likewise, the prediction is false$_i$ if the speaker knows that Susan is dead and still utters *I will meet Susan tomorrow*. In both cases, in fact, we claim that the speaker is lying.

To sum up: predictions and assessments MUST/FUT p are true$_i$ or false$_i$ (i.e. subjectively) relative to the individual anchor's i knowledge, while p has a truth value objectively depending on what is/was/will be the case. A prediction is true$_i$ if the truth conditions are met, i.e. $\forall w' \in \text{Best}_{\mathcal{S}}$: $\exists t' : p(w', t')$. The objective value of p does not matter for the truth$_i$ of predictions, just as it does not matter for epistemic modals and for predicates of personal taste. In all cases, truth conditions are assigned independently of the objective status of p.

4.2.2 Indeterminate predictions: far into the future

The metaphysics seems to be irrelevant also for what we call next *indeterminate* predictions. Imagine utterances like the following:

(71) a. O Nicholas tha jini spoudaios kapja mera. (Greek)
the Nicholas FUT be.NONPAST.3SG important some day

b. Giacomo sarà una persona importante un giorno. (Italian)
Giacomo be.3SG.FUT a person important one day.
'Nicholas/Giacomo will be an important person some day.'

This is an indeterminate prediction. This type of prediction is actually quite common, and is reinforced by indefinite adverbs such as *some day*, or *when he grows up*. The indefiniteness creates considerable temporal distance between the time of prediction and the time of (possible) fact. The

[22] An anonymous reviewer points to us the following excerpt from McFarlane (2014).

> Suppose you are standing in a coffee line, and you overhear Sally and George discussing a mutual acquaintance, Joe. SALLY says: Joe might be in China. I didn't see him today. GEORGE: No, he can't be in China. He doesn't have his visa yet. SALLY: Oh, really? Then I guess I was wrong. It seems that George is contradicting Sally and rejecting her claim. It also seems that, having learned something from George, Sally concedes that she was wrong. Finally, it seems appropriate for her to retract her original claim, rather than continuing to stand by it. Think how odd it would be were she to respond: SALLY: Oh, really? # Still, I was right when I said 'Joe might be in China,' and I stand by my claim.

Extending the argument for epistemic English *might* to Italian and Greek future, we would claim that those who judge epistemic/future claims to be false when the prejacent is false are looking at the bare propositional content excluding the speaker index. Those who judge such claims to be true even when the prejacent is false are looking at the final truth value including the speaker index. For clarity we are glossing truth/falsity as truth$_i$/falsity$_i$ to highlight those cases in which the speaker index is taken into account. We thank the reviewer for providing this material.

speaker again relies on knowledge at the present time, i.e. that Nicholas and Giacomo are super-smart, that they are ambitious, hard working, etc., as well as stereotypical assumptions such that if you are smart, ambitious, and hard working, and if nothing bizarre happens, you will succeed and be important. The metaphysical reality, however, is too far from the time of prediction to assume reasonably that it plays a role for the speaker when making the prediction. The speaker makes her predictive statement even though the metaphysical alternatives are, from the perspective of now, hard to access. Normalcy conditions will also have to be relaxed, thus rendering these predictions a bit weaker.

Indeterminate predictions also challenge the bouletic approach to FUT (Copley 2002) which posits a presupposition that an agent will take action to bring out p. The indeterminate prediction is associated with no such presupposition (see section 6 for more discussion). Overall, indeterminate prediction suggests that the speaker reasons with what she knows, and projects that knowledge into an expectation about the future. If future morphemes relied on metaphysical alternatives, indeterminate predictions should have been either impossible or necessarily false, since the truth condition would be too strong to satisfy given that a lot is unknown between now and the indeterminate future.

4.3 Prediction as epistemic modality

The parallelism between epistemic modality and prediction that we observed suggests that metaphysics is not foundation for the prediction. We found the prediction to be epistemic and subjective, just like epistemic modal statements. As such, both epistemic and predictive statements depend for their truth and correctness on what the predictor knows or believes. The null hypothesis, namely that *tha* and Italian *futuro* are epistemic modals in the predictive reading can thus be pursued. Keep in mind that *will* was shown to pattern similarly in all respects discussed here.

The truth condition for predictive FUT are those for epistemic future, with the difference that here we have NON-PAST, and this shifts the time to the future.

(72) $[\![$FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base M$(i)(t_u)$ is nonveridical; if defined,
$[\![$FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff $\forall w' \in \text{Best}_{\mathcal{S}} : \exists t' \in (t_u, \infty) \wedge p(w', t')$

The temporal information comes from the tense below— we develop this further in section 5. Our analysis of prediction is close to Veltman (1996), who uses expectation in defining information states. An information state is a pair $\sigma = \langle \epsilon, s \rangle$, where s is a proposition and ϵ is an expectation pattern, an ordering of worlds. $\langle w, v \rangle \in \epsilon$ means that w is at least as expected as v (every expectation that is met by v is also met by w, $w \leqslant_\epsilon v$). As Portner points out commenting on Veltman, 'another way to describe the maximally normal worlds uses the vocabulary of ordering semantics' (Portner 2009:100). In Veltman, the ordering is expectedness, that is to say, the best worlds are the most expected ones, or those which are as normal as possible, given the beliefs we have about how the world really is. This is also the view that we have been defending here. The parallelisms between epistemic and predictive future further plea for this type of analysis.

The analysis is exactly parallel to that for epistemic future, i.e. once again we take into account an epistemic modal base, facts known by the speaker, and stereotypical ordering sources. The modal base contains worlds compatible with what the speaker i knows. Consider now the disagreement between Mary and Susan about the time of Gianni's arrival. Mary utters:

(73) Gianni arriverà alle 4. (Italian)
John arrive.3SG.FUT at 4.
'John will arrive at 4.'

(74) O Janis tha ftasi stis 4. (Greek)
the John FUT arrive.NON-PAST.3SG at 4.
'John will arrive at 4.'

Susan replies:

(75) No. Gianni arriverà alle 5. (Italian)
No John arrive.3SG.FUT at 5.
'No; John will arrive at 5.'

(76) Oxi. O Janis tha ftasi stis 5. (Greek)
No. the John FUT arrive.NON-PAST.3SG at 5.
'No. John will arrive at 5.'

What we called earlier the future criterion is the body of information that Mary and Susan have, i.e. the set of propositions known by Mary and Susan, i.e. their epistemic modal bases.

(77) Mary's epistemic modal base = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde Park to Lakeview will be take 20 minutes'}

(78) Susan's epistemic modal base = {'around 4 it is not yet rush hour', 'the traffic is easy outside rush hour', 'if you travel outside rush hour the trip from Hyde park to Lakeview will be take 20 minutes', 'there is construction going on on the Lake Shore Drive', 'when there is construction on the road, traffic slows down'}

The epistemic space of each Mary and Susan is nonveridical. For instance, they do not know whether Gianni, that day, has an appointment with a doctor, in which case, he will not be at home before 7pm. Their epistemic space is thus partitioned into p and $\neg p$ worlds. Each of them uses another set of propositions, which represents the normality conditions. Both Mary and Susan reason on the assumptions that Gianni is in good health, does not run out of gas, that the lake does not invade the LSD, and so on. The worlds in which normality conditions are met are p worlds and future expressions quantify over this set. Note that there might also be extraordinary worlds in which Gianni arrives at 4. For instance worlds in which the lake invades the LSD but nonetheless John makes it to home without troubles.

Before concluding our analysis of FUT as epistemic modal, uniformly across the epistemic and the predictive interpretations, we want to emphasize two points. First, the nonveridicality of the FUT does not entail metaphysical unsettledness, as we saw in the case of felicitously predicting p while in fact p is metaphysically settled negatively. Epistemic modals, as noted several times, are subjectively nonveridical, i.e. their modal bases are partitioned. As a class, then, modals are weaker than propositional attitudes of knowledge and belief, or the default epistemic states of unembedded assertions. Recall the contrast:

(79) a. Flavio is/was doctor.
b. Flavio must be a doctor.

c. Flavio will be a doctor.

Assuming that all sentences are evaluated wrt to the speaker's epistemic state, the *must* and *will* sentences are still epistemically weaker than the unmodalized present or past. This is so because, as we mentioned, the umodalized present or past is subjectively veridical, i.e. its truth condition requires that the epistemic state be veridical. *Must*/FUT, on the other hand, are subjectively non-veridical because their modal base is partitioned into Best worlds where p is true, and $\neg p$ worlds (by the nonveridicality axiom).

Mathematical truths, in agreement with our analysis, do not cope well with prediction:

(80) #Domani 2+2 farà 4. (Italian)
#Avrio 2+2 tha kani 4. (Greek)
'#Tomorrow 2+2 will be 4.'

The use of FUT is odd also on a pure epistemic reading (without 'Tomorrow') because it wrongly presupposes that the speaker does not know that 2+2 equals 4. However, FUT including *will* is fine when some calculation is needed:

(81) 68009753+8007525 farà 8821459. (Italian)
68009753+8007525 tha kani 8821459. (Greek)
'68009753+8007525 will be 8821459.'

This is a context in which the speaker cannot know the sum of the addition, and is asked to calculate by head in a few seconds.

Finally, our account allows us to disentangle bare assertions from future / epistemic modal sentences with respect to the notion of "correctedness" and pave the way for a deeper understanding of denials. It should be by now clear that, for us, if the speaker is not lying, all assertions are true subjectively (while also having objective truth values, with the exception of predicates of personal taste). As we said, the main addition of the future and other epistemic modals is that the speaker signals that s/he does not know that p, that she is not fully certain. In this general framework, being *correct* and being wrong become a matching (and non-matching) relation between the value of p in the subjective and the objective space.

When uttering a future sentence, the speaker cannot be accused of being incorrect once the objective truth is revealed (either at a future time or at the time of utterance): his epistemic modal base is nonhomogeneous, which means it cannot be either correct or incorrect, as both notions require settledness in the subjective space.

Let us consider the strategies of denial returning to the scenario in which Susan is dead and Mary does not know it. She has just uttered "I will meet Susan tomorrow". Once Mary is informed that Susan is dead the most normal reaction would be the "I did not know that !"

(82) a. Me: Susan è morta. (Italian)
'Susan is dead.'
b. Mary: Oddio non lo sapevo !
'Oh my god ! I did not know that!'

It is unlikely Mary will be willing to say that "she was wrong" or at least in Italian, (83) is somehow an unnatural dialogue.

(83) a. Me: Susan è morta. (Italian)
'Susan is dead.'
b. Mary: #Oddio mi sbagliavo !
c. Mary: #O thee mou. Ekana lathos! (Greek)
'#Oh my god ! I was wrong !'

Likewise, in Greek. The "I was wrong" reply becomes natural with a non-modalized assertion, where p is both settled in the entirety of the epistemic space M(i) and in an objective manner.

(84) a. A: Gianni é a casa. (Italian)
'Gianni is at home.'
b. B: No, é in Olanda.
'No he is in Holland.'
c. C: Ah, mi sbagliavo allora.
d. C Ekana lathos. (Greek)
'Oh, I was wrong then.'

The impression of epistemic commitment with FUT arises because the speaker is quantifying over the Best set of worlds. If the "I was wrong" reply can somehow not be excluded (see dialogue in (83)), it is in virtue of the weak-strong ambiguity of FUT quantification to which we pointed earlier. Although Mary did not know that Susan was dead, she was somehow committed to the belief that she was not and that she was meeting her tomorrow (although she signaled that she did not know for sure). But again, the dialogue in (83), although not unforeseeable, it is less natural than the one on (82), where Mary will have the tendency of distancing by recalling that her statement was based on her own knowledge and that her epistemic state was a partitioned one.

A deeper study of the strategies for denials is certainly needed, and experimental evidence may be able to shed more light. It is our hope that our initial comments here pave the way for such research driven by the idea that correctness is a relation between the value of p in the subjective and in the objective spaces, and suggesting that correctness applies to cases in which there is at the very least a support set of p in the epistemic modal base.

We move in section 5 to the final piece of our analysis, the role of inner tense. Just before that, we wanted to briefly consider the role of modal adverbs which can accompany predictions.

4.4 Adverbs and prediction: from Stat'micets to Italian and Greek

Often, predictions are accompanied by epistemic adverbs. When this happens, the force of the prediction can be weakened or strengthened depending on the adverbs used— which range from weak to strong (see Bertinetto, 1979; Tasmowski and Dendale 1998; Kissine 2008; Giannakidou and Mari 2013a,b). Consider here Italian:

(85) Piero arriverà forse/sicuramente alle 4. (Italian)
Peter arrive.3SG.FUT possibly/surely at 4
'Piero will maybe/certainly arrive at 4.'

Kissine (2008) proposes that the adverbs take wide scope and, on his assumption that *will* is a tense interpreted under a contextually provided epistemic modal, the adverbs are overt instantiations of

the otherwise covert modal. We sketch here an alternative analysis, but notice that, even in Kissine, the (external) modality of FUT is epistemic.

If FUT is a modal, what is the adverb doing? Clearly, we cannot appeal to modal concord (Huitink, 2012, Giannakidou 2012 for the Greek patterns), since FUT is an epistemic universal modal that can be combined as we see with *forse* "possibly". Note that FUT can be combined with strong and weak adverbs in the non-predictive reading as well see (86).

(86) Le luci sono accese. Sarà forse/sicuramente a casa. (Italian)
The lights are lighted. Be.3SG.FUT maybe/certainly at home.
'The lights are on. He must maybe/probably be at home.'

(87) Ta fota ine anamena. Tha ine malon/sigoura/pithanos spiti. (Greek)
The lights are lighted. FUT be.3SG probably/certainly/possibly home.
'The lights are on. He must probably/certainly/possibly be at home.'

The adverbs appear to affect the force of the statement. If FUT is a universal quantifier over the Best worlds, the adverb, we argue, takes the modal base as input and delivers a support set of variable size: the stronger the adverb, the larger the support set, the stronger the prediction. Without an adverb the Best worlds (and size) will be determined contextually— by default strongly as with *must*. But the adverbs allow modulation of the support set explicitly.

The device we will use to capture the adverbs is the choice function used in Matthewson et al. (2007). These authors use choice functions to account for varying forces of a universal modal in St'at'micets. The similarity between their data and our adverb data here is that they can both be downgraded to express weak conjectures while being admittedly universal. With Matthewson et al. *ibid.*, we postulate a choice function $\mathcal{F}$, which in Greek and Italian is the adverb, not the modal itself. The default $\mathcal{F}$ will give the support worlds. With weak adverbs, $\mathcal{F}$ will give a smaller set, with a strong adverb a bigger set, with subjective adverbs like *obviously, definite* a set satisfying additional subjective criteria, as in *John will obviously/definitely be here*.

On the assumption that these are speaker-oriented adverbs (Ernst 2009) that take wide scope, the truth conditions can be augmented as in (88).[23]

(88) $[\![$Adv FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base $\mathrm{M}(i)(t_u)$ is nonveridical; if defined,
$[\![$Adv FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff
$\forall w' \in \mathcal{F}(\mathrm{M}(i)(t_u)) : \exists t' \in (t_u, \infty) \wedge p(w', t')$

The adverb is the choice function $\mathcal{F}$. The support set for p is now the output of $\mathcal{F}(\mathrm{M}(i)(t_u))$. When the adverbs are not present, the choice function is contextually determined and gives the Best set.

Notice, crucially, $\mathcal{F}$ cannot be in the scope of negation, thus supporting the higher scope we assign to it:

(89) #John will not probably/possibly be here tomorrow.

(90) John will probably/possibly not be here tomorrow.

[23] We do not provide here a demonstration that the adverbs are speaker oriented, as this would lead us too far away from the primary goal of the paper (which is to study the relation between epistemic and predictive future). On epistemic adverbs, see Nielsen 2004; and recent discussion in Wolf 2014.

This is clearly in agreement with Ernst's (2009) treatment of these adverbs as positive polarity items, needing to escape negation.

One could ask: why not simply treat Greek and Italian FUT as an underspecified quantifier (as e.g. Mari 2009a,b,c)? There are two reasons for not doing so. First, the distributions observed for FUT are parallel to those with MUST, e.g. for Italian *dovere*. In the epistemic reading, *dovere* is also compatible with adverbs of varying strengths, including weak ones:

(91) Le luci sono accese. Deve forse/sicuramente essere a casa. (Italian)
The lights are lighted. Must.3SG.PRES maybe/certainly be at home.
'The lights are on. He must maybe/probably be at home.'

But we have no reasons to believe that *dovere* is unspecified like the Salish modal. The same holds for Greek *prepei*. Both Greek and Italian lexicalize the distinction between possibility and necessity modals (see Staraki 2013 for a recent analysis of Greek). Choice functions provide us with the flexibility we need, while not giving up the standard analysis of necessity modals. The second reason is that, by default, the force of the FUT statement is strong as befits universal modals (see Giannakidou 2012). Hence, it must be admitted that the weakness is added by the adverb.

In sum, we proposed that prediction is an epistemic, not a metaphysical category, and offered a unified analysis of Greek and Italian future morphemes as epistemic modals. The epistemic future and the predictive future are, in other words, the same category, differing only in the time of the prejacent proposition. The analysis is rather simple, and revealed a richness in prediction that metaphysical analyses tend to overlook. We proceed now to address the role of inner tense.

5 Syntax-semantics: modality and lower tense

In the meaning we defined for *tha* and *futuro*, they are pure epistemic modals. As such, they rely on knowledge at the utterance time, which is a parameter of evaluation. When they combine with past or present, as we saw, there is no prediction. The predictive reading arises when the lower temporal component is a non-past. The separation between the modal component and the temporal one is particularly visible in Greek where FUT is a particle that appears above the lower tensed verb. We address the combination with perfective non-past which is responsible for producing the prediction, as well as combinations with pasts, first in Greek and then Italian.

5.1 The Greek nonpast as a polarity item: Giannakidou 2009

In Greek, the future is separated from the tense system and appears above the tensed verb (TP), as we mentioned at the beginning. Besides *tha*, above TP we can have the subjunctive and optative particles. The morphological tense can be, again, a past or nonpast:

(92) Na/ As/ Tha figi o Janis. (Greek)
SUBJ/ OPT/ FUT leave.PERF.NON-PAST.3SG the John.
'Let John go/John will go.'

(93) Na/ As/ Tha efige o Janis. (Greek)
SUBJ/ OPT/ FUT leave.3sg.PAST the John.

It's OK that John left! (optative, subjunctive)
John must have have left (FUT).

The particles *na, as* have further clause typing and speech act properties and move to C positions (Giannakidou 1998, 2009, Roussou 2000). Generalizing, we can say that the modal and temporal information are dissociated in the Greek clausal system, and the perfective nonpast is responsible for the prospective, future orientation with FUT.

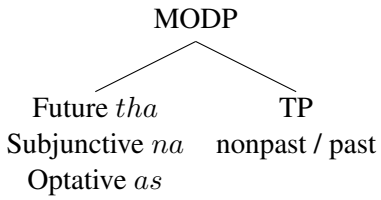
Recall that, following the literature, we identified three tensed forms that interact with FUT: PRES, PAST, and the nonpast which is ungrammatical on its own, but responsible for prediction:

(94) grap- s- o
write- PERF 1SG.NONPAST.
(no English equivalent; * on its own)

(95) *grapsi i Ariadne. (Greek)
write.PERF.NON-PAST.3SG the Ariadne.

The tensed verb appears in T. Modal particles are heads above TP in what we call MODP (see also Philippaki (1998) postulation that tha embeds TP). We assume that this differentiation of tense and modality is true also for Italian, and holds perhaps even universally. Giannakidou 2016 treats optative and subjunctive as existential modals:

(96)



Giannakidou 2009 treats the morphological perfective nonpast as a *semantic nonpast* defined below: it is a form with a *dependent* variable t which needs to be syntactically identified with t_u, thus necessitating the higher structure:

(97) *Non-past* (adapted from Giannakidou 2009)
$[\![\text{Non-past}]\!] = \lambda P \lambda t \lambda w(P(t, \infty)(w))$

(Following standard practice, we use "(" in the left interval to show that t is excluded from the interval, hence P will be true at a time later than t). Giannakidou's analysis relies on the substitution operator WOLL (Abusch 2004), but proposes the WOLL denotation for the nonpast. According to Abusch (2004:39): "In the substitution operator, t is a bound variable that corresponds to the tense argument of WILL [which in English is a default n, coming from *an implied higher PRES*; clarification ours]. For a top-level occurrence of WILL, the effect is to substitute (n, ∞) for n."

In Greek, Giannakidou argues, the left boundary t is a polarity item, it must therefore be licensed syntactically (e.g. like *any*); this means that n needs to be introduced and identified with t in the syntax. The polarity status of the Greek form derives the difference between the Greek nonpast and other non-pasts which do not need to be syntactically licensed but can forward shift by default. The modal particles, FUT in particular, occupy the higher structure, and because they all have t_u as a parameter of evaluation, they satisfy the licensing requirement and supply t_u. Giannakidou (2009) actually claims that the particles *denote* t_u, thus rendering them (including FUT)

temporal operators. We deviate here from that analysis, and argue that t_u is introduced syntactically in Greek in the higher structure by default.

5.2 Non-past and FUT

Recall the truth conditions we gave for prediction:

(98) $[\![$FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if the modal base M$(i)(t_u)$ is nonveridical; if defined,
$[\![$FUT/*tha/futuro* (NON-PAST (p))$]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff $\forall w' \in$ Best$_{\mathcal{S}} : \exists t' \in (t_u, \infty) \wedge p(w', t')$

We will show now how we reach these truth conditions by computing the role of the lower tense. We assume a lexical entry for FUT is as follows:

(99) Lexical entry for FUT/tha/futuro
$[\![\text{FUT}/tha/futuro]\!]^{M,i,\mathcal{S},t_u} = \lambda p \forall w' \in Best_{\mathcal{S}} : p(w')$; p is the prejacent proposition.

All epistemic modals, as we suggested, have t_u as a parameter of evaluation, and epistemic modals tend to scope above the verbal tense (Hacquard 2010; Portner 2009); hence the position of FUT (and subjunctive etc.) is justified syntactically as belonging to the class of epistemic modals. Adding t_u as a parameter of evaluation of the modal means that the modal base is anchored to t_u. We call anchoring to t_u *Now anchoring*.

How is Now anchoring done? There are two possible implementations. One way is to say that FUT actually adds t_u in the syntax. This is essentially the view pursued by Giannakidou 2009, who claimed that FUT adds t_u in the syntax. If we take that view, then we must also concede that t_u is added also by the other particles that appear in MOD, namely the subjunctive and the optative (and possibly others, see Giannakidou 2009 for fuller exposition). But if we say that, we end up saying that the modal particles *as a class* denote t_u, and this is a bit strange given that they are modal particles and that t_u is always a parameter of evaluation for them anyway. Assuming that t_u is introduced syntactically, in addition to being a parameter of evaluation, is akin to saying that the judge is both a parameter of evaluation (à la Lasershohn) and an argument (à la Stephenson) with predicates of personal taste. We do not believe that this is a position that anyone in the literature on personal taste would be willing to make. Consider also that, when combining with PAST, t_u would be redundant, and we would have to somehow cancel it (which is what Giannakidou 2009 does).

The other way of understanding Now anchoring would be to treat it as a substitution rule for free variables. (This was the spirit of Abusch's rule for WOLL: "In the substitution operator, t is a bound variable that corresponds to the tense argument of WILL. For a top-level occurrence of WILL, the effect is to substitute (n, ∞) for n." (Abusch 2004: 39)). We can thus posit the following rule:

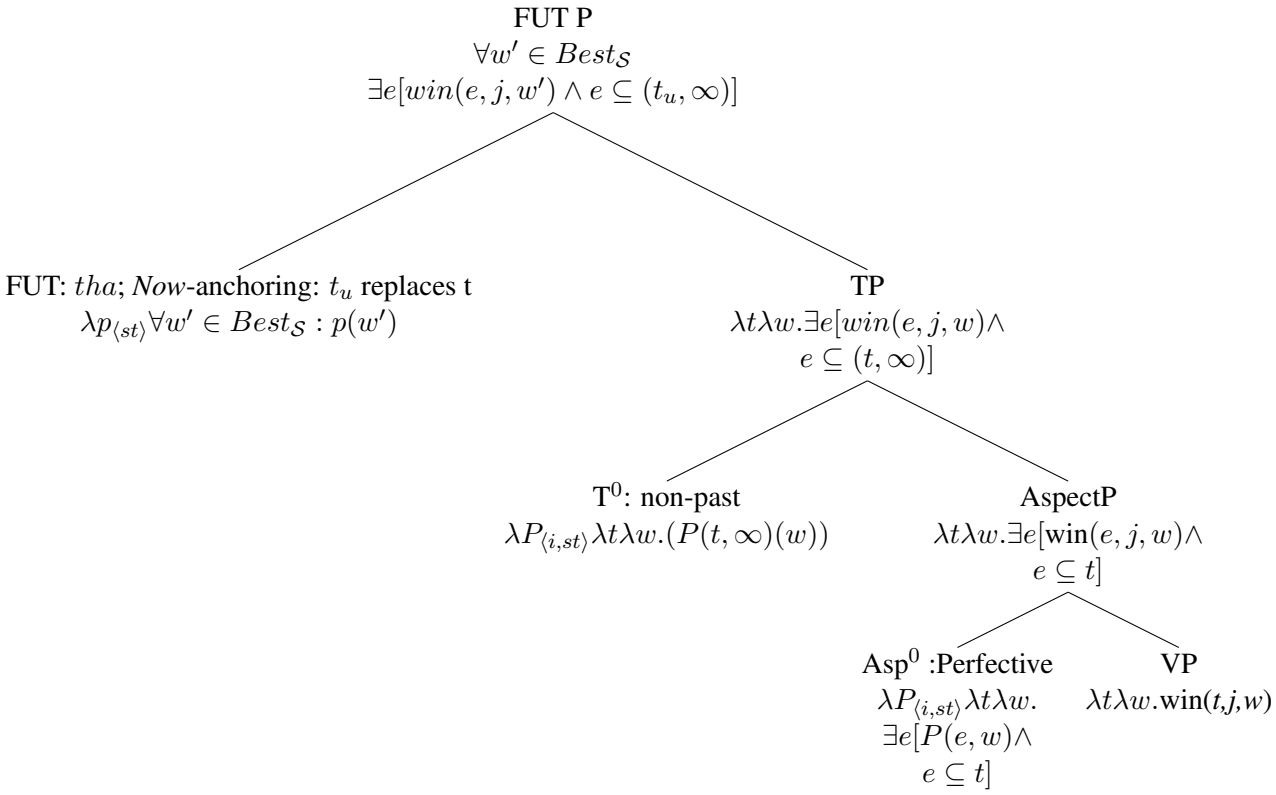
(100) *Now*-anchoring rule, triggered at MOD
Substitute any free variables t in TP with t_u

This rule will be triggered only if there are free variables in TP— and it will not apply to lower PAST, for instance, as we indicate in 5.3, since the past contains no free variables. The rule will enable the free variable t of the nonpast to be identified with t_u. As a result, the nonpast interval will then be anchored to t_u, which is what we want. The advantage of having this rule is that it allows

us to keep the semantics of modality clear of time— and it avoids the undesirable positions that all modal particles introduce t_u, and that t_u is dually present both as a parameter of evaluation *and* an argument of FUT. Introducing t_u appears to be a property of the higher structure, and positing this rule seems to be the better option. Here we work it through the following basic sentence:

(101) O Janis tha kerdisi.
the John FUT win.nonpast.3sg
John will win.

(102)



Meaning is represented explicitly at LF, and semantic composition is limited to function application, variable binding, and type raising. Starting from the bottom, perfective aspect applies yielding a statement that there is a winning event. Following Giannakidou 2009, PFT (perfective aspect) and non-past are modifiers: their input is a property P and give back the same property with the addition of the event argument, and replacement of t by (t, ∞). PFT introduces the event argument and existentially closes it (as is normally assumed). One could also posit a rule at the aspectual head, e.g. ADD EVENT. This event has to be located at t, which itself must be placed within the non-past interval. At TP, the t variable remains unbound. At FUT, the *Now*-anchoring rule applies, resulting in identifying the t from nonpast with t_u. The interval at FUT P is set to (t_u, ∞). The modal meaning can be thus properly computed.

Our analysis of nonpast embedded under FUT is very similar to the idea of a prospective marker under FUT, found in recent literature in Kush 2011 and Matthewson 2012, for Gitksan— which actually has overt prospective aspect marker *dim*, see (103).

(103) da'akxw[-i]-'y dim ayee=hl bax-'y (Gitskan)
circ.poss[-tra]-1sg.II PROSP go.fast=CN run-1sg.II
'I can run fast'.

We want to make clear that Greek does not have a prospective particle, but a morphological and semantic non-past verbal form. Kush, further, (*ibid.*) studies the Hindi modal particle *gaa*, which, like FUT, shows a flexibility between epistemic and predictive readings. The future reading arises with the bare verb (no tense or aspect) (104), and the epistemic with perfective (past) (105-a) or progressive aspect (present) (105-b) (examples and glosses from Kush, *ibid.*, ex. (5)-(6a)-(6b)):

(104) ve bacce do din=mẽ aa-ẽ-gee. (Hindi)
dem.3.pl child.m.pl two day=in come-sbj.pl-mod.m.pl.
'Those children will come in two days.'

(105) a. ve log ab^{h}i=tak pahũc^h-ee hõ-∅-gee. (Hindi)
dem.3.pl people now=by arrive-pfv.pl aux-sbj.pl-mod.m.pl
'They must have arrived by now.'
b. ve log ab^{h}i naac rah-ee hõ-∅-gee. (Hindi)
dem.3.pl people now dance prog-m.pl aux-sbj.pl-mod.m.pl.
'They must be dancing now.'

Kush analyzes *gaa* as a modal operator, but posits metaphysical modality for the future reading. Future/metaphysical modal base arises with no tense in Kush's account, and the epistemic reading relies on as aspect: "from the ungrammaticality of auxiliaries in Future constructions we can conclude that Tense is absent." (Kush 2011: 417).

Given the Greek system we outlined above, we cannot say that tense is absent with non-past. Morphologically, non-past is a tense in Greek. So, when FUT selects a perfective non-past, it selects a tense/aspect combination. At the same time, the non-predictive epistemic reading in Greek and Italian rely on PAST and PRES, which does create a parallel with Hindi— but we do not claim that there is a shift in modal base, as FUT uniformly quantifies over epistemic alternatives in our account. Overall, and this is worth emphasizing, looking at Kush, Matthweson, and our account we find systems where modality and tense/aspect are dissociated, and the modal particle scopes above tense/aspect. Therefore the data from Greek, Italian, Gitksan, and Hindi jointly suggest that (at least) future modals in these languages are not mixed modal/temporal operators (thus challenging the generality of Condoravdi (2002)).

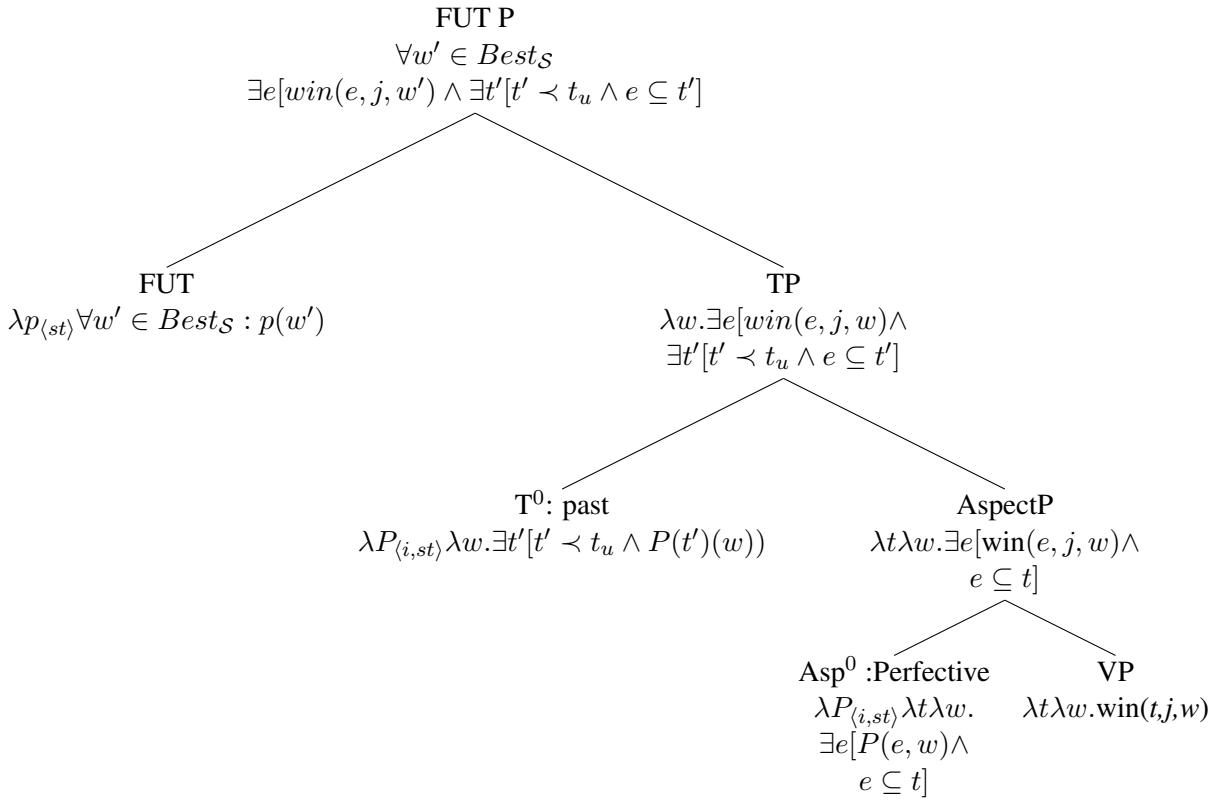
5.3 FUT with PAST

Before turning to Italian, we are now ready to provide the analysis for FUT with PAST. As we explained, PAST is a perfective in Greek. We thus distinguish a perfective and a PAST layer.

(106) O Janis tha kerdise.
the John FUT win.PAST.3sg
John must have won.

Here, the embedded time is a simple past which is deictic, therefore it denotes the interiority relation wrt t_u: t' $\prec t_u$. The Now anchoring rule does not apply since there are no free variables.

(107)



To conclude, FUT is an epistemic modal in both cases, and it does not provide tense. When it embeds a non-past proposition it expresses a conjecture about an event that has not happened yet, and, when it embeds a past proposition it expresses a conjecture about the past. The temporal information, in both cases, comes form the tense below FUT. As noted in section 2, FUT plus PAST does not have the future of a past reading, which supports our analysis that FUT provides modality and not futurity.

5.4 Syntax-semantics of Italian

In Italian, *futuro* appears on the verb (108-b), like present (108-a) and simple past (108-c) (S-PAST).

(108) a. Arriv- a. (Italian)
Arrive 3SG.PRES.
'He arrive any moment soon.'

b. Arriver- à. (Italian)
Arrive 3SG.FUT.
'He will arrive.'

c. Arriv- ò. (Italian)
Arrive 3SG.S-PAST.
'He arrived.'

We propose that abstractly the structure is similar to Greek, with FUT being expressed higher than TP. The order of application of the semantic functions Perfective, Tense, and Future is the same as in Greek - and it is merely a morphological fact that future is a Tense, and must therefore stay within the V-form in Italian. In Greek, FUT is a particle and stays outside the V. In other words, in Italian there is a mismatch between the function of *futuro* (modal) and its status as a verbal category. The same, by the way, holds for subjunctive, which in Italian, unlike Greek, also appears on V.

The main difference between Italian and Greek, is that, in Italian, Aktionsart determines the aspectual information - since in Italian there is no grammatical aspectual distinction in the nonpast. We note with previous literature (and most notably Bertinetto 1979), that, in Italian, the eventive/stative distinction plays a role, just as in a variety of other languages (see Cipria and Roberts 2000; Condoravdi 2002; Copley 2002; Laca 2008). With eventive predicates embedded under present (109-b) or future (110-b), the time of evaluation of the prejacent is forward-shifted— unlike with stative predicates (109-a)-(110-a). Such data can be replicated for English, and extend beyond present and future (e.g. see Copley 2009).

(109) a. Gianni è malato. ((Italian) stative, present reading)
Gianni be.3SG.PRES ill.
'John is ill.'
b. Gianni arriva. (eventive, future reading)
Gianni arrive.3SG.PRES.
'John will arrive immediately.'

(110) a. Gianni sarà malato. ((Italian) stative, present epistemic reading)
Gianni be.3SG.FUT ill.
'John must be ill.'
b. Gianni arriverà. (eventive, predictive reading)
Gianni arrive.3SG.FUT.
'Gianni will arrive.'

Condoravdi (*ibid.*) notes the same pattern for modals (see (111)) and proposes an account that relies on aspectual differences between statives and eventives, from which it follows that the time of evaluation of the prejacent is forward-shifted only with eventive ones.[24]

(111) a. John might be ill (stative, present orientation)
b. John might become ill (eventive, future orientation)

According to Condoravdi (*ibid.*) the modal itself bears the temporal information and provides a forward-shifting interval. Dedicated AT rules provide an inclusion relation for eventives (the temporal trace of the event is located within the interval provided by the modal) and an overlapping relation for statives (the temporal trace of the stative eventuality overlaps with the temporal interval provided by the modal).

We cannot adopt this view here, since, as we just noted, forward-shifting with eventives is independent of modal embedding, see (109-b). Our proposal builds on a parallelism between grammatical and lexical aspect, according to which lexical statives are standardly imperfective, whereas eventives are perfective unless they are marked by a progressive verb form (see Smith

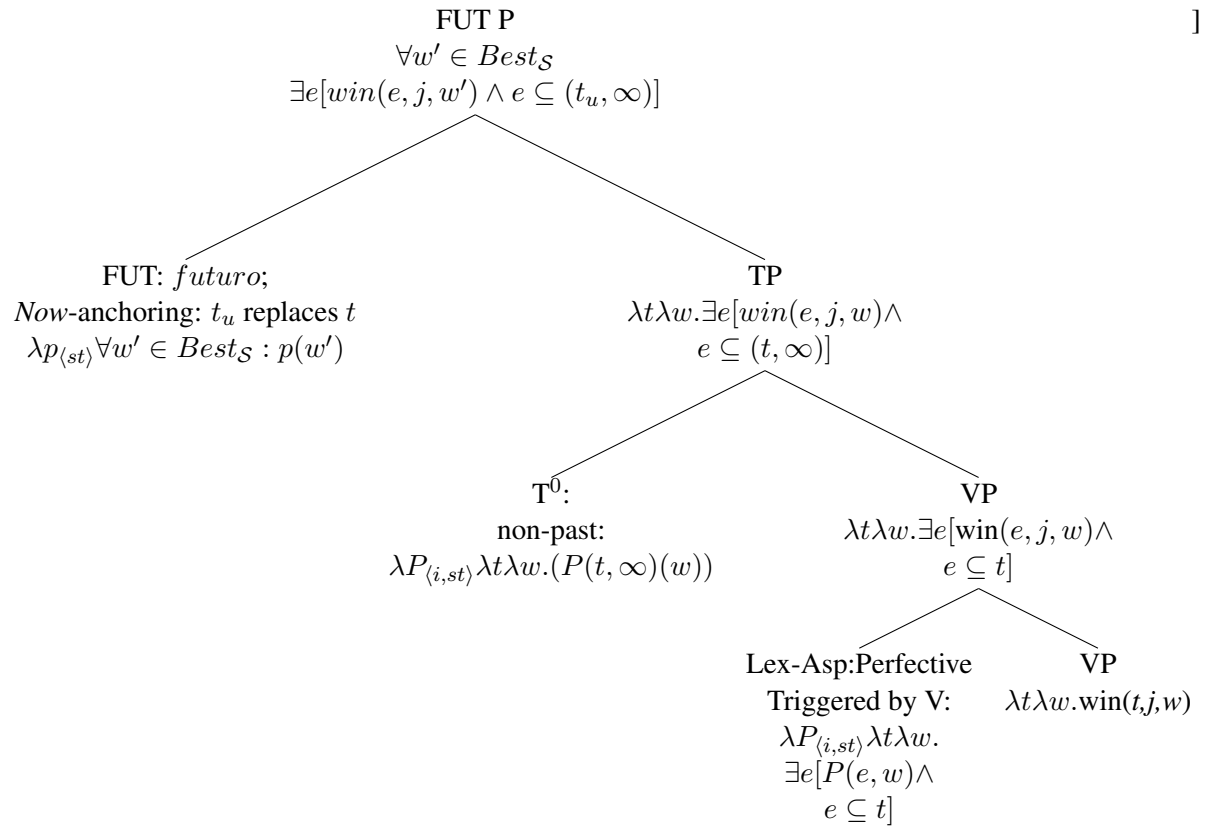
[24]When the prejacent is stative (and the time of evaluation is not forward-shifted), the modal has an epistemic interpretation. According to Condoravdi (2002) the modal has a metaphysical interpretation in (111-a).

1991; Boogaart and Trnavac 2011). In this line of thought, lexical eventives provide aspectual information – perfectivity – and perfectivity, in absence of PAST, triggers futurity (the non-past, $\lambda P \lambda t \lambda w(P(t, \infty)(w))$). Aspect is thus contributed in the VP.

Note that, just as in Greek grammatical perfectivity combines with either non-past or past, in Italian, lexical perfectivity is compatible with past or non-past, as is the case here to produce the predictive reading.[25]

Above the VP, the derivation in Italian is parallel to the one one in Greek. We see that, by being parametric to the time of utterance, FUT provides *Now*-anchoring in Italian as well.

(113)



Why perfectivity, in non-past environments, triggers futurity has been the object of much study— although there is no final answer to this question (Copley 2009, Mari 2015a, Boogaart and Trnavac 2011). Here we would tend to align with Boogaart and Trnavac (*ibid.*) who espouse the classical view from Comrie (1976): "a perfective verb form instead presents a situation, 'from the outside', as a completed whole, thus including both its starting point and endpoint." Perfectivity thus establishes a distance between the boundaries of the event and the perspectival point, which

[25] As often noted, forward-shifting is observed with statives too, e.g. , as in 'Domani sarà malato' (*Tomorrow he will be ill*), which guarantees that the left boundary of the state be located after the time of utterance. In Greek, statives can also forward shift, but with perfective aspect:

(112) O Giannis tha arrostisi
'the John FUT ill.PERF.NON-PAST.3SG.
'John will get ill.'

in the case of future is the utterance time. For this reason perfectivity can combine with past or non-past, but does not provide PRES.

Let us now turn to the morphological future anterior in Italian.

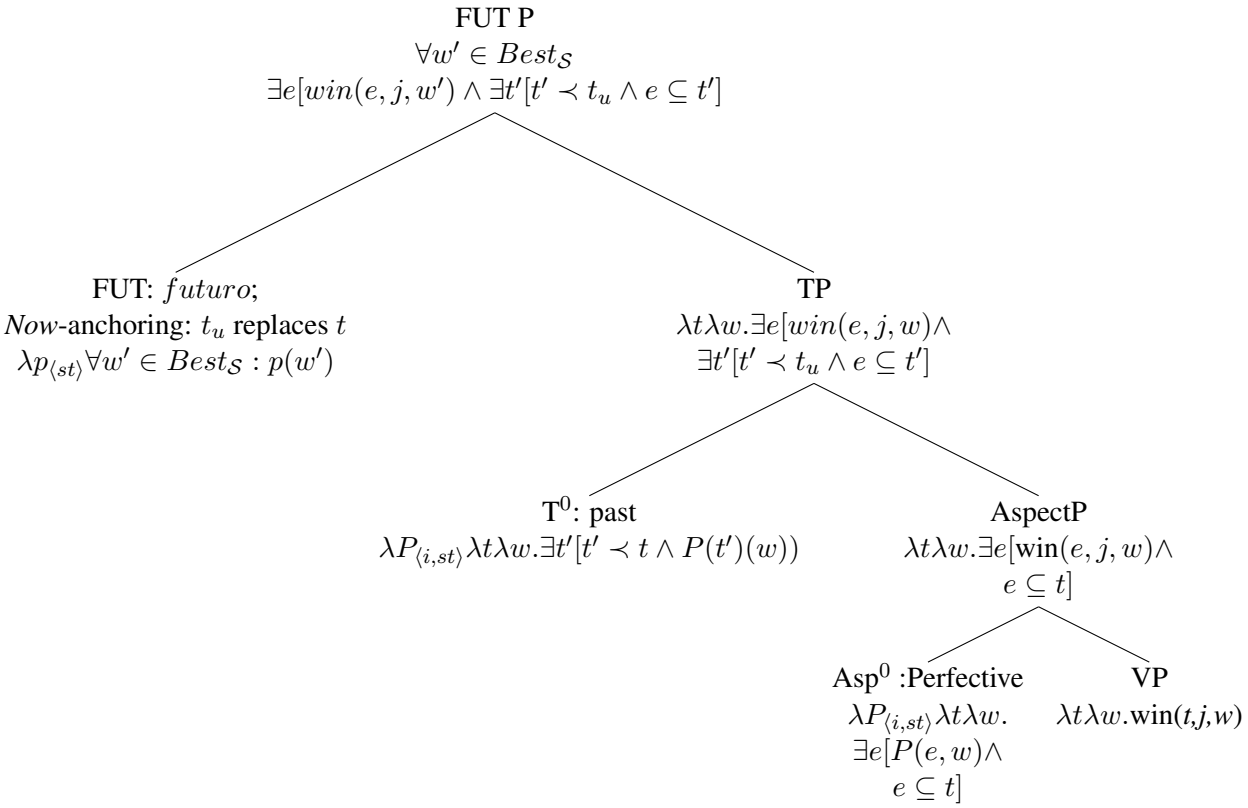
(114) Gianni sarà andato al cinema ieri.
Gianni be.FUT.3SG gone to-the theatre yesterday.
Gianni must have gone to the theatre, yesterday.

Recall that the corresponding sentence is a a simple past, i.e. past perfective, in Greek. In Italian, FUT is in complementary distribution with a variety of auxilaries bearing different tenses (115), thus entering apparent Perfect constructions (see de Swart, 2007).

(115) è,fu,sarà andato.
be.3sg.pres.simple-past.fut gone.

We decompose the perfect component as a combination of PAST and PERFECTIVE, as in Greek. The perfective layer provides the temporal boundaries of the eventuality; the PAST expresses anteriority. But given the possibility of combining with a variety of tenses, we must concede that the PAST we are positing is *not* deictic but *relative*: it does not express anteriority with respect to t_u but wrt a time t which is a free variable TP. This triggers the Now-anchoring rule. The derivation is as follows.

(116)



We can thus generalize that, regardless of whether the embedded PAST under FUT is a simple past or a perfect, the anteriority relation is expressed— only in the case of the simple past (Greek)

it makes reference to t_u, but in the case of the perfect (Italian, English, Dutch, German) we have relative anteriority and reliance on the Now-rule. What is important is that the anteriority relation is in the scope of FUT. Our analysis of Italian can be extended to cover Dutch, German and English apparent perfects under FUT and MUST.

6 Further comparisons, cross linguistic predictions

6.1 More arguments against metaphysical future

We argued that the predictive future involves knowledge, based on the observation that one can disagree about the future. We showed that the metaphysical modal base can be antiveridical. *A fortiori*, then, a purely metaphysical account of prediction should be rejected. For completeness, let us provide further arguments. One can argue, for example, that there are no stereotypicality conditions for cases like (117), inspired by Bonomi and Del Prete 2008.

(117) Il dado cadrà sul 6. (Italian)
The dice come-up.3SG.FUT on 6.
'The dice will come up 6.'

This sentence is infelicitous under normal circumstances: if the die is normal, one cannot utter (117) because the speaker does not have knowledge to favor this one possibility of 6. The sentence can be uttered by a magician, however, who tampered with the die, and knows that it will come up six. Although the epistemic space of the magician is veridical (s/he knows that six is the only option) s/he nonetheless uses the future to *pretend* that s/he is making a prediction. In other terms, s/he can pretend that her/his own space is non-veridical (contrary to the facts, since the die is tempered). The use of the future is felicitous in this scenario, as non-veridicality is met.[26] Alternatively, (117) can express a hope, an ingredient that our analysis does not touch upon (though it may be present also in what we called indeterminate predictions), and which can be easily accommodated— hopes have been argued to be a special type of doxastic modality (Portner and Rubinstein 2012)).

The same sentence has been used to argue that FUT features a 'wait and see' interpretation, with no truth conditions assigned at the time of the utterance (McFarlane, 2005; Bonomi and Del Prete, 2008). This is yet another possible analysis for future sentences. We have not adopted it here, as one would not be able to capture the systematic cross-linguistic relation between the epistemic and predictive future. It would also lead one to posit ambiguity for the predictive future which, according to Bonomi and Del Prete (*ibid.*) would feature modal meanings (regular prediction, e.g., (73)), on the one hand, and truth value gaps (117), on the other, thus multiplying the lexical entries for FUT.

[26]Note that metaphysical modality also involves knowledge, just like any statement, including non-modalized ones. However, a metaphysical modal as in *The Western underground orchid can grow here* does not involve a non-veridical epistemic state. Just as the non-modalized version *The Western underground orchid grows around here*, it involves subjective veridicality (recall section 3.2): the speaker knows that the conditions for having orchids growing here are met. This is subjective veridicality. On the other hand, the metaphysical modality is not implicative: it is not entailed that the orchid actually grows here (the modality is only compatible with orchid growing here). In our terms, metaphysical modality presupposes non-veridicality in the metaphysical space. It does not presuppose non-veridicality in the subjective space, which is the one targeted by future sentences and epistemic modals.

Kaufmann (2005) proposes that metaphysical options are open and ordered by Kratzerian ordering sources. The ordering source used by Kaufmann is 'likelihood' and, for future, Kaufmann does not consider the role of knowledge (he discusses knowledge in relation with the modal future oriented present instead). Just like Giannakidou and Mari (2013b), Kaufmann (*ibid.*) suffers from the problem of metaphysical options, and no ordering sources can rescue this type of account. Ordering sources are also used in accounts which treat *will* as a bouletic modal, which we consider next.

6.2 Bouletic future?

Copley 2002 is a well-known account of *will*, but does not address the epistemic future. As far as we can see, it does not have the tools to address it. Copley discusses the predictive reading, and the criteria for partitioning the metaphysical modal base are inertia, abilities and commitment to bring about p. Copley's commitment is related to volition.

A central question for Copley, just like with us, is how the speaker can be confident about her prediction when in fact the future is metaphysically open. She advances the following claim.

> "One way is to be confident that someone (the agent of the sentence or some other person) has the ability to determine whether an eventuality happens or not, and is committed to making it happen. The other is to be confident that non-accidental properties of the world entail that it will happen. These two options were reflected in bouletic and inertial orderings on a metaphysical modal base, with universal quantification over the set of worlds." (Copley, 2002:59)

Here we have a distinction between bouletic and inertial futures, a difference that Copley traces back to Dahl (1985). Desires and inertia are two criteria to partition the modal base. Let us consider an example from Copley, a case where two friends are discussing:

(118) Don't worry, she'll be there at 5:00 p.m. (ex. 124 in Copley, 2002)

According to Copley, the speaker has two possible reasons for asserting this: either he believes that some fact about the world will ensure that she is there (she has some obligation just before 5:00 in the same room, she always walks by there at 5:00, etc.), or he believes some person will personally ensure that she is there, and has the power to do so (ability and commitment component. For Copley, commitment is a bouletic notion, as we said). The first reason seems to reflect an inertial ordering, the second a bouletic ordering. For us, there is no bouletic (or ability) component.

Consider now the following example paying attention to the restriction on the worlds of the modal base, which are p worlds. (119) is an example of bouletic future, according to Copley.

(119) Don't worry, it'll snow tomorrow; it always snows on my birthday. (ex.144 in Copley 2002)

The truth conditions Copley provides for (119) are in (120) and are paraphrased as: 'in all situations overlapping the present, a contextually specified director wants p at some future time.' (Copley, 2002:69). Note that the notion of director includes those of ability to carry about p.

(120) $\text{ALL}_t(\text{ALLb(d)(q)})(\text{w})(\text{t}) = 1$ iff
$\forall t' \supset t : [\forall w'$ metaphysically accessible from w at t' and maximally consistent with d's commitments in w at t':
$\exists t'' > t' : [q(w')(t'')]]]$
Presupposed: d directs q in w at t'

This example is emblematic of the deep differences between our and Copley's account. In our account, the truth conditional content comprises only an epistemic modal base and a stereotypicality ordering source. Nothing more. In our view, to utter (119), the speaker considers a set of propositions: e.g., what happened the previous years and that, if everything goes normally given that knowledge, it will snow this year too. There is no director, ability or commitment to carry about p, and the metaphysical branches are not partitioned according to ability or volition. Note that bouletic modals do allow entertaining two contradictories desires, given one individual anchor.

(121) I want to marry John and I do not want to marry John.

But this does *not* hold for FUT.

(122) #I will arrive at 4 and I will not arrive at 4.

The sentence is ruled out in our account because of the stereotypicality conditions and the Best set. A speaker cannot at the same time consider ideal p and $\neg p$ worlds.

A potentially useful observation is that *will* relates historically to volition. Cross-linguistically, paths from volition to future have been documented— *tha* has also been claimed to derive from *thelo na* 'want' plus the subjunctive *na* (Tsangalidis 1998, Joseph and Pappas 2002, Markopoulos 2009). But the historical path does not entail volitional meaning synchronically. And while it may be conceivable that there are volitional futures (perhaps along the lines of Copley 2002; see also Del Prete, 2011 on a root interpretation of *will*), it has not been shown in any of the works we have seen that *will* synchronically conveys volition in its future use. The evidence amassed with purely epistemic usage of *will* doesn't seem to support a volitional analysis, and an argument based on diachronic volition would be tenuous at best. If the diachronic path of Greek *tha* from volition to future led to meaning change, we see no reason not to assume the same for *will*.

6.3 Crosslinguistic variation in epistemic futures: ratificational *will*

As we have reached the end of the paper, let us think now a little but more about English. There is variability in judgements among native English speakers, and some accept easily the non-predictive epistemic reading of *will*; we even encountered some speakers that accept epistemic *will* with past adverbs (thanks to Chris Kennedy and Jason Merchant for their judgements and data). It remains true that although the Greek and Italian epistemic futures are unexceptional and widely attested, epistemic non-predictive *will* may not be as routine, and its existence has been contested in the literature (see e.g. Copley 2002). Cariani 2014, on the other hand, develops an analysis where *will* is, as he puts it "a kind of epistemic modal", and in our own analysis of Greek and Italian, we found *will* to behave very similarly and pattern the epistemic futures definitely in the present.

Regarding English, sometimes one hears that epistemic modality is *not* compatible with future orientation, e.g., for Condoravdi 2002, the future oriented modal shifts to a metaphysical modal

base. As can be seen with *might* below, however, *might*, an epistemic modal, receives easily future orientation with non-past. We include below eventive and stative predicates:

(123) a. If John continues to smoke like this, he might be ill in a few years.
b. For all I know, John might bring his friend to the party.

Hence, there is no incompatibility of epistemic modality with future temporal orientation. Enç 1996 discusses future orientation with *may* and suggests that "if *will* is treated not as a tense but as a necessity operator quantifying over possible worlds consistent with predictions, then future shifting *may* is the dual of *will*" (Enç 1996: 356). In our analysis, Italian and Greek future morphemes are the dual of *might*, all epistemic modals.

Still, there is a tendency to interpret future oriented *must* deontically:

(124) a. Next month, Ariadne must move to Paris.
b. Next month, Ariadne will move to Paris.

With the mention of *next month* we have an explicit future context. In such a context, there will be competition with the specific (thus unmarked) form *will* for the future universal modal in English. A speaker is expected to use *will*. In not using it, it is understood that something else is intended, and this 'dooms' *must* to the realm of the deontic modality with the future adverb.

In Greek and Italian, on the other hand, MUST and FUT are not in competition— since they are not both modal verbs— and can combine (Giannakidou 2012, Giannakidou and Mari 2013a,b, 2016):

(125) I Ariadne tha prepi na milise xthes (Greek)
the Ariadne FUT must subj talk.3SG.PAST yesterday
'Ariadne must have spoken yesterday.'

(126) Giacomo dovrà aver parlato ieri. (Italian)
Giacomo must.3SG.FUT have spoken yesterday.
'Giacomo must have spoken yesterday.'

(127) I Ariadne tha prepi na milisi avrio. (Greek)
the Ariadne FUT must SUBJ talk.3SG.PAST tomorrow
'For all I know, it must be the case that Ariadne will speak tomorrow .' or 'Ariadne has the obligation to speak tomorrow.'

(128) Giacomo dovrà pralare domani con il direttore. (Italian)
Giacomo must.3SG.FUT talk tomorrow with the director.
'Giacomo must talk tomorrow with the director.' or 'Giacomo has the obligation to talk with the director tomorrow.'

As we see, these sentences have an epistemic-predictive reading "it must be the case that Ariadne will speak tomorrow". *Tha* and futuro combine with the universal epistemic modal and appear to "agree" with it— a real case of modal concord (Giannakidou 2012, and Giannakidou and Mari 2016). In addition, the sentences also have a deontic reading, as indicated.

Here is now the million dollar question: Is *will* an epistemic future? There is no doubt that *will* has epistemic uses, as the numerous examples we discussed here prove. However, it is equally correct to observe that the epistemic uses of *will* may be less common than the epistemic uses of

Greek and Italian future. As a matter of fact, while speakers do acknowledge that *That will be the postman* has an epistemic reading, the sentence below is odd:

(129) He is not at school. ??He will be ill.

In Greek and Italian, this example is absolutely fine; in English, *must* must be used:

(130) a. Dhen ine sto sxolio. Tha ine arrostos. (Greek)
Not be at school. FUT be ill.
b. Non é a scuola. Sarà malato. (Italian)
Not is at school. Be.3SG.FUT ill.
'He is not at school. He *must* be ill.

Crucially, *will* is not the only future featuring this pattern; we find it also with French future.

(131) a. La sonnette sonne. Ce sera le facteur. (French)
The doorbell ring.3SG.PRES. That be.3SG.FUT the postman.
'The doorbell is ringing. It will be the postman.'
b. Il n'est pas à l'école. ??Il sera malade. (French)
He not-be.3SG.PRES at the-schoold. He be.3SG.FUT ill.
'He is not at school. ??He will be ill.'

(132) a. La sonnette sonne. Ca doit être le facteur. (French)
The doorbell ring.3SG.PRES. That must.3SG.PRES be the postman.
'The doorbell is ringing. That must be the postman.'
b. Il n'est pas à l'école. Il doit être malade. (French)
He not-be.3SG.PRES at the-school. He must.3SG.PRES be ill.
'He is not at school. He must be ill.'

The contrast between *will* (129) and French future (131-b), on the one hand, and Greek/Italian future (130), on the other, can be understood within the context of a recent study by Mari (2015b). Mari identifies a subclass of epistemic futures that she calls *ratificational*. A ratificational future is epistemic, but requires further that there be a time of verification (no matter how far into the future). A ratificational future won't be used if there is no verification time in the future. This is shown below, with a very clear minimal pair in Italian-French in (133). Here two friends are speculating about the shape of the universe.

(133) a. Sarà sferico. (Italian)
Be.3SG.FUT sferical.
b. ??Il sera sphérique. (French)
It be.3SG.FUT sferical.
'It must/#will be spherical.'

(Mari *ibid.* presents multiple differences between Italian and French futures and French future and *devoir*, 'must' in French.) Note the translation with *must*, as *will* is odd, patterning with French future. According to Mari (2015b), the oddness is due to the impossibility of the verification of the shape of the universe (see also de Saussure and Morency, 2011). Ratification is not required for the Greek and Italian FUT, hence (133-a) is not odd in Italian. Most importantly, the ratification time

must be in the future, and this explains why *will* resists epistemic uses in the past (unlike Greek, Italian, German and Dutch futures):

(134) a. Tha efije xthes. (Greek)
FUT left.3SG yesterday.
'He must/#will have left yesterday.'
b. Sarà andato via ieri. (Italian)
Be.3SG.FUT left away yesterday.
'He must/#will have left yesterday.'

Verification at a future time, then, appears to be a factor constraining further the distribution of certain epistemic futures, and crucially for our purposes, *will* appears to be one of those futures. A tentative truth condition in line with Mari's proposal for French future (Mari to appear-b) can be given below— where the existence of a future verification time t_{ver} is cast as a presupposition:

(135) $[\![\text{WILL (NON-PAST}(p))]\!]^{M,i,\mathcal{S},t_u}$ will be defined only if:
(i) the modal base M(i)(t_u) is epistemic and nonveridical; and (ii) $\exists t_{ver} \in (t_u, \infty)$ such that p will be verified in t_{ver}.
If defined,
$[\![\text{WILL (NON-PAST}(p))]\!]^{M,i,\mathcal{S},t_u}$ = 1 iff $\forall w' \in \text{Best}_{\mathcal{S}} : \exists t' \in (t_u, \infty) \wedge p(w', t')$

We will not be able to embark on a fuller consideration of *will* in the present paper, and we realize that our tentative semantics above needs to be tested against various challenges, including e.g. the indeterminate futures *Giacomo will be an artist some day*. We feel that in such cases there is belief or expectation that there will be a t_{ver} although such a time is not identifiable. Crucially, although these cases show that the ratificational future does not require the existence of a *specific* or *identifiable* time (in the sense of Farkas 2002), the connection between verifiability (propositional domain) and identifiability (the nominal domain) appears to be a fruitful one to explore.

Finally, treating *will* as an epistemic future of the more restrictive kind that depends on the existence of a future verification time also resonates with McFarlane's 'time of assessment.' (Note that for McFarlane (2005) no truth conditions can be assigned at the utterance time, but for us *will*, like all epistemic futures, conveys truth$_i$ at the time of assertion.). It appears therefore that epistemic futures are not only common crosslinguistically, but also diverse along the verification parameter. The plausibility, implications, and further coverage of ratificational futures will have to be left for the future.

7 Conclusions

Our goal in this paper was to offer an analysis of what it means to make a prediction using a future morpheme. Our novel strategy was to address this question by examining the behavior of Greek and Italian future morphemes which happen to have extensive, unmarked, epistemic use along with the predictive use. We pursued the null hypothesis, and offered a unified analysis of Greek *tha* and Italian *futuro* as epistemic necessity modals– and in so doing we pointed out numerous important parallelisms between predictive future and epistemic modals suggesting that metaphysics cannot be the right foundation for the prediction. We found the predictive statements to be subjective,

just like epistemic modal statements. As such, both epistemic and predictive statements depend on what the predictor knows or believes— and not on what will actually be the case.

In our analysis, it is no surprise that future morphemes systematically show in a number of languages (including English) epistemic and predictive use. The two readings are essentially the same. The prediction is an epistemic modal sentence about an eventuality that the speaker has reason to believe will happen at a future time, and the temporal information comes from the tense below, *not* from the future morpheme itself. If, as we argue, prediction is an epistemic category, the need for metaphysical modality loses much of its motivation, and this is an implication of our analysis worth thinking about.

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