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ORIGINAL RESEARCH

The Italian futuro as a non-biased epistemic necessity: a reply to Ippolito and Farkas

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Abstract
In a recent paper, Ippolito and Farkas (Linguist Philos, 45(4):943–984, 2022b) (I&F) question the premise that Italian future is epistemic necessity; in this brief response we want to show that there is no empirical motivation for abandoning it once we employ a more flexible framework of modality such as the one advanced in Giannakidou and Mari (Linguist Philos 41(6): 623–664, 2018) (G&M) which posits a ranking meta-evaluation in the modal structure that explains the empirical objections raised by I&F. We show that the core of the account in I&F shares the main ingredients with G&M and that, unlike what I&F propose, Italian future is not pure credence.

Keywords Future · Epistemic modality · Belief

1 The future and modality

In the light of recent studies of future morphemes (henceforth FUT) in various languages, it is no longer a surprise that FUT words such as in Greek, French, English, German, and Dutch have routine epistemic uses. In our own work, we proposed an analysis of them as epistemic necessity modals (Giannakidou and Mari, 2012, 2013, 2016, 2017, 2018a, 2018b, 2021, henceforth G&M; see also Mari, 2009, 2010; Giannakidou 2012, and references in all these works).[1] Italian is one of the languages

[1] As in our previous work, we use capital letters for cross-linguistic expressions belonging to the grammatical class future (FUT), and use likewise upper case MUST and MIGHT for expressions of epistemic necessity and possibility respectively. We use italics to refer to specific expressions within a specific language, and English translations are in quotes.

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discussed in this context; the observation that the Italian futuro has epistemic usage goes back to Bertinetto (1979) and Pietrandrea (2005). Consider (1):

(1) Gianni sarà a casa.
Gianni be.FUT.3sg at home
'Gianni must be at home.'

G&M translate the FUT statement with MUST and propose that FUT belongs to the class of MUST modals which express epistemic necessity. We offered a compositional analysis that derives present, past, and forward shifted (temporal future readings) from the interaction between the epistemic modal and the embedded tense. In contrast to modal verbs and auxiliaries akin to MUST (*must* (English), *müssen* (German), *prepi* (Greek), *dovere* (Italian), *should* (English), *have to* (English)) which in addition can also express deontic necessity, the FUT modality only associates with an epistemic modal base (like the English word *might* which is unambiguously epistemic). The evidence we presented for the epistemic necessity analysis of FUT relied heavily on similarities between MUST and FUT in a number of crucial diagnostics including the incompatibility of both with knowledge of the prejacent. As necessity modals, we argued, both FUT and MUST convey positive bias towards the prejacent, and for this reason we called them *biased modals*.

In a recent paper, Ippolito and Farkas (2022) (henceforth I&F) offer some new data patterns from Italian futuro as challenges to the epistemic analysis. In this brief response, we address the key objections raised by I&F, and show that their apparent challenges in fact illustrate not that the epistemic analysis is insufficient for futuro (as I&F intend it), but that the original G&M analysis must be augmented with an understanding that the parallelism between MUST and FUT modals is not perfect. While both epistemic necessities, some FUT modals—the Italian future but *not* the Greek *tha*—may be more flexible in that they have no bias. This more refined understanding requires the framework of modality we advanced in Giannakidou and Mari (2018b), where we posited a ranking meta-evaluation in the modal structure that explains, as we shall show, the apparent freer distribution of futuro. The I&F paper is specifically about futuro, we will therefore focus on that—but the comparison with Greek will be useful in illustrating the cross-linguistic scope of our theory.

Because I&F rest most of their case on data slightly diverging from the main Greek and Italian patterns we documented in G&M, we must note—as a more general methodological point—that belonging to a given semantic class does not entail that all members of the class exhibit identical behaviors. Quite the opposite: diversity within a semantic class turns out often to be the case. Polarity items or mood morphemes, to use two examples from a related realm, do not have exactly the same distributions across languages; and while the differences are real, the systematic similarities are substantial enough not to warrant exclusion of the partly diverging items but rather modification of the theory so as to accommodate them in a principled way. Only if such modification cannot be done do we conclude that a new analysis is needed—otherwise, we end up with case by case analyses differing little and failing to capture the commonalities that produce analytically useful generalizations.

In G&M, we noted indeed empirical differences within the FUT class: Italian and Greek futures, for instance, differ from English *will* and French FUT in that *will* and French FUT have a ratificational presupposition that Greek and Italian futures lack, they can thus only be used in contexts where this presupposition is satisfied.[2] The specific data that I&F bring to light in their paper, upon closer inspection, suggest that the epistemic analysis of FUT must allow for the possibility that some FUT expressions may lack bias. Italian futuro presents this possibility. The modal framework of Giannakidou and Mari (2018b) can capture this quite successfully because it dissociates modal force from ranking.

Importantly, a FUT lacking bias is different from an underspecified FUT. The idea that futuro is unspecified for force was already advanced in Mari (2010). I&F propose data against this hypothesis, which we address here in the light of the new notion of meta-evaluation which offers an articulated meaning for future—that was absent in Mari (2010) but can account both for universal quantification (like MUST) and lack of ranking (like MIGHT). With the framework of Giannakidou and Mari (2018b) we have the necessary tools to explain how futuro is an epistemic modal, yet different from both *dovere* 'must' and *potere* 'can'.

Once our analysis of futuro gets updated, we can ask how G&M and I&F differ and whether their "presumptive" future is categorically different from epistemic future. A careful comparison will show that the main ingredient that teases the two accounts apart is what goes into the epistemic modal base: for us, it is a mixture of credence (pure belief) and knowledge of the speaker, but it is just belief for I&F, echoing again Mari's (2010) earlier paper. As we will show, pure belief is not viable for FUT which is why we didn't adopt Mari (2010) in the first place. As ultimately both accounts rely on non-settledness, as a presupposition of non-veridicality and lack of knowledge in G&M and as a non-cancellable implicature in I&F, it seems to us there is no motivation for an additional category for "presumptive" future as substantially different from the epistemic future.

We proceed to outline the main components of the G&M analysis first adding Giannakidou and Mari (2018b); then take up the empirical challenges of I&F, update our analysis of futuro, and finally compare the two accounts—addressing the issue of credence—in Sect. 4.

2 Epistemic necessity, nonveridicality, and ranking meta-evaluation

G&M propose an analysis of FUT as an epistemic modal operator akin to MUST (in all uses, thus also in the future shifted reading). Following standard practice, G&M assume that as an epistemic modal, FUT will take a modal base which they define as purely subjective, i.e. dependent on the speaker who is the individual anchor i. The modal base of an epistemic modal, following standard practice, contains what i **knows** or **believes**.[3]

[2] See more discussion in de Saussure and Morency (2011) and Mari (2016a).

[3] See earlier formulations in Giannakidou (1998, 1999) and Giannakidou (2013). The idea that epistemic modality contains a doxastic component is pretty standard also in Kratzer's original analysis and in

(2) *Epistemic state of an individual anchor i* (Giannakidou, 1999: (45))
An epistemic state M(i) is a set of worlds associated with an individual i representing worlds compatible with what i knows or believes.

M(i) is a private space encompassing i's knowledge and beliefs relevant to the prejacent proposition (and is relative to and updates in time). M(i) is a nontrivial, non-singleton set; Giannakidou in earlier work, and Giannakidou and Mari (2021) define various kinds of such states for different types of modalities. G&M take a realist stance and do not distinguish between credence (belief) and knowledge: individual anchors judge the truth of sentences typically based both on what they know and what they believe, including of course public knowledge and beliefs. Every epistemic modal operator combines with M(i), hence all epistemic modality is subjective.

Another important premise of G&M is that the M(i) of modals is *nonveridical*: a modal space is nonveridical if it is unsettled, i.e., it contains p and $\neg p$ worlds. The nonveridical state is thus partitioned:

(3) Nonveridical epistemic state:
An epistemic state M(i) is nonveridical about p iff M(i) contains both p and $\neg p$ worlds.

(4) *Epistemic unsettledness and nonveridicality*
M(i) is epistemically unsettled iff it is nonveridical.

Nonveridical epistemic states M(i) are uncertainty spaces, containing both p and $\neg p$ worlds, and do not entail p.[4] When a speaker choses to modalize, she does so because she doesn't know that p is true, p is thus not settled in M(i). The requirement that the modal base be nonveridical is a presupposition of modalities:

(5) *Nonveridicality Axiom of modal expressions* (MODAL);
Giannakidou and Mari (2018b, 2021):
MODAL (M(i)) (p) can be defined iff the modal base M(i) is a nonveridical state.

Nonaleithic modals obey Nonveridicality, and come with nonveridical modal bases (see also Condoravdi's (2002) and Beaver and Frazee (2011) who adopt the nonveridicality presupposition as a defining property of modals).[5] Since p and $\neg p$ are open possibilities, modals as a class are *anti-knowledge* markers. They do not entail the truth of their prejacent, and this explains the well-known paradigm below:

Footnote 3 continued
Portner (2009). A distinction between belief and knowledge is done only if it matters in a given context. Finally, lots of examples of MUST given in Lassiter (2016) are doxastic.

[4] See Giannakidou and Mari (2022) for specific discussion on the relation between (non)veridicality and (un)settledness.

[5] There are two exceptions both resulting in trivialization of modality: the actuality entailment of ability modals (although see Mari (2016b) for the claim that nonhomogeneity persists as a presupposition) and aleithic modality; Giannakidou and Mari (2016) distinguish empirically aleithic from epistemic *must* by noting that only the former can be focus.

(6) Context: i is standing in front of the window and sees the rain.
a. #It must be raining.
b. #Starà piovendo. (Italian)
be.FUT.3sg rain.GERUND
c. #Deve star piovendo. (Italian)
must.3sg be.FUT.3sg rain.GERUND

MUST and FUT are infelicitous here because if I see the rain, I *know* that it is raining. Knowledge is veridical, and visual evidence matters as a reliable path to knowledge. It can thus be concluded that futuro and MUST, as modals, are incompatible with knowledge of p and can be continued by "but I am not entirely sure" (as first noted in Bertinetto (1979); see related evidence for English *must* in Lassiter (2016)):[6]

(7) Deve essere/ Sarà a casa ma non sono totalmente sicuro.
must.PRES.3sg be/ FUT.3sg at home, but not be.PRES.1sg entirely sure
'He must be home, but I am not entirely sure.'

That much is admitted by I&F in their positing a "non-cancellable implicature that p is not positively settled in D_i, the modal base ((26) in I&F)":

(8) p is not positively settled.
A speaker i who asserts a declarative sentence of the form PF(S) implicates that p is not positively settled in D_i.

I&F recognize in a footnote that this corresponds our non-veridicality condition. For us, this is a presupposition but for I&F is a "non-cancellabel implicature"—a terminological difference that does not play a crucial role in the analysis.

Giannakidou and Mari (2018a) define a secondary modal base $\text{Ideal}_{\mathcal{S}}$ as a function over $\text{M}(i)(t_u)(w_0)$ in the spirit of Portner (2009). The output $\text{Ideal}_{\mathcal{S}}$ is a subset of $\text{M}(i)(t_u)(w_0)$.

(9) $\text{Ideal}_{\mathcal{S}}\,(\text{M}(i)(t_u)(w_0)) = \{w' \in \text{M}(i)(t_u)(w_0) : \forall q \in \mathcal{S}(w' \in q)\}$

So defined, $\text{Ideal}_{\mathcal{S}}$ delivers the worlds in the modal base in which all the propositions in $\mathcal{S}$ are true. $\mathcal{S}$ is a set of propositions that correspond to common ground norms and subjective preferences. The truth condition for MUST/FUT says that p is true in the $\text{Ideal}_{\mathcal{S}}$ set of $\text{M}(i)$. Given a set $\text{Ideal}_{\mathcal{S}}$ and the utterance time t_u,

(10) $[\![\text{prepi/dovere/must/FUT (PRES } (p))]\!]^{M,i,\mathcal{S}}$ is defined only if $\text{M}(i)$ is non-veridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds.
If defined, $[\![\text{prepi/dovere/must (PRES } (p))]\!]^{M,i,\mathcal{S}} = 1$ iff $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Note crucially that at this stage, even if there is universal quantification over $\text{Ideal}_{\mathcal{S}}$ worlds, there is no ranking yet. This is where MUST and futuro diverge, but this divergence is not observed across all languages we argue: Greek treats FUT like

[6] We are not claiming here that this tests holds for English *will*, which, as we have argued in Giannakidou and Mari (2018a) and Mari (2016a) is to be treated on a par with French future as featuring a ratificational component which is absent from futuro.

MUST, Italian does not.[7] We do not reiterate here the demonstration for Greek *tha*, but concentrate on how the G&M framework can accommodate the difference between MUST and futuro within the class of epistemic modality.

In Giannakidou and Mari (2018b), $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds are ranked by an ordering source $\mathcal{O}$. $\mathcal{O}$ is a "meta-evaluation" that compares $\text{Ideal}_{\mathcal{S}}$ to its complement in $\text{M}(i)$ and ranks them as either better possibilities or weak necessities (in the sense of Kratzer, 1991 and Portner, 2009) producing positive bias. $\mathcal{O}$ can also be empty, which results in absence of bias. The $\mathcal{O}$ function manifests itself often in the form of an overt adverb, and its effect changes depending on the adverb. We offer here a summary from Giannakidou and Mari (2018b):

(11) Effect of the adverbs with *universal* modals.
   a. DEFINITELY (It. *assolutamente*; Gk. *oposdhipote*; Eng. *definitely*): Strengthening the positive bias of necessity.
   b. PROBABLY (It. *probabilmente*; Gk. *mallon*; Eng. *probably*): Maintaining the default positive bias of weak necessity.
   c. MAYBE (It. *forse*; Gk. *isos* Eng. *maybe*): Lack of bias: no ranking.

The typical MUST modal structure, we argued, contains a default null PROBABLY which ranks the Ideal worlds (where p is true) as better possibilities than the non-p worlds, producing positive bias:

(12) For any $\text{Ideal}_{\mathcal{S}}$, $[\![\text{Probably/Probabilmente/Mallon}]\!]^{\mathcal{O},\text{M},i,\mathcal{S}} = \lambda q$. $\text{Ideal}_{\mathcal{S}}$ is a better possibility with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\text{M}(i)$ and $\mathcal{O}$ & q

(13) $[\![\emptyset\,\text{MUST (PRES }(p))]\!]^{\mathcal{O},\text{M},i,\mathcal{S}}$ is defined only if the modal base $\text{M}(i)$ is non-veridical and it is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined, $[\![\emptyset\,\text{MUST (PRES }(p))]\!]^{\mathcal{O},\text{M},i,\mathcal{S}} = 1$ iff: $\text{Ideal}_{\mathcal{S}}$ is a better possibility with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\text{M}(i)$ and $\mathcal{O}$ & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Positive bias is thus derived as an effect of association of MUST with a default PROBABLY that ranks the p worlds as better possibilities than the non-p worlds. With possibility adverbs, on the other hand, $\mathcal{O}$ is empty and produces no ranking. Yet, as observed in Giannakidou and Mari (2018b), possibility adverbs do occasionally occur with necessity modals in which case these appear as more flexible or 'weaker' as the bias is cancelled. The following is a spontaneous example from an online forum:

(14) I **must maybe** be stupid since I can't see anyone else asking my question, but where the ... is the revision's page?
(https://otland.net/threads/your-first-open-tibia-server.140934/page-11)

[7] Precursors of this idea are Baranzini and Mari (2019), Mari (2010, 2021).

Compare this to the following variants:

(15) a. I must definitely be stupid since I can't see anyone else asking my question.
b. I must probably be stupid since I can't see anyone else asking my question.

The examples in (15-a) and (15-b) illustrate stronger construals reinforcing and strengthening the default bias of MUST: being stupid is a better possibility, thus more likely than not being stupid. The construal *must maybe*, we argued, is one where the positive bias of MUST is weakened or cancelled because the adverb *maybe* introduces an empty $\mathcal{O}$. This is occasionally possible with MUST as well as Italian *dovere*. Here is another attested example from Giannakidou and Mari (2018b):

(16) Il vaso, che costituisce uno dei premi guadagnati dagli atleti negli agoni panatenaici di Atene, **deve forse** fare parte del corredo di una sepoltura ubicata non lontano dall'area di Castel Nuovo.
'The jar, which constitutes one of the prizes earned by the athletes in the pan-athenians olympics of Athens, must maybe belong to the kid of a burial located not far from the area of Castel Nuovo.'[8]

Our system posits that MUST associates by default with non-empty ranking thus with bias—and bias weakening is indeed rare, and in Greek even impossible as is illustrated below where MUST *prepi* is not compatible with a possibility adverb at all:

(17) Ta fota ine anamena. O Janis prepi na ine #isos/mallon sto spiti.
the lights are on. the John must SUBJ be.3sg maybe/probably at home
'The lights are on. John must maybe be at home.'

Greek is therefore more rigid in lexically specifying its MUST as one where $\mathcal{O}$ can never be empty, and this observation, we see next, carries over to the Greek future modal. This is the key point where Greek and Italian diverge: Italian allows its MUST expressions to appear with possibility adverbs and no bias, but Greek does not. Anticipating what is to come in the next section, in Italian, the combination of MUST modals and MAYBE is attested, but futuro with the futuro-MAYBE combination is perfectly natural unlike *dovere* plus MAYBE which is indeed attested but is not as natural.

If languages parametrize with respect to whether their MUST modals are rigidly or non-rigidly associated with bias-inducing ranking, it is also to be expected that such parametrization might exist in the class of MUST modals within a language. Specifically, our system allows for the possibility that there may be a MUST modal without bias (as well as a possibility modal with bias). These are possibilities we entertained in Giannakidou and Mari (2018b). We will examine now the apparent contrasts between *dovere* and futuro that I&F present, and conclude that they can be understood as evidence that futuro is indeed a MUST without bias. We will then offer a modified semantics for future as a MUST with a silent *forse*/MAYBE as $\mathcal{O}$, in contrast to *dovere* and English and Greek MUST whose $\mathcal{O}$ is by default non-empty.

[8] Source: https://www.comune.napoli.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1425/UT/.

3 The empirical challenge of I&F

Perhaps the most appealing aspect of the I&F paper is that it offers subtle new data presenting a number of discrepancies between futuro and *dovere*. We address the challenging data here, and show that they are indeed compatible with the idea that both are epistemic necessity modals, once we disentangle universal quantification over the $\text{Ideal}_{\mathcal{S}}$ set from the ranking. The data suggest, however, that futuro and *dovere* differ in that futuro has a default lack of bias (which can be systemically strengthened); but *dovere* having a default positive bias can only marginally, as we said, combine with empty ranking. The difference in default biases explain the challenges that I&F submit without having to abandon the epistemic necessity analysis.

Futuro vs. MUST If futuro has a default lack of bias, it can very easily combine with adverbs of possibility (18-a), as already noted by Bertinetto (1979), see (18).

(18) a. Gianni sarà forse in piscina.
John be.FUT.3SG maybe in pool
'John will perhaps be at the pool.'
b. Gianni sarà probabilmente/sicuramente in piscina.
John be.FUT.3SG probably/certainly in pool
'John will probably/certainly be at the pool.'

Futuro also easily combines with PROBABLY and DEFINITELY adverbs (18-b). This is straightforwardly captured in our framework, which is designed to account for the flexibility of epistemic modality. Epistemic modal expressions display different degrees of flexibility inter and intra-linguistically. Greek FUT is not flexible at all, and can only combine with PROBABLY/DEFINITELY adverbs, as we noted (Giannakidou and Mari, 2018b).

(19) #Tha ine isos stin pisina.
FUT be.3SG maybe in-the pool
'He will perhaps be at the pool.'

Intra-linguistically, MUST+MAYBE construals are quite restricted, and not every possibility adverb is admitted. For instance *magari* is more rare if not impossible with *dovere*. (We thank the reviewer for commentary on this point.). *Dovere* and futuro differ in that *forse* is much more routinely used with futuro than with *dovere*.

If manipulations are possible, we may assume that there are different defaults and that would explain the distributions. In particular, a default lack of bias of futuro, unlike *dovere*, can explain why in a medical context the latter is more appropriate as claimed in I&F. Let us consider their main case (20) (judgements from I&F, these are examples (6) in their paper; we have simplified the context):

(20) Maria is at the doctor, who has reviewed her test results. She asks her doctor what is wrong with her. The doctor replies:
a. Deve essere narcolessia.
must.PRES.3SG be narcolepsy
'It must be narcolepsy.'

b. #Sarà narcolessia.
be.FUT.3SG narcolepsy
'It will be narcolepsy'.

I&F comment that "intuitively, PF [presumptive future] is inappropriate in this scenario because it suggests that the doctor is guessing rather than drawing an inference based on the (medical) evidence and information available" (I&F, online version, p. 4).[9] We need to note that MUST is also undesirable in a doctor scenario. We expect from a doctor certainty and knowledge and whenever a doctor uses an epistemic modal the diagnosis appears less certain. That being said, we agree that futuro is less felicitous than MUST suggesting, as we are arguing, that futuro is compatible with no bias.[10]

There might be evidential underpinnings to the contrast (see Mari, 2021). It could be that, unlike MUST, futuro relies on evidence that is not *reliable*, thus allowing a broader modal base that enables mere guesses or expectations (as we actually suggested in Giannakidou and Mari (2013), see also Frana and Menéndez-Benito (2019)). This explains the contrast here, and why the choice of future makes a more imperfect diagnosis.[11]

Futuro vs. MIGHT I&F also note, and we agree, that futuro is not equivalent to MIGHT.

(21)

a. Sono le 5. #Sarà a casa e sarà al lavoro.
be.PRES.3pl the 5. be.FUT.3sg at home and be.FUT.3sg at the work
'It is 5pm. #She will be home and she will be at the office.'

b. Sono le 5. Potrebbe essere a casa e potrebbe essere al lavoro.
be.PRES.3pl the 5. can.COND.PRES.3sg be at home and can.COND.PRES.3sg be at the work
'It is 5pm. She might be at home and she might be at the office.'

This contrast is explained as follows. Futuro conveys commitment in the Ideal$_S$ set, that it is to say a subset of the modal base that complies with common ground norms, beliefs, expectations. MIGHT, on the other hand, is a possibility modal and conveys mere equilibrium, lacking the secondary modal base of such compliance. In this respect futuro behaves like *dovere* and MUST:

(22) Sono le 5. #Deve essere a casa e deve essere al lavoro.
be.PRES.3pl the 5. must.PRES.3sg be at home and must.PRES.3sg be at the work
'l is 5pm. #She must be at home and she must be at the office.'

[9] Notice I&F's translation of FUT with *would*, we use here the future to remain faithful to the Italian version. The Italian correspondent of *would* is the conditional *sarebbe*, which is not used in (20-b).

[10] Their example in (7) is aleithic, thus irrelevant for epistemic MUST.

[11] Notice, incidentally, that guessing per se is not incompatible with MUST: *I guess it must be narcolepsy* is a fine sentence—though not something that you expect to hear from your doctor. Hence FUT and *I guess MUST* are equally odd in this context.

I&F and we agree, therefore, that futuro cannot be a mere possibility modal.

Questions A flexible account of futuro can also explain the observation that futuro is possible in questions while epistemic *dovere* (MUST) is not, as noted by I&F:

(23) a. Sarà arrivato? ((5) in I&F)
be.FUT.3sg arrived
'Might he have arrived ?'
b. #Deve essere arrivato? ((10) in I&F, reported as impossible)
must.PRES.3sg be arrive

With Eckardt and Beltrama (2019) and Giannakidou and Mari (2022), we will take these questions to be *reflective*. The reflective question differs from the information question in being open-ended and vague; it can perfectly well be self-addressed without expecting an answer at all.[12] Notice that *dovere* with *forse* can also be used in reflective questions, as opposed to the bare one above:

(24) Più che mostrare come una città sia veramente, questo mezzo **deve forse** essere capace di ricrearne le atmosfere?
'Rather than showing how a city is for real, this tool must perhaps be able to recreate their atmosphere?'

We see here a flexibility of *dovere* that futuro has even without an overt *forse* (see Baranzini and Mari, 2019). Plausibly, then, we can argue that futuro comes with a silent *forse*, while *dovere* has a silent PROBABLY which imposes bias. The default *forse* leaves the universal quantification intact, hence such statements are weakened necessities and not possibility statements.

Further evidence in favor of the fact that futuro comes with no bias is provided by Greek which blocks FUT in questions. In Greek, reflective questions appear with the subjunctive (as noted in Giannakidou, 2009, 2012, and discussed further in Giannakidou and Mari, 2019, 2022), and can contain additional reflective particles.[13]

(25) Na/#Tha eftase arage?
SUBJ/FUT arrived perhaps
'Might he have arrived perhaps?'

As we can see, the Greek FUT cannot be used in a question, thus demonstrating an equivalence to MUST with default positive bias.[14] Greek *tha* combines only with *mallon* 'probably' but not with *isos* 'possibly':

(26) Ta fota ine anamena. O Janis tha ine #isos/mallon sto spiti.
the lights are on. the John FUT be.3SG maybe/probably at home
'The lights are on. John must maybe be at home.'

[12] The literature refers to these questions as *conjectural*, see discussion in Eckardt and Beltrama (2019).

[13] See also Kang and Yoon (2016) on reflective questions with the disjunctive particle INKA in Korean. As can be seen, reflection does not depend on the future.

[14] Instead, the subjunctive *na* must be used with *isos*; see Giannakidou (2012, 2016) for arguments that the Greek subjunctive in these contexts is a possibility modal.

Given this contrast between Greek and Italian, it again becomes plausible to argue that FUT appears in Italian questions because it lacks bias by default. This lack of bias easily accommodates the use of the weak adverb *forse*: *Sarà forse a casa?* 'Is he maybe at home?'. The observed differences between MUST and Greek *tha*, on the one hand, and futuro on the other, lie in the default meta-evaluation.

An updated analysis of futuro as MUST with default empty meta-evaluation We are now ready to update our earlier analysis of Italian futuro in the light of the facts discussed here. Futuro, we propose, is a FUT that comes with a default empty $\mathcal{O}$ such as *forse* defined as in (27) (see also Mari, 2021). The lexical entry for futuro is in (28), which is equivalent to (29).

(27) $[\![\text{Maybe/Forse/Isos}]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}} = \lambda q.\ \mathcal{O}$ is empty & q

(28) $[\![\emptyset\ \text{FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\emptyset\ \text{FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}} = 1$ iff $\mathcal{O}$ is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

(29) $[\![\text{MAYBE FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{MAYBE FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}} = 1$ iff $\mathcal{O}$ is empty & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

Bias can be strengthened as illustrated in (30):

(30) $[\![\text{PROBABLY FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}}$ is defined only if $\mathrm{M}(i)$ is nonveridical and is partitioned into $\text{Ideal}_{\mathcal{S}}$ and $\neg\text{Ideal}_{\mathcal{S}}$ worlds. If defined,
$[\![\text{PROBABLY FUT (PRES}\ (p))]\!]^{\mathcal{O},\mathrm{M},i,\mathcal{S}} = 1$ iff
$\text{Ideal}_{\mathcal{S}}$ is a weak necessity with respect to $\neg\text{Ideal}_{\mathcal{S}}$ relative to $\mathrm{M}(i)$ and $\mathcal{O}$ & $\forall w' \in \text{Ideal}_{\mathcal{S}} : p(w', t_u)$

The strengthenings are systematic and depend on contextual information as well as the presence of stronger modal adverbs. Hence, futuro is a MUST modal with a ranking that can be empty or non-empty, and this makes it more flexible than the MUST or Greek FUT with bias, therefore useable in a wider range of situations including those with less reliable evidence or heightened uncertainty about the prejacent, or even guessing situations where biased MUST cannot be used. This flexibility makes futuro look 'weaker' then biased MUST and the Greek FUT *tha* which are specified for default positive bias.

Futuro exemplifies the case, predicted by our system, of a MUST with a semantic component (an empty ranking) that is typically expected with possibility modals.[15] This is then a welcome contribution of engaging with the I&F data: the concept of non-biased necessity emerges which could be used to capture other kinds of apparent weaker necessity modals such as *should, would*, the conditional mood, and similar items which cross-linguistically, as is often observed, contain a future component.

[15] Yet as we noted FUT and possibility are not equivalent. Possibility modals do not have $\text{Ideal}_{\mathcal{S}}$, and are in equilibrium, i.e., $\mathrm{M}(i)$ is partitioned between p and $\neg p$ worlds.

4 Pure belief?

Having completed our own analysis of futuro, we proceed now to examine the two theories in order to see if there is some other analytical advantage in the I&F analysis that we missed.

I&F claim that futuro has the semantics of a special type of "comparative subjective modal", with the implicature of nonveridicality. They claim that with the futuro "the speaker commits to p having the highest degree of subjective likelihood among a set of *contextually salient* alternatives C" triggered by focus (I&F, p. 11, online version). We give here the full I&F (25) truth conditions, and summarize the two approaches in Table 1:

(31) a. $[\![PF(S)_F]\!]^{g,w,t,c}$ is defined iff $[\![S_F]\!]^{g,w,t,c} \in C$ and there is a $q \in C$ s.t. $\forall r : r \in C$ and $r \neq q, q >_{i,t,D_i,w} r$.

b. If defined, $[\![PF(S)_F]\!]^{g,w,t,c} = 1$ iff $[\![PF(S)_F]\!]^{g,w,t,c} =$ the q s.t. $[\forall r : r \in C$ and $r \neq q, q >_{i,t,D_i,w} r]$, where

(i) $C \subseteq [\![S_F]\!]^f$ (where $[\![S_F]\!]^f$ is the focus semantic value of the prejacent)

(ii) is a contextually bound variable; in default cases its value is the speaker in declarative and the addressee in interrogatives:

(iii) **for any propositions** $p, q \in \mathcal{P}(\mathbf{W}) : p >_{i,t,D_i,w} q$ **iff** i**'s credence in** p **is greater than** i**'s credence in** q **in** w **at** t **relative to** D_i**.** (emphasis is ours).

Table 1 shows that while the terminology is different, the two accounts share nevertheless the same core ingredients, with an additional advantage for the G&M account that it does not raise the contradiction encoded in I&F whereby D_i is both homogeneous and non-homogeneous. According to G&M, M(i) (which is non-homogeneous) and Ideal$_{\mathcal{S}}$ (which is homogeneous) are two different sets. In the I&F account, futuro emerges as a focus sensitive item, but it is a bound morpheme (which makes it unlikely to be focus sensitive), and no evidence is offered that futuro depends on focus in any non-trivial way (other than contrastively, for instance). As an epistemic MUST expression, in fact, we expect futuro to *not* be sensitive to focus, because focus triggers the aleithic reading of MUST (Giannakidou and Mari, 2016). In our account the only two alternatives that matter are p and its negation, and do not depend on anything other than the modal base.

Table 1 Comparison of G&M and I&F

Common Features	G&M	I&F
Lack of knowledge	Presupposition	Non-cancellable implicature
Non-homogeneity	M(i) is nonveridical (non-homogeneous)	D_i is nonveridical (non-homogeneous)
Certainty in p	Universal quantification over p Ideal$_{\mathcal{S}}$ worlds	Entailment
Homogeneity	Ideal$_{\mathcal{S}}$ set is homogeneous	D_i is homogeneous

The main point of difference between G&M and I&F boils down to what goes into the modal base. We adopted the common premise in the literature (with Kratzer (1991) and Portner (2009)) that the modal base with epistemic modals is mixed, and contains both belief and factual knowledge—but according to I&F the modal base of futuro contains strictly credence worlds, it is purely doxastic. The claim about the modal base being doxastic is intended to capture the 'weakness' of future with respect to MUST, but as we showed in the preceding discussion this weakness can have an alternative explanation. Let us now evaluate the claim that the modal base is purely doxastic.

First, we can see that futuro can be used when the speaker reasons with and forms hypotheses with facts, e.g., provided by an if-clause:

(32) Se non è là fuori sarà per forza andato a prendere Violet.
'If he is not outside he must have necessarily gone to pick up Violet.'
(https://efpfanfic.net/viewstory.php?sid=316072)

Here the speaker considers the two options based on what she knows. The reasoning proceeds based on facts and stereotypicality rules that are known to the speaker, i.e., given what the speaker knows about today's schedule. MUST is very appropriate in this context, as can be seen. Contexts explicitly designated as 'given what I know' are all fine for both MUST and futuro:

(33)

a. Da quello che so, Ariadne sarà necessariamente a scuola.
from what that know.PRES.1SG, Ariadne be.FUT.3sg necessarily at school
'Given what I know, Ariadne must necessarily be at school.'

b. Da quello che so, Ariadne deve essere necessariamente a scuola.
from what that know.PRES.1SG, Ariadne must be necessarily at school
'Given what I know, Ariadne must necessarily be at school.'

Reported information is another example showing that futuro uses knowledge and not simply credence. Still wondering about Ariadne's whereabouts, the modal base in (34) includes information Ariadne gave the speaker. If futuro were unlike MUST and relied only on credence such examples should be problematic, but we observe no contrast.

(34)

a. Da quello che mi ha detto, Ariadne sarà necessariamente a scuola.
from what that me has told, Ariadne be.FUT.3SG necessarily at school
'Given what I was told, Ariadne must necessarily be at school.'

b. Da quello che mi ha detto, Ariadne deve essere necessariamente a scuola.
from what that me has told Ariadne must be necessarily at school
'Given what I was told, Ariadne must necessarily be at school.'

At the same time, as Mari (2021) observes, pure belief is not sufficient for futuro even in purely subjective statements expressing mere credence of the kind advocated by I&F. Notice below:[16]

[16] If any, the only interpretation of (35-b) is temporal, and sounds a prediction from an omniscient being.

(35) a. Zeus esiste.
Zeus exist.PRES.3sg
'Zeus exists.'
b. #Zeus esisterà.
Zeus exist.FUT.3sg
'#Zeus will exist.'

Since Zeus is an object of belief, futuro should be admissible here, but it is not. Pure credence is thus neither a necessary (32)–(34), nor a sufficient condition (35-b). Futuro behaves just like epistemic modals as far as the modal base is concerned: it involves both belief and knowledge, in agreement with G&M.

5 Conclusion

In this brief response, we engaged in a conversation with the recent paper of Ippolito and Farkas regarding the analysis of Italian futuro. A welcome feature of the paper, as we mentioned, is that it reveals a distribution of futuro more nuanced than predicted by our earlier analysis of Giannakidou and Mari (2018a). Having addressed the new data and adding some more, we concluded that the analysis of futuro as an epistemic necessity modal can indeed be maintained—with the modification that not all necessity modals are positively biased towards the prejacent. Futuro, we argued, is a MUST modal without positive bias, thus more flexible than MUST and useable in situations with less reliable evidence or heightened uncertainty or even with mere guessing. This flexibility makes futuro look 'weaker' than the more familiar MUST and the Greek FUT *tha*, and it is indeed weaker in not being lexically specified for default positive bias unlike these. Remember that, as we noted in the Giannakidou and Mari (2018a) paper, even English *will* can be compatible with guessing in contexts such as *He will be a great doctor some day!*, uttered by a proud mother speculating about the future of her 2-year-old son. Removing the bias is a strategy occasionally available for MUST and future modals; but for futuro, we argued that non-bias appears to be the default. We have Ippolito and Farkas's paper to thank for enriching our system with this important category of non-biased necessity modals.

Overall, a modal system that allows dissociation of the modal force from ranking (meta-evaluation) such as the one in Giannakidou and Mari (2018b) is analytically attractive because it allows a flexibility in the modal meaning which derives diversity within semantic classes without giving up a common semantic core. The landscape of epistemic futures, it turns out, allows at least three classes: futures with bias (Greek), futures without bias (futuro), and ratificational futures (English, French, which we discussed in Giannakidou and Mari (2018a)). The future words all share the epistemic modal necessity core, and their distributions vary in a principled way. The concept of non-biased necessity is applicable to other kinds of weaker necessity modals such as *should, would*, the conditional mood, and similar items—which cross-linguistically often contain a future component. A welcome implication is, thus, that the concept of weak necessity can be remodeled as the absence of ranking, and our theory predicts

that just as there are necessity modals without bias there might also be possibility modals with bias—a prediction that we hope can be addressed in future work.

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