The prospective as nonveridical: polarity items, speaker commitment, and projected truth

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1. Introduction: NPIs in prospective contexts

Frans Zwarts and I wrote two papers in 1999 on the connection between temporal structure and nonveridicality—*Aspectual properties of temporal connectives,* and *Temporal, Aspectual operators and nonveridicality.* In those papers, we uncovered a link between temporal structure and negative polarity, in the fact that NPIs (such as English *any,* and its Dutch and Modern Greek counterparts *ook maar iets, kanenas*) appear in 'prospective', i.e. future oriented clauses including *will* and *before* clauses, but not in 'retrospective', i.e., past clauses. That great project, which was honored with a fellowship to me from the Royal Dutch Academy of Sciences, was alas not completed, as life and worked moved me from Groningen to Chicago; but it remained dear to my heart, and left me with an abiding curiosity about temporal reasoning, truth and polarity. I worked out details in my more recent work on the subjunctive, modals and the future, and this paper is a report to Frans of how far-reaching our initial ideas were.

I will take the following passage from our 1999a paper as the point of departure.

(1)   '*Prospective is Nonveridical' thesis*
       "In a linear model of time, retrospective past is deterministic, and in this sense, *veridical*. Prospective future, on the other hand, *embodies a notion of projected but not actual truth*, hence it is non-deterministic, and thus nonveridical: we do not

know whether the expected events will take place. Hence, in our view, future behaves more like a modality than a real tense." (Giannakidou & Zwarts 1999a: 109).

The intriguing premise is the suggested difference between *actual* and *projected truth*, and it is this difference that I will address here. The initial empirical motivation for (1) was to explain why NPIs appear with prospective and future oriented operators, but not under past. I illustrate below in English, Dutch, and Greek. The respective future markers are the modal verbs *will, zullen*, and the Greek particle *tha:*

(2) a   At the dinner tonight, Nicholas *will* eat anything.
    b   *At the dinner last night, Nicholas ate anything.

(3) a   *De kinderen vertrokken zodra   ze   ook maar iets ontdekten.
         the children   left.3sg   as soon as they NPI-thing   discovered.3sg
         The children left as soon as they discovered anything.
    b   De kinderen *zullen* vertrekken zodra   ze   ook maar iets ontdekken.
         the children will   leave.3pl as soon as they NPI-thing   discover.3pl
         The children *will* leave as soon as they discover anything.

(4)   What will Nicholas eat?
    a   O Nicholas tha   fai   kamia makaronada.
         the Nicholas will eat.PNP.3sg NPI-pasta-dish
         Nicholas will eat a pasta dish.
    b   *O Nicholas efage   kamia makaronada.
         the Nicholas ate.3sg NPI-pasta-dish
         Nicholas ate a pasta dish.

Important for future orientation is not just the particle or the modal verb, but also the verbal form I label here PNP, for perfective non-past (we come back to this in section 3). When these NPI data were first discovered in the mid-90s, the shared wisdom about NPIs was that they appear in negative or mere downward entailing (DE) contexts—and Frans's earlier work (most notably, his 1986 dissertation and his 1996 paper) were among the pioneers of that thesis. However, when confronted with data like the above, one needs to say that the sensitivity of NPIs goes beyond mere polarity (negation-affirmation) or DE. NPIs must also be sensitive to temporal structure; somehow, the past is bad for them, but the future is good. Why is that? This difference cannot be tied to negation and DE.

Frans and I suggested that this temporal sensitivity of NPIs is due to veridicality: the past is veridical, but *FUT p* is nonveridical. Therefore the veridicality judgment, i.e. the judgment about the truth of sentences, is apparently relevant for the licensing of polarity items, in at least these three languages. Since then, similar data have been produced for East Asian languages (Lee 1999, Lin 1996), Salish languages (*ku*-determiner, Matthewson 1998), Navajo (Fernald and Perkins 2006), Albanian (Xherija 2013) and other languages, see Giannakidou 2011 for an overview). And although *any* licenses a free choice implicature in these contexts (Giannakidou 2001, 2011), in Greek, Dutch, and the other languages we are talking about, the NPIs appearing in future clauses do *not* have free choice readings. At the same time, free choice items (FCIs) also appear in the future context, as illustrated below for Greek:

(5) a   O Nicholas tha fai   otidhipote.
         the Nicholas will eat.PNP.3sg FCI-thing
         "Nicholas will eat something."
    b   * O Nicholas efage otidhipote.
         the Nicholas ate.3sg   NPI FCI-thing
         "Nicholas ate something."

Giannakidou 1998, 2001 shows that FCIs are also polarity items, in the sense that their distribution is limited to more or less the same contexts as NPIs, as seen also above. Therefore, the overarching generalization seems to be that future clauses are good environments for polarity items generally (NPIs and FCIs) while past positive sentences systematically block them. The Giannakidou and Zwarts thesis offers an explanation of this fact by saying that (a) the past is veridical and the future nonveridical, and (b) veridicality and nonveridicality are key factors in understanding the distribution of NPIs.

I will proceed with discussing the notion of veridical and nonveridical when applied to temporal domains in the next sections. But for now, as another piece of foundational information on why this generalization is important, consider that NPIs tend to appear in other contexts that, like the future, are nonveridical, and have prospective orientation, i.e. they make reference to times (and possibly events) after the speech time. These contexts are the scope of modal verbs, deontic as well as epistemic, but I will give here mostly deontic examples because of their clear prospective orientation:

(6) O Nicholas bori   na milisi   me kanenan/opjondhipote fititi.
    the Nicholas may SUBJ talk.PNP.3sg to NPI-/ FCI   student
    "John may talk to any student."

(7) O Nicholas prepei na milisi me kanenan fititi. [2]
     the Nicholas may SUBJ talkPNP.3sg to NPI student
     "Nicholas must talk to any student."

(8) Fae kanena/opjodhipote glyko!
     Eat any   cookie!

Deontic modalities and the imperative have prospective orientation, and they seem to be good for NPIs and FCIs. Hence the generalization is, correctly, about prospectivity and not, strictly speaking, the future. Also, I give below examples from early modern Dutch (from Hoeksema 2010) illustrating the NPI *enig*, which just like Greek lacks FCI use:

(9)   *Modal*
      Men moest toch wel   enige aanwijzing hebben.
      one ought PRT PRT   some clue have
      "One should have some clue."

(10) *Subjunctive*
      En wie geen steenen kan aandragen storte [..] eenige gift in de offerbus.
      And who no stones can to-carry throw.SUBJ   some gift in the offertory-box
      "And who cannot carry bricks, should donate some gift in the offertory box"

Here again we observe prospective orientation with a deontic modal and a subjunctive.

Besides the future, Greek possesses a number of other prospective particles, and which also typically license NPIs: the subjunctive particle *na*— which we saw already as a complement to the modal verbs, but can also occur in main clauses (Giannakidou 2009)—, the optative *as*, the conditional particle *an*, and the temporal connective *prin* 'before'. As shown here, NPIs appear in all these cases:

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[2] FCIs are not plausible with the universal modal contexts because they trigger an exhaustivity inference that seems to be at odds with the universal quantifier (Giannakidou and Quer 2013); *any*, naturally, also is odd, because of its free choice implicature. I will largely shy away from the interpretation of NPIs and FCIs in this paper because the focus is on the prospectiveness question.

(11) What should Nicholas bring for dinner?
> a   Na (subj.)   feri   kanena   glyko.
>   'It will be a good idea to bring a dessert.'
> b   As (optative) feri   kanena   glyko.
>   'Let him bring a dessert.'

These are neutral, soft invitations or suggestions for Nicholas to bring dessert, some dessert or other, the speaker remains agnostic as to what the actual dessert will be. (FCI interpretation is again odd, hence *any* is impossible).

(12) *Prin* erthi {kanenas/opjiosdhipote},   prepi na katharisoume to domatio.
     before come.PNP.3sg NPI/FCI person,   must SUBJ clean.PNP.3pl the room
     Before anyone comes, we must clean up the room.

(13) *An* erthi {kanenas/opjiosdhipote}   prepi na katharisoume to domatio.
     before come.PNP.3sg NPI/FCI person,   must SUBJ clean.PNP.3pl the room
     Before any gues comes, we must clean up the room.

Notice again the use of the PNP, crucial to the prospective orientation. It becomes obvious that we have a real generalization here: prospective orientation creates a good licensing environment for polarity items of various kinds, and, as Giannakidou and Zwarts suggested, the reason for this is that prospective contexts are non-veridical.

Now, putting together the fact that these polarity items also appear in negative and downward entailing contexts, we can summarize the whole theory of NPIs in the diagram below. This schema says that all polarity item licensers are nonveridical. The inner most circles are the negative domain, what Zwarts calls strong negations; DE is *minimal* negation. Crucially, negative contexts are proper subsets of the nonveridical. But the set of nonveridical operators includes non-negative functions too. The prospective operators we are talking about belong to this class— and as we saw, they are overwhelming licensers of polarity items cross-linguistically. Nonveridicality thus allows us to explain why NPIs appear with seemingly unrelated licensers – e.g. negation, the future and other modalities— without claiming that negation somehow becomes modal.

(14) *The Giannakidou-Zwarts Theory of polarity items*
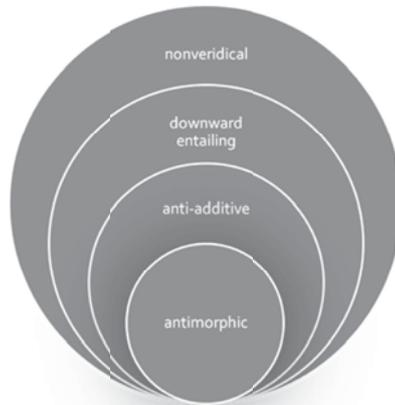
Having clarified these foundational premises, we can now proceed to address the two important points in the *Prospectiveness and Nonveridicality* thesis (1): (a) the past is deterministic and therefore veridical, and (b) that prospective expressions (including the future) "embody a notion of *projected* but not actual truth" and are therefore non-nonveridical. I will illustrate by studying the Greek particles.

2. (Non)Veridicality judgment: subjunctive, optative and *commitment weakening*

Consider first bare, i.e. unmodalized, non-negated, sentences in the simple past or present (which is the present progressive in English):

(15) a   Nicholas brought dessert.
     b   Nicholas is washing the dishes.

These are sentences about actual events that happened in the past or are happening right now; in the present, the speaker actually may be witnessing the event unfolding. So, when one judges the sentences describing these facts, one judges them as true. This truth judgment is a veridicality judgment, and the speaker judges the past and the present progressive to be veridical. The veridical assertion is then added to the common ground, and the discourse proceeds by only looking at worlds where Nicholas brought dessert or is washing the dishes.

Consider now the sentences mentioned earlier with the subjunctive and the optative:

(16) What should Nicholas bring for dinner?

> a   Na (subj.)   feri   kanena   glyko.
>   'It will be a good idea to bring   a   dessert.'
> b   As (optative) feri kanena   glyko.
>   'Let him bring a dessert.'

Both sentences are invitations to *bring a dessert* (*p*), but do not entail that *p* is true, or that it will be true. In both cases, there is also non-assertive illocutionary force; but neither force nor the desire that *p* entail *p* now or in a future time. With these sentences the speaker expresses a desire that there be an event described by *p*, at some point in the future, but has no commitment to the event happening; a desire *does not commit* the speaker to p, or add *p* to the common ground. (The same, by the way, is true of imperatives.). These sentences are nonveridical.

So, when we talk about truth judgments, we talk about them by appealing to speakers' commitment to the truth of a sentence. Prospective oriented particles do not convey commitment to the truth, but when a speaker asserts a past or present sentence, they are referring to facts, and by asserting them they are committed to them. In this context, veridicality— being a judgment about the truth of a sentence— it applies in two ways. First, objectively: if an expression entails the truth of its argument, it is veridical. This was the original inception of Zwarts (1995), and Giannakidou (1994, 1997):

(17) Def 1: *Objective veridicality*

> A propositional function *F* is veridical if Fφ entails φ; otherwise, F is nonveridical.

We can think of this as 'objective' veridicality. It is very close to *factuality*—a sentence φ under F is true if it refers to a fact. In this sense, veridicality is more or less equivalent to the traditional *realis*, and any sentence that does not refer to a fact is nonveridical. Past or present sentences are veridical in this objective way, hence Giannakidou and Zwarts' claim that past is deterministic. The prospective domains aren't veridical. In a branching time model, future branches share a history, a past up the time where they branch out, and this divides the model into a deterministic (past/*now)* space which is objectively veridical, and non-deterministic, prospective space, which branches and allows for a number of possibilities. I come back to this in section 3.

As I have shown in earlier work (Giannakidou 1994, 1998, 1999, 2009), this notion of objective veridicality can afford substantial results in natural language, but it needs to be enriched with an epistemic component when we consider mood choice, NPIs, and modality. Truth judgment is done by individuals (in main clauses the speaker), and when

the speaker assesses truth, she does so based on her beliefs and knowledge. This is *subjective* veridicality. Subjective veridicality is shown, in recent work, to be important in extracting truth assessment from texts (de Marneffe et al. 2012), and in Trnavac and Taboada (2012) and Giannakidou (2013, to appear), a correlation is posited between nonveridicality and evaluation that further supports the subjective nature of the veridicality judgment.

To capture the idea that truth is assessed relative to an individual, I defined 'models' of evaluation (Giannakidou 1998, 1998, 1999). These models are sets of worlds, relative to an individual *i*, the epistemic agent, corresponding to what the agent believes or knows. We can think of them as information states, or modal bases, associated with individuals:

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

(19)   Truth in an epistemic model
        A proposition p is true in an epistemic model M(*i*) iff M(*i*) ⊆ p:
        $\forall$w [w ∈ M (*i*) $\rightarrow$ w ∈ λw'. p (w')]

In main past sentences, the model represents the epistemic space of the speaker, and it includes worlds compatible with what she believes. A proposition *p* of a main assertion will be evaluated with respect to the epistemic space of the speaker:

(20)   a   John won the race.
        b   [[John won the race]]= 1 iff $\forall$w: w ∈M(speaker)$\rightarrow$ w ∈λw'.
             John won the race in w'

If the speaker truthfully asserts the sentence *John won the race*, she must believe that John won the race. Believing the proposition means that all worlds in her epistemic space are *John-won-the race* worlds. Hence: M(s) ⊆ *p*. This explains Moore's paradox, i.e. why #*John won the race, but I don't believe he did* is odd. In the main unmodalized past assertion the speaker is fully committed, within her belief/knowledge space, to the truth of the proposition she expresses with the sentence she utters. Veridicality is this state of full commitment:

(21)   Def. 2. Veridicality, nonveridicality, antiveridicality wrt individuals

  i. A function F is veridical iff Fφ conveys an epistemic state M(i), relative to an individual i, such that: all worlds in M(i) are φ worlds, i.e. M(i) ⊂ φ.

  ii. If i. doesn't hold, F is nonveridical.

  iii. If all worlds in M(i) are non- φ worlds, then F φ antiveridical.

Under this definition too, optative and subjunctive particles are nonveridical because of *ii*. In both definitions, nonveridicality is the absence of veridicality. Negation, on the other hand, is the opposite of full commitment, antiveridicality: the speaker is *fully not committed* to *p*. An antiveridical operator is also nonveridical, since *i.* is valid for it too.

(22)   Ariadne did not kiss Nicholas.

(23)   Ariadne is not kissing Nicholas.

(24)   [NOT (Ariadne kiss Nicholas)] is true iff: all worlds in M(s) are worlds where Ariadne did/does not kiss Nicholas

So, both versions of veridicality, objective and subjective (*Def*s 1 and *Def. 2*) capture the sensitivity of NPIs to both negation and the, seemingly unexpected from the perspective of negation and DE, prospective operators. Possibility modals like *might*, *may*—, regardless of orientation— are also nonveridical and license NPIs as we saw.

(25)   a   Nicholas might bring a dessert.

  b   Nicholas may bring a dessert.

(26)   a   Nicholas might have brought a dessert.

  b   Nicholas may have brought a dessert.

Past possibilities contrast with the simple past assertions in that the speaker is no longer committed to the truth of *p*; *p* is regarded merely as possibility. Adding the possibility modal weakens the commitment and creates non-veridicality. As de Marneffe et al. (2012: 102) put it, "declaratives like *Ariadne left* conveys firm speaker commitment, whereas qualified variants with modal verbs or embedded sentences *imbue the sentence with uncertainty*." Giannakidou (2013) calls assertions with possibility modals *inquisitive assertions,* and one can think of the subjunctive, optative, and possibility modals as a class of *commitment weakening operators* whose function is to create a nonveridical space:

(27)   *Commitment weakening and possibility operators*
    i.   Commitment weakening is the creation of a *nonveridical epistemic* space.
    ii.   Possibility operators (subjunctive, optative, weak modals) have the function
        of weakening an individual's commitment to a proposition.

The epistemic effect of commitment weakening can be viewed now as conveying a partitioned space containing both *p* and *non*-p worlds.

(28)   Def. 3: *Veridicality, nonveridicality, antiveridicality and commitment*
    An epistemic space (a set of worlds) M(i) relative to an individual i:
    i.   Is *veridical* with respect to a proposition *p* just in case *all* worlds in M($i)$ are
        p-worlds. (*Full commitment*)
    ii.   If there is at least one world w in M(i) that is a *not-p* world, M($i)$ is
        nonveridical. (*Weakened commitment*)
    iii.   If all worlds in M(i) are *not-p* worlds, M(i) is *antiveridical.*
        (*Counter-commitment*)

The nonveridical epistemic space in this definition contains at least one *not-p* world. As previously, in the extreme case where all worlds are *not p*, we have an antiveridical space , that I call here *counter*-commitment. Counter-commitment as well as weakened commitment are non-commitment to *p.* Only in veridical spaces is *i* committed (i.e. fully committed) to *p.*

Notice that commitment weakening is irrespective of the past-prospective contrast, since modals, as well as *na* and *as*, can be used with past tenses and weaken commitment:

(29) a   Isos   na   ixe   gripi.
         Perhaps SUBJ   had.2sg flu
         'Maybe he had the flu.'
    b.   Malon   *na/tha ixe gripi.
         probably SUBJ/FUT had.2sg flu
         'Probably he had the flu.'

(30)   As   tou milouse.
    OPT he.gen. talked.3sg
    'If only he had talked to him.'

The subjunctive *na* is used together with the possibility adverb 'isos' *maybe,* but not with the stronger adverb *malon* 'probably'. The latter is compatible with the future, suggesting that the future itself has stronger force (see discussion in section 3). The co-occurrence of *na* with *maybe* can be viewed as a case of modal concord, and it suggests the subjunctive being akin to a possibility modal (see also Giannakidou 2014). The optative has counterfactual force, a fact observed for optatives in general (Grosz 2011), so it behaves antiveridically with the past—though nonveridically with the non-past, as we saw earlier.

So, to sum up: possibility expressions, including the subjunctive and the optative, are *commitment weakeners*: they create a nonveridical epistemic space. With some of them, the speaker is in what Giannakidou 2013 calls 'non-veridical equilibrium'.

(31)   *Nonveridical equilibrium* (Giannakidou 2013: 14)
         An epistemic space M(*i)* is in nonveridical equilibrium iff:
         M(*i*) is partitioned into *p* and *not p*, and *there is no bias* towards *p* or *not p*.

The equilibrium means that the speaker considers *p* and *not p* as equally good possibilities, so sentences with equilibrium as typically neutral. But as I argued in the 2013 paper, the equilibrium is easily disturbed. This happens with the optative and other counterfactual operators for instance, which in the past create bias toward *not p*. When we use future expressions and necessity epistemic modals, as we see next, *positive* bias is created (Giannakidou and Mari 2013, 2014), and it brings with it the *projected truth* mentioned by Giannakidou and Zwarts. Projected truth is responsible for the stronger flavor that universal modals and the future have.

3**. The future: nonveridicality, *partial* commitment, and projected truth**

The starting point of discussions of future sentences is often Aristotle's very famous sea battle example (*Περί Ερμηνείας*, *De Interpretatione* 9).

(32)   a.   There will be a sea-battle tomorrow.
         b.   There will not be a sea-battle tomorrow.

A major goal of Aristotle in *Περί Ερμηνείας* is to discuss the thesis that, of every contradiction, one member must be true and the other false (the "Law of the Excluded Middle"). Regarding the future sentences, Aristotle acknowledges that the truth or falsity of each sentence will, in time, be fully determined by how things will turn out: there will either be or not be a sea battle. Aristotle also acknowledges that, at present (i.e., at the

speech time), it is *not known*, in the sense that a past sentence can be known, that there will be a sea battle tomorrow. So, the future sentences at *n* are objectively nonveridical, i.e. the future is non-deterministic.

The future is also subjectively nonveridical, as it is compatible with an epistemic state that includes, *for a future time, both p (there will be a sea battle)* and *not p* (*there will not be a sea battle)*. This is the position Alda Mari and I defended in recent publications (Giannakidou 2012, Giannakidou and Mari 2013, 2014), and I will try to spell it out in the rest of this section. In *FUT p*, the epistemic state M(*s*) of the speaker at present is nonveridical and allows, for a future time, both *p* and *not p*; but unlike with possibility modals, there is a subspace within M(s) that *fully supports p*. This creates *partial* commitment of the speaker to *p*, and makes the statement with the future stronger than the mere possibility statements.

3.1. The future, the present and the non-past

From the perspective of nonveridicality, future statements are pretty much like statements with necessity modals like MUST:

(33) a.   For all I know, there must be a sea battle tomorrow.
     b.   (In order for this conflict to end), there must be a sea battle tomorrow.

Modal verbs, in epistemic and mostly deontic uses, come with the same kind of indeterminacy about the prejacent proposition *p*, and are therefore also nonveridical. Broekhuis and Verkuyl (2013) point out the parallelism of the future auxiliary with other modal verbs in Dutch, e.g., in their example (9), given here below:

(34) a. Elsa <u>zal</u> dan wandelen.   a'. Elsa <u>moet</u> dan wandelen.
         Elsa   will then walk   Elsa must then walk
         'Elsa <u>will</u> walk then.'   'Elsa <u>must</u> walk then.'
     b. Ik zal je   bellen.   b'. Ik ga je   bellen.
         I will you call   I go you call
         'I will call you'   'I am going to call you.'
     c. We zullen morgen   thuis zijn.   c'. We kunnen morgen thuis zijn.
         We will   tomorrow home be   We may   tomorrow home be
         'We will be home tomorrow.'   'We may be home tomorrow'

Future orientation is common to *zullen* and non-*zullen* modalities, as we see in the prime examples. Broekhuis and Verkuyl claim that, despite the future orientation, it doesn't make sense to say that the modal verbs *moeten* 'must', *kunnen* 'may', and therefore also *zullen* are future tenses. Future orientation is going to be attributed to the present tense on the auxiliaries, which in their account carries prospective meaning. The modal verb itself (i.e., minus the present) is thus an indicator of pure modality.

Let us now return to the observation that prospective orientation in Greek comes with non-past.

(35) a. **As** fiji   o Janis.

 as leave.PNP.3sg the John

'Let John go.'

   b. **Na** fiji   o Janis.

 na leave.PNP.3sg the John

'Let John go.'

   c. **Tha** fiji   o Janis.

tha   leave.PNP.3sg   the John

'John will leave.'

The imperfective non-past is the actual semantic present in Greek (Giannakidou 2009, in press). The PNP is a defective perfective nonpast that can't function as a present, because of its aspectual limitation of perfectivity. So, Greek actually possesses a semantic present (morphologically: imperfective nonpast) *and* a semantic nonpast. In the occurrences of PNP plus particle we have prospective orientation, so future reference, just like in Dutch, is not a privilege of the future particle *tha*. Giannakidou (2009) argues that the Greek perfective nonpast denotes a prospective interval—but unlike the prospective present interval whose left boundary is *n*, the left boundary of the nonpast is undefined. It contains a dependent variable *t*.
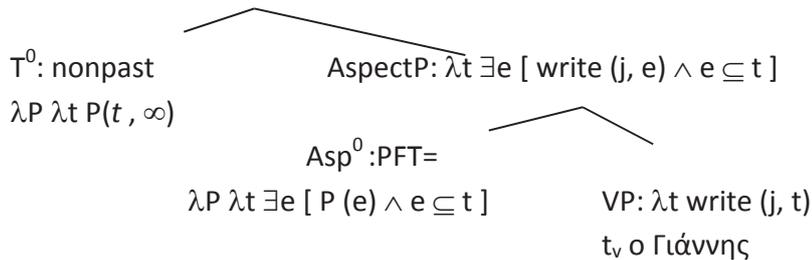
(36)   [[perfective nonpast]] = $\lambda P \, \lambda t \, P(t, \infty)$

A dependent variable cannot remain free, but must be valued by some higher value. This idea is inspired by Abusch's (2004) analysis of *WOLL* as a substitution operator. According to Abusch, "In the substitution operator, t is a bound variable that corresponds to the tense argument of *will* [which is *n*, coming from an implied higher PRES; clarification

mine]*. For a top-level occurrence of will, the effect is to substitute (n, ∞) for n*" (Abusch 2004:39).

The Greek perfective nonpast then is a WOLL, but unlike *will*—where *n* is triggered by default (Abusch 2004: 48)—the Greek perfective nonpast does not trigger PRES; so it becomes necessary to have an overt exponent of *n* in the structure, otherwise the structure is illicit:

(37)   * TP: λt $\exists e$ [write (j, e) $\wedge$ e $\subseteq$ (t, ∞)   'grapsi o Janis' 'John write.PNP'

  T^0: nonpast   AspectP: λt $\exists e$ [write (j, e) $\wedge$ e $\subseteq$ t]
  λP λt P(t , ∞)

                 Asp^0 :PFT=
                 λP λt $\exists e$ [P (e) $\wedge$ e $\subseteq$ t]   VP: λt write (j, t)
                                                                                            t$_v$ o Γιάννης

The interval (t, ∞) is ill-formed, because t is unvalued. The particles save the structure by providing *n*. If we add, for example, the future *tha, t* can now be identified with *n*:

(38) [[tha]] = *n*

(39) [[tha]] (TP (19))= λt $\exists e$ [write (j, e) $\wedge$ e $\subseteq$ (t, ∞)] (n) = $\exists e$ [write (j, e) $\wedge$ e $\subseteq$ (n, ∞)]

The event of John's writing will now be located at the interval that starts at *n* and stretches through infinity. This explains the possibility of future for the PNP. The analysis says that the additional structure provided by the particles gives a locus for triggering of the speech time.

3.2. **Epistemic future and MUST**

It is a common observation that future morphemes exhibit purely epistemic readings, and in Giannakidou and Mari we call this 'epistemic future'. Here are some well-known examples (see also Enç (1996), and Tsangalidis (1998)):

(40) a.   The French'll be on holiday this week.   (Palmer 1987)
     b.   No doubt, you'll remember John.
     c.   Ed will lay in bed all day reading trashy novels.   (Huddleston 1995)
     d.   Oil will float on the water.   (Haegeman 1993)

According to Palmer, *will* here expresses conclusion of reasoning that the speaker does, (see also Broekhuis and Verkuyl (2013)). What kind of reasoning? Obviously, reasoning that relies on what the speaker knows or has evidence for. In concluding with *will,* the prejacent is supported. However, and we come back to this, the speaker's confidence is not as high as it would have been had she chosen a non-modalized form, e.g., *The French are on holiday this week.* The non-modalized sentence is veridical, and therefore expresses full commitment.

In Greek, as we see below, the future particle in the non-predictive use can be followed by a present or a past form. Past tense is compatible with past adverbials:

(41) a   I Ariadne   tha   pezi   tora.   (nonpredictive)
        the Ariadne FUT *play.imp.nonpast.3sg* now
        'Ariadne must be playing now.'
(42) a.   I Ariadne   tha kimithikeprin 2 ores.   (nonpredictive)
        the Ariadne FUT sleep.PP.3sg   before two hours
        'Ariadne must have slept two hours ago.'
    b.   I   Ariadne tha milise   xthes.   (nonpredictive)
        the Ariadne FUT talk.PP.3sg yesterday
        'Ariadne must have spoken yesterday.'

None of these cases is 'future' in the sense of making reference to an event that follows *n*. Rather, as can be seen in the translations, we use *must.* Giannakidou and Mari call this the 'epistemic future'. Epistemic future and MUST convey strong support for *p,* but no full commitment, no veridicality. This is shown by the test below (Giannakidou & Mari 2013):

(43) a.   I Ariadne itan arosti—#ala dhen ime ke endelos sigouri.
        Ariadne was sick—#but I am not entirely sure.
    b.   I Ariadne tha itan arosti—ala dhen ime ke endelos sigouri.
        Ariadne will/must have been sick—but I am not entirely sure.

Tha, FUT, and modalization in general convey nonveridical modal spaces, and still allow for *not-p* worlds. Hence, *all* modalized sentences, even with necessity modals, are 'weaker' than non-modalized assertions (*pace* von Fintel & Gilles 2010; for critical discussion see also Lassiter 2013). Future *tha* in the epistemic use is thus akin to *must*, i.e. a universal quantifier (recall its compatibility with *malon 'probably'),* and the modal base ($\cap f(w)$) is epistemic.

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(34)   For any world w, and conversational backgrounds *f, g*:   (Giannakidou 2012)
         [[**prepi/** tha/ MUST]] w,f,g = λq<st> . ∀w′∈ Best $_{g(w)}$ (∩*f*(*w*)): q(*w′*) = 1;
         where *Best* g(w)(X) selects the most ideal worlds from X, given the ordering given
         by *g*(*w*)

Crucially, only in the *Best* (see Portner 2009 and discussion therein) worlds is *p* true, therefore the universal modal is nonveridical, since the modal base still contains *not p* worlds. In terms of truth conditions, then, epistemic FUT and *must* are equivalent, and in Greek they can co-occur with modal concord: e.g. *Tha prepi na exi gripi* 'She must have the flu'. *Tha prepi* is equivalent to *prepi* 'must' (Giannakidou 2012).

    So, FUT and *must* contain nonveridical spaces, but at the same time, they contain a privileged (*Best*) inner domain of commitment, the domain they quantifier over. For this reason,   universal epistemic modals are stronger than the mere possibility statements which express no commitment, as we discussed earlier. The effect of bias will be seen more strongly in the predictive use that I consider next. Before I move on to show this, I wanted to note a similarity, in exactly this respect of combining nonveridicality with partial commitment, between FUT/*must* and the so called 'modal' discourse particles in Germanic such as *wohl* (Zimmermann 2011):

(44)   a.   Max ist <u>wohl </u>auf See.   (example from Zimmermann 2011)
              Max is prt at sea
              Max must be at sea.
         b.   (For all I know), Max will be at sea.

Zimmermann claims 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. Still, though, this is only partial commitment: in case I know p, I cannot use the particle.

(45)   A: I can't see Hein.
         Er ist <u>wohl</u> auf See.
         'He may be at sea.'

(46)   A: I know for sure:
         #Hein ist <u>wohl</u> auf See.
         Hein is   prt   at sea

Likewise, in Greek, if I know for sure, I can't utter *Tha ine sti thalasa 'He must be at sea'.* In using the epistemic future and *wohl,* I am in a nonveridical state of knowledge that still allows *not p*, and if the context forces full knowledge (as is the case e.g. of direct evidence) the result is odd. These particles, and *must*, Giannakidou and Mari 2014b argue, depend on *partial* knowledge. Crucially, Dutch *zullen* seems to function similarly, as we see below. The Dutch counterpart of *wohl, wel* can also combine with *zullen* (and we can think of this as modal concord too, on a par with co-occurrences of *tha* and *prepi* mentioned earlier):

(47) A:　I can't see Hein.
　　　　　Hein zal (wel) op zee zijn.
　　　　　'He may be at sea.'
(48) A:　I know for sure:
　　　　　# Hein zal op zee zijn.
　　　　　'He may be at sea.'
(49) A:　He is so grumpy!
　　　　　Hij zal wel slecht geslapen hebben!
　　　　　'He must have slept really bad!'

Zullen appears to epistemically weaken statements about the past too, just like *tha*, *wohl*. So, FUT*, wohl, wel*, and MUST seem to form a natural class of nonveridical, *positive bias* operators:

(50) *Positive bias operators*, *partial support of propositions*
　　　A nonveridical linguistic expression *F* creates positive bias if:
　　　(a)　*F* conveys a partitioned epistemic space M(*i*) into *p* and *not-p*; (nonveridicality), and
　　　(b)　*F partially supports p* via universal quantification over a subset of worlds in M(*i*), selected by the ordering source.

Because the ordering source is the 'ideal' (i.e. the golden standard in the context), partial support of *p* in the best worlds makes that set privileged and creates bias. In the case of partial support, we talk about *projected truth* within the set supporting *p*. All universal modal operators thus have this dual nature of allowing both *p, not p*, while privileging option *p.* And for this reason they give the impression that they are 'strong'.

　　I move on now, finally, to show how these ideas explain the modality of prediction, based on the analysis of Giannakidou & Mari (2013b, 2014a).

3.2. The future: projected truth and bias in *reasonable* worlds

Prediction has an epistemic basis (see also Broekhuis and Verkuyl 2013). In predicting *FUT p* at the speech time *n*, the speaker is confident that the proposition will be made true at some point following *n.* This confidence relies on knowledge at the present, but it is not itself knowledge of the future event, since such events have not yet materialized.

The future can be thought of in terms of branching times (Thomason 1984, Kaufmann et al. 2005), and Giannakidou and Mari argue that the speaker uses her knowledge as a domain restriction, i.e., to universally quantify over only a subset of these metaphysical alternatives. Speakers project their knowledge to clean up the metaphysical branches, to carve them out into *reasonable* and *unreasonable* ones (Mari 2013). Reasonable futures are those where everything proceeds as expected and nothing peculiar happens (see Mari 2013 for extended discussion of this). The knowledge a speaker has at *n* allows her to know which branches are reasonable, and which not. In the figure below, the dotted line to w$_3$ indicates unreasonable future (Giannakidou & Mari 2014: 58):

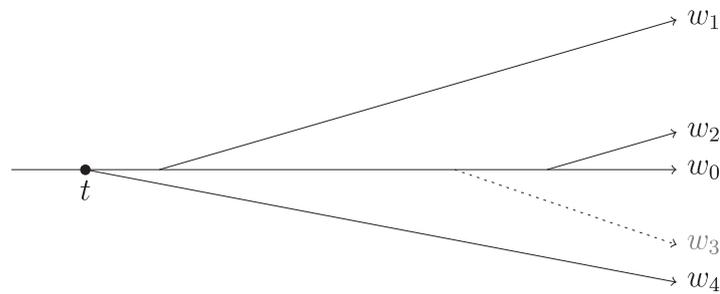$$(58) \qquad \text{ReasFut}(t) = \{w_1, w_2, w_0, w_4\}$$

Figure 4: Reasonable Future Worlds (ReasFut)

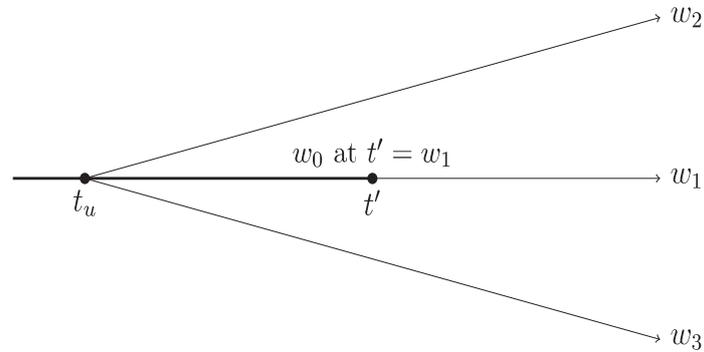Now consider the sentence *John will be here at 5.*

(51)

Figure 5: The actual world at t' coincides with a reasonable future determined at t

The event unfolds in the actual world w_0, which has a reasonable development w_1. The sentence says that if the course of events remains reasonable, the speaker is highly confident that John will be here at 5. However, it is still possible that an accident happens. In this case, the actual world-to-come becomes an unreasonable one:
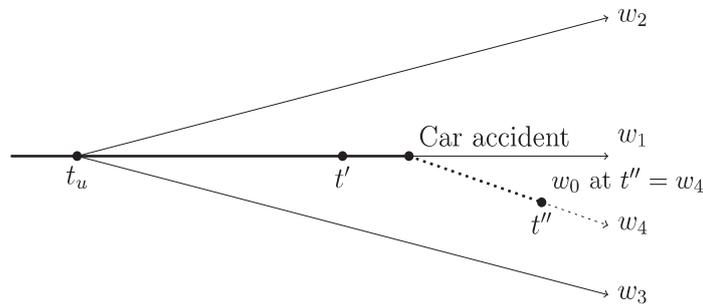

Figure 6: The actual world at t'' does not coincide with a reasonable future determined at time t

When we predict, we normally don't consider as relevant such possibilities (only if we know that John is prone to accidents, do they become relevant, in which case the force of our prediction *John will be here at 5* becomes weaker). As a universal quantifier over reasonable worlds then, FUT expresses support for *p* within the reasonable worlds, thus 'projected truth' onto that set:

(52)   *Truth conditions for predictive FUT*   (Giannakidou and Mari 2014)
         At speech time *n* and with respect to the speaker's epistemic state M(s) at *n*:
         i. [[**FUT (p)**]] is 1 iff $\forall$w'$\in$ ReasFut (*n*): $\exists$t' $\in$ (*n*, ∞) & p (*w', t'*), i.e. p is true in all
         reasonable futures, given present knowledge in M(s).
         ii. Not all worlds in M(s) are ReasFut at *n*. (Nonveridicality)

These truth conditions render predictive future a positive bias nonveridical operator; and allow us to see why, depsite nonveridicality, we get Moore's paradox (thanks to Itamar Francez for raising this question):

 (53)   # John will be here at five, but I don't believe it.

The reason why this sentence is bad is not because the speaker is committed to *p* with the future conjunct, but because the speaker projects truth onto the set of reasonable worlds. *FUT p* is supported in the reasonable worlds, i.e. all reasonable worlds *w* are *p* worlds. Though the epistemic state M(s), which included the modal base, allows *not p*, the continuation targets the reasonable worlds, and *I don't believe it* contradicts the universal quantification, by asserting that in the reasonable worlds there are also *non-p* worlds. In other words, with positive bias nonveridical operators are bound to get the Moore effect because the second clause targets the supporting worlds, hence they are weaker than the veridical operators where the Moore effect targets the whole M(s) (see Giannakidou and Mari 2014 for more details). Why the supporting worlds are targeted is probably due to a pragmatic fact: they are, by the use of FUT, the most salient ones.

     To sum up, the predictive future statement has this dual nature: nonveridical and thus weaker than the unmodalized past assertion and allowing for NPIs— while also stronger than mere existential statements, and expressing partial commitment to *p* and projected truth onto the *p*-supporting set.

4. Conclusion

My goal of this paper was to show Frans what an extraordinary journey our initial ideas in Giannakidou and Zwarts 1999 have initiated. Given the breadth of data discussed here and in my work since the 1990s, Frans will be happy to see that the notions of projected truth (now understood as *partial*, *bias* creating commitment*)* and nonveridicality, that we so humbly envisioned as relevant fifteen years ago, have far-reaching consequences— consequences that, in fact, go beyond the mere licensing of polarity items. In the end,

veridicality judgment has been shown to be decisive for mood triggering, i.e. in order to capture commitment weakening with subjunctive and optative particles. And it is also necessary for the analysis of *all* modalities—while discriminating between weaker modalities (possibility ones, with nonveridical equilibrium) and stronger ones, i.e. universal modalities of the future and MUST with partial support and positive bias for *p*. The notions of actual and projected truth that accompany the veridicality judgment have also been shown to be useful tools for modeling linguistic semantic facts. Ultimately, then, the (non)veridicality judgment appears to be complex, and this is a good thing: it mirrors the complexity of (non)veridicality phenomena in human language. The way epistemic agents judge truth is not a simple matter, and frankly, life would be quite boring if it were.

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