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# Relativizing truth of future-tensed sentences[1]

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## The problem of contexts of assessment

In MacFarlane (2003, 2008) an argument is presented to the effect that a context of assessment should be recognized in its own right besides the context of utterance. His argument is based on certain intuitions we are said to have about the truth-status of future contingent statements such as the one we make by uttering (1) in a context where physical symmetry of the coin is presupposed.

(1)     The coin will land heads up.

MacFarlane's first claim is that we have an "indeterminacy" intuition, according to which our utterance of (1) is neither true nor false at the time that we make it. His further claim is that we have a "determinacy" intuition, according to which the *same* utterance of (1) is taken as determinately true (or determinately false) once the actual course of events has settled the issue (i.e., once the coin has landed heads up, or tails up). On this basis, MacFarlane argues that the standard Kaplanian notion of truth-in-context should be revised so as to allow for its relativization to a context of assessment, besides its original relativization to the context of utterance.[2] Given that for each utterance event *u*, only one context of utterance for *u* is admitted in Kaplanian accounts, there is no way − so the argument runs - for such accounts to save both our intuitions concerning the truth-status of future contingents. Only one world of the utterance is recognized for any utterance event, therefore, as far as the notion of truth-in-context goes, there is no way to evaluate the same

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[1] These notes rely on previous work that I did with Andrea Bonomi at Università degli Studi di Milano. The main philosophical ideas expressed in the first part have been articulated in an unpublished manuscript, 'Evaluating future tensed sentences in changing contexts' (referred to in the main text as Bonomi and Del Prete 2008). I am also indebted to François Recanati for discussion of the ideas presented in these notes, in particular the non speaker-centered notion of utterance context.

[2] MacFarlane's approach to the truth-evaluation in context of future contingents is based on a supervaluational strategy, accordingly he proposes that the notion of truth-in-context has to be formalized in the *postsemantics*, while the *semantics* proper is concerned with formalizing the more primitive notion of truth at an evaluation point (basically, truth relative to an *index*, in the sense of the Index Theory). From his (2003) paper, the following definitions can be obtained for a future-tensed sentence 'WILL($\varphi$)':
**Semantics**: truth of a sentence at an evaluation point $<m, h>$ (where *m* is a moment in a Branching Time structure S, and *h* is a history in S such that $m \in h$)
'WILL($\varphi$)' is true at $<m, h>$  *iff*  for some $m' > m$, such that $m' \in h$, $\varphi$ is true at $<m', h>$
**Relativistic postsemantics**: truth of a sentence at a context (utterance-truth)
'WILL($\varphi$)' is true (false) at a context of utterance $C_{ut}$ *and* a context of assessment $C_{ass}$ *iff* 'WILL($\varphi$)' is true (false) at every evaluation point $<m_0, h>$ such that $m_0$ is the moment of $C_{ut}$ and *h* passes through both $m_0$ and the moment of $C_{ass}$
MacFarlane makes his point as the discovery of a new kind of context-sensitivity: the semantic value of a linguistic expression – e.g. the truth value of a sentence – can depend on the context of assessment as well as on the context of utterance.

utterance both truth-valueless and truth-valued. Of course, Kaplanian semantics has the resources to evaluate the proposition expressed by a particular utterance $u$ relative to circumstances of evaluation other than those set up by the utterance context for $u$. In the case considered by MacFarlane, however, we don't seem to face a situation in which the proposition expressed by $u$ is first evaluated relative to the circumstance of the context and then relative to another arbitrary circumstance. Intuitively, in the case at hand we seem to evaluate the same utterance $u$ at both times relative to the circumstance of the context of $u$. On both occasions (when we evaluate $u$ as neither true nor false, and when we evaluate it as determinately true or determinately false) we seem to look at facts as they show up in the actual world, i.e. in the very world in which $u$ has taken place. MacFarlane's argument for relativizing truth-in-context to a context of assessment as well as to a context of utterance is crucially based on an assumption. The crucial assumption, which is shared with Kaplanian accounts, concerns the uniqueness of the world of the utterance. It can be stated as follows:

(2)     Given an utterance event $u$, only one value for the world-coordinate of the context of $u$ can be specified.[3]

Note that this assumption is not to be confounded with a deterministic assumption according to which a unique wholly connected world-history, one with a unique past for $u$ and a unique future for $u$, can be associated with $u$ – in fact, MacFarlane does not endorse such a deterministic option. No commitment to determinism is thus entailed by the assumption under discussion: this assumption might be coherently made in an indeterministic frame where multiple futures are taken as objectively possible, and in this case it would reduce to the assumption that only one set of branching world-histories can be associated with $u$.

Bonomi and Del Prete (2008) agree with MacFarlane on the two contrasting intuitions about the truth-status of future contingents, but they develop a framework in which both intuitions are accounted for without relativizing utterance-truth to contexts of assessment (whatever these may ever be), as constructs theoretically distinct from Kaplanian contexts of utterance. Here, I wish to take up one of their philosophical points against relativistic semantics in the style of MacFarlane,

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[3] In the same direction, one could point to the following assumption about contexts of utterance:
*Uniqueness of the utterance context.*  For any given utterance $u$, one and only one context of utterance can be specified for $u$.
Uniqueness of the utterance context can be shown to be a corollary of a more primitive assumption, according to which any one of the features that can be ascribed to a particular utterance event $u$ (e.g. the agent of $u$, the addressee of $u$, the place of $u$, and in particular the world of $u$) can take on no more than one value. Hence, each one of the coordinates of the sequence which represents the utterance context of $u$ can get only one value.
In particular, for a given utterance $u$, only one world can be considered as the value of the world-feature of $u$, the idea being that $u$ happens only in one world, the world that is actual with respect to $u$.

and elaborate it in further details. The point can be made explicit as follows. There is no philosophically interesting and semantically relevant distinction between the notions of evaluation and assessment. The only semantic sense that can be ascribed to acts of "assessment" is the same that we ascribe to the familiar acts of evaluation. When MacFarlane says that we assess our claim that the coin will land heads, made at $t$, at a subsequent time $t'$ at which the coin has actually landed heads, and that our assessment ascribes the value True to our claim, he says nothing more and nothing less than he would have said by saying that we *evaluate* our previous claim as true at $t'$. To assess an utterance $u$ relative to a circumstance $c$ is the same act as to evaluate $u$ relative to $c$. The notion of assessment is not philosophically different from that of evaluation, and it is not susceptible of formalization in a truth-conditional semantic system as something having a different functional role from the evaluation of a formula relative to an index. A formal semantic system that pretends to make a distinction between assessment and evaluation is at best redundant.

What the two apparently contrasting intuitions actually show is that we need a semantic framework in which the notion of world (of evaluation) is suitably "temporalized", namely we need to be able to refer to worlds not just as internally unstructured entities, i.e. temporally unanalyzed objects given under one invariant *gestalt* (as they perhaps would be conceived by God's mind). Basically, we need to be able to talk of a world as given from a particular spatio-temporal perspective, the *here and now* of the evaluator. For the purpose of evaluating a given future contingent statement, we can abstract away from space and just consider the temporal perspective of the evaluator. A possible way of representing a world as given from a particular temporal perspective, sticking at the same time at an indeterministic option, is by specifying a moment $m$ in a Branching Time structure. The specified moment is understood as an event which is maximally extended through space and has no temporal duration (so, the present moment is conceived as all the facts in the universe now). Moment $m$ will have its own unique past (a chain of moments preceding $m$ and temporally related to each other) and many possible futures (different chains of moments following $m$, where moments from different chains are temporally unrelated to each other, being time-slices of alternative world-histories). By specifying a moment $m$ in a BT structure, a particular indeterministic world is given from the temporal perspective of $m$: this is the world consisting of all and only the histories to whom $m$ belongs, which we will call '$H_m$' (following a common practice in the literature on BT). Thus, for any moment $m$ in a BT structure, we regard the set of histories $H_m$ as a particular indeterministic world. We also refer to $H_m$ as a BT-world.[4]

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[4] The temporal conception according to which a world, as given from the particular perspective of a moment $m$ in a forward-branching structure S, is the cluster $H_m$ of all histories in S which pass through $m$ (rather than being any single one of such histories), is proposed by Belnap, Perloff and Xu (2001: 139-141). It is then pursued by Bonomi and Del Prete (2008) in an informational setting in which a world is conceived as a contextually restricted set of histories. On Bonomi and Del Prete's approach, metaphysically possible histories which are not compatible with the assumptions

The BT world $H_m$ (to whom we can more simply refer as the world $m$, exploiting the fact that the set-theoretical construct $H_m$ can be always determined in a unique way starting from $m$) consists of a unique past up to $m$, and many alternative futures diverging from each other after $m$. In general, two distinct BT-worlds $m$ and $n$ will have different shapes, as $m$ and $n$ will typically have different futures stemming from them, the relation between the futures of $m$ and the futures of $n$ being as follows: when $m < n$, the futures of $m$ form a superset of the futures of $n$ (more precisely, the set $H_m$ is a superset of $H_n$, as certain possibilities which were open at the early moment $m$ are no longer open possibilities from the later perspective of $n$).

Given such temporal construal of worlds, it is natural to see an event (e.g. an utterance $u$) as belonging to different BT-worlds $m$, $m'$, $m''$, …, where each of these worlds (moments) either follows or coincides with the moment at which $u$ takes place. Indeed, if $u$ occurs at $m_0$, then $H_{m_0}$ will be the temporally most primitive world of $u$, as $m_0$ is the earliest moment with regard to which $u$ is fully actual. But then, for any $m > m_0$, $H_m$ too will be a world of the utterance $u$, as $u$ is fully actual with regard to $m$, and we will say that $H_m$ is a *temporal development* of $H_{m_0}$. On this view, an event $e$ is fully actual with respect to a moment $m$ when $e$ occurs either in the past of $m$ or at $m$.

On this view, there are as many BT-worlds as moments, so that the same individual can be seen as living in many different worlds, each one lasting no more than one instant. Someone might intend this as an objection against this proposal. But if one sees any difficulty here, it's nothing substantial, since we can always define a higher notion of world in an analogous way as one defines a higher notion of (lasting) individual on the basis of the most primitive notion of time-slice. In such definitions, a relation of causality plays a crucial role, as we require that two different "lower-level" worlds $m$, $n$, be regarded as parts of the same "higher-level" world W only when $m$, $n$ are causally related to each other, i.e. either $m < n$ or $n < m$. To take care of this objection, we could then change our terminology, and use the term 'world' only for the higher-level construct, while using a term such as 'world-phase' for the low-level construct. Two points have to be stressed here: first, even if we wanted to use 'world' in the higher-level sense given above, we would not be able to specify a world as a temporally complete history (one including a unique chain of moments constituting the actual future of that world), so at any time $t$ we would face a temporally partial world, the world under the shape it would have from the perspective of (an agent located at) $t$, i.e. a world with a unique past but many possible futures, continually reshaping in the transition from a time $t$ to a subsequent time $t'$; second, even if we wanted to use 'world' in this higher-level sense, we would need to refer to "worlds" in the lower-level sense for purposes of semantic evaluation of tensed discourse, and it would be so because a proper semantic theory of natural language (a semantic

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made by the conversational participants are not relevant for the evaluation of future tensed sentences, with the consequence that a proper subset of $H_m$ is taken as world of evaluation.

theory compatible with the most elementary facts about the perspectival nature of the human mind) cannot ignore the temporal location of the evaluator.

I want to consider now what predictions the BT framework enables us to make concerning the semantic functioning of tenses. It is interesting to note that the BT framework puts some constraints on the possible interpretations of tenses. The most basic facts are the following. As for the past tense, given the linear arrangement of moments in the past of any moment $m$, it follows that a semantic interpretation of this tense along the lines of linear tense logic (see [3] below) is a possible option.

(3)     $[\![P\varphi]\!]^{M,t} = 1$     *iff*     there is a time $t'$ such that $t' < t$ and $[\![\varphi]\!]^{M,t'} = 1$

It should be obvious that the framework does not force an interpretation of the past tense exactly in terms of a temporal operator like the '$P$' of definition (3). What the framework uniquely does is to predict that such an interpretation is possible. The framework would also be compatible with alternative analyses in which the past tense is interpreted, for instance, as an explicit existential quantifier over past times or as a referential device constrained to pick out a time in the past.

As soon as we look at the future tense, we realize that a semantic interpretation along the lines of linear tense logic (see [4] below) will turn out to be problematic in the framework, as moments in the future of any moment $m$ are not linearly arranged.

(4)     $[\![F\varphi]\!]^{M,t} = 1$     *iff*     there is a time $t'$ such that $t' > t$ and $[\![\varphi]\!]^{M,t'} = 1$

If the interpretation of the future tense were as in (4), we would end up with too weak truth-conditions for future tensed sentences, as any such sentence S would be true provided that the eventuality referred to in S occurred in one of the possible futures, no matter how things would be on the other possible futures with regard to the eventuality at stake. Let's illustrate the problem by means of an example. If a speaker $s$ is located at a moment $m$ at which $s$ faces two possible futures, on one of which there will be a meeting in the afternoon, whereas on the other there won't be any, it will be unsuitable for $s$ to inform anyone with regard to the activities in the afternoon by uttering (5):

(5)     There will be a meeting in the afternoon.

Therefore, BT apparently provides us with a structural reason to expect that an interpretation like the '$F$' operator of definition (4) be not a possible option for the future tense after all. Why would it not be a possible option? Certainly, it cannot be that the framework disqualifies (4) on logical grounds, say, because of some logical inconsistency. As a matter of fact, the '$F$' operator defined in (4) would be perfectly possible from a purely logical point of view, and one might want to introduce

such operator in a BT framework for some purposes. The point is not one of *logical* possibility, but rather hinges on considerations of *pragmatic* possibility, in a sense to be made precise. At a descriptive level, a past tensed form like 'ran' and a future tensed form like 'will run' are complementary to each other with respect to the task of temporally locating events of a certain kind, as the former is used to locate (running) events in the past of the utterance *u*, while the latter is symmetrically used to locate (running) events in the future of *u*. Locating in the future of *u*, however, is just not the same affair as locating in the past, as in the foreground of *u* we always face many alternative courses of events, and no one of these could be privileged over its competitors, no one could be selected by the assertor or the evaluator as the actual future to whom the utterance refers. The only sensible way to interpret the indexical description 'the actual future (at *m*)' in the BT framework is by taking it as referring to the whole structure of futures branching at *m*. A straightforward way to account for the complementarity of 'ran' and 'will run' in this framework is as follows: the form 'ran' locates a (running) event at some moment on the unique course of events on the back of *u*, whereas the form 'will run' locates a (running) event at some moment on every course of events on the fore of *u*.

Thus, as an approximation to a proper analysis of the future tense, one might consider the semantic interpretation in (6) (we assume here that the future tense is correctly represented as a temporal operator, but nothing essential hinges on this assumption):

(6) $[\![F\varphi]\!]^{M, m} = 1$     *iff*     for every history $h \in H_m$ there is a moment $m' \in h$ such that $m' > m$ and
$$[\![\varphi]\!]^{M, m'} = 1$$

An interesting aspect of this approach is that the "modal" character of the future tense, i.e. the fact that it intuitively functions as a universal quantifier over world-histories in (at least) some of its uses, would not have to be treated as a semantic property that it has by accident, i.e. a property that it might have lacked, but would rather be a natural fall-out of the branching structure characterizing the temporal model. Following the leading idea of this approach, one might propose a cross-linguistic generalization to the effect that in any language endowed with future tense morphology (be it realized as bound morphology or as an auxiliary verb), this conveys modal meanings, besides the idea of a forward shift with respect to the utterance time. It is significant in this respect that languages from different families, also characterized by different kinds of future tense morphology, such as Italian (which has a synthetic future) and English (which has an analytic future), share a core of modal interpretations for their future tensed sentences—the most apparent ones are (a) the epistemic, (b) the gnomic, (c) the deontic, and (d) the performative interpretations (see [7]-[10] below).

Epistemic future

(7)    a.   John sarà partito.

         b.   John will have left.

Gnomic future

(8)    a.   Il futuro come categoria grammaticale coinvolgerà sia nozioni modali che temporali.

         b.   The future as a grammatical category will involve both modality and temporality.

Deontic future

(9)    a.   Mi restituirai quel libro entro domani!

         b.   You will return that book to me by tomorrow!

Performative future

(10)   a.   Chiameremo 'fattività in avanti' questa proprietà.

         b.   We will call this property 'forward factivity'.

Another interesting aspect of this approach is that the apparent modality of the future tense, though not being an accidental property (as made probable by the fact mentioned above that future tensed sentences from different languages share a core of modal meanings), can be regarded at the same time as nothing intrinsic to the semantics of the future tense morphology. As far as the semantics goes (in a strict sense of the word 'semantics'), it might well be that nothing pertains to the meaning of the future tense besides a shift toward the future in the evaluation time. In other words, what this approach enables us to do is to see the modality which at a descriptive level characterizes future tensed sentences as a property which is contingent more on structural properties of the world to whom these sentences refer, than on aspects intrinsic to the meaning of the future tense.

      Why should we regard these potentialities of the approach under consideration as something positive? Well, I believe that it would be a welcome result if one managed to overcome the traditional dilemma, *tense or modal?*, about the future through a consideration the most simple possible of what the meaning of the future tense is. I want to explore a line of research characterized by the hypothesis that the future tense morphology belongs to the same grammatical category as the past tense morphology. The future tense, as the past tense, is a pronominal element whose value is a temporal interval. As in the case of the past, there is a presupposition on the possible values that this pronominal element can take: with the future, the presupposition is that the value is an interval lying to the future of the reference time. The pronominal element corresponding to the future can be either free or bound. When it is free, the variable is evaluated in the extra-linguistic context.

## Proposal for a non speaker-centered notion of utterance context

From the previous discussion, a conception of utterance context somewhat non standard results. I assume that a standard conception is one according to which a context of utterance encompasses features of the utterance situation which are in some sense close to the speaker. A loose way of characterizing such relation of closeness is by saying that those features fall within the limits of the speaker's cognitive and perceptual reach, or in a less roundabout way, that they are features of which the speaker is aware. Now, in the conception that I have highlighted above, a context for a given utterance $u$ turns out to encompass at least one feature (i.e. the *world* feature) which over time can take on different values, and what is more, when a large interval of time has elapsed from the utterance $u$, the value of the world feature will be far remote from the original value that the feature had at the time $t_u$ at which $u$ was made, and it might well present a situation which was completely unpredictable for the speaker at $t_u$, hence the value of the world feature might well be far beyond the reach of what the awareness domain of the speaker was at $t_u$. This aspect of the conception of utterance context that I have highlighted above, however, might be not as revolutionary as it might have appeared at first, if only one considers that the world of the context, in more standard theories too such as Kaplan (1989), is certainly something of which the speaker could not possibly have a complete cognitive and perceptual awareness. Besides this obvious observation, there is also the widely recognized fact that the speaker can be mistaken on the identity of the values of some features of the utterance context, and use e.g. the indexical 'you' with the intention to refer to a person who is actually different from the real addressee, and it is generally recognized that in such cases the speaker would come to express a proposition of which she is not aware but which is still there on the table, so to speak, as the proposition she actually expressed (see Perry 1993). Concerning the specific problem of the world feature of the utterance context, and the apparently non-standard assumption that I made for which its value can change over time (in spite of the utterance event being the same), it can also be pointed out that according to some researchers the world, unlike the agent and the time, is not to be counted amongst the metaphysically *essential* features of the utterance event (see e.g. Perry and Israel 1996), which might provide further philosophical support for the assumption mentioned above. There are yet other cases (discussed in the philosophical literature on relativism) which can be used to show that the values of some features of the utterance context can shift far away from the awareness domain of the speaker. I

won't discuss such cases here, and I'll confine myself to referring to Bonomi and Del Prete (2008) for discussion of one potentially relevant example.[5]

## Proposal for a semantic analysis of 'will'. The quantificational variability of the future tense

My proposal for a semantic analysis of the future tense consists of the following main claims:

(C1)    The future tense has no quantificational force (Q-force) *per se*.

[Motivation for (C1). It is standard in modal approaches to the semantics of future-tensed sentences to see 'will' as a universal quantifier over possible worlds, hence as a kind of necessity modal (e.g. Condoravdi 2003). The intuition at the basis of such approaches is that (11a) would bear to (11b) a similar relation to the one that (12a) bears to (12b):

(11)    a.   John may be at home now.

       b.   John will be at home now.

(12)    a.   John may go on vacation.

       b.   John must go on vacation.

Sentence (12a) expresses a permission, which is standardly represented as truth in some of the possible worlds compatible with the relevant rules. Sentence (12b), on the other hand, expresses an obligation, which is standardly represented as truth in all the possible worlds compatible with the relevant rules. Evidence for the $\exists$-analysis of 'may' and for the $\forall$-analysis of 'must' comes from the (in)consistency of a continuation like 'but he may also stay at home if he prefers', as shown in (12'a, b) below.

(12')    a.   John may go on vacation, but he may also stay at home if he prefers.    [consistent]

       b.   John must go on vacation, but he may also stay at home if he prefers.   [inconsistent]

Analogously, (11a) expresses a possibility which is "permitted" by the relevant state of information (according to what the speaker knows, John being at home now is a possible state of affairs), and this can be represented as truth in some of the possible worlds compatible with that information state. Sentence (11b), on the other hand, would express a necessity which is determined by the relevant state of information, and could be represented accordingly as truth in all the possible

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worlds compatible with that information state. The relevant intuition is thus that (11b) expresses the same kind of epistemic necessity as would be expressed by the modal verb 'must' in (13):

(13)     John must be at home now.

By analogy with the case of (12a,b), one should be able to find evidence for the ∃-analysis of 'may' and for the ∀-analysis of 'will' in (11a,b) by considering the (in)consistency of a continuation like 'but he may be in his office as well'. This should be ok after (11a), but should produce an inconsistent discourse after (11b). This seems to be the case, as shown by the acceptability of (11'a) and the unacceptability of (11'b):

(11')    a.  John may be at home now, but he may be in his office as well.      [consistent]
         b.  John will be at home now, but he may be in his office as well.     [inconsistent]

However, the universal quantifier force of 'will' (hence, its nature of necessity modal) is not as obvious as would perhaps seem from the examples discussed above. For one thing, a future-tensed sentence with epistemic reading, unlike a corresponding sentence with 'must', can be modified by adverbs of epistemic possibility like 'perhaps' (a point which is also made by Kissine 2008), as shown in (14a):

(14)     a.  John will perhaps be at home now.
         b.# John must perhaps be at home now.
         c.  John must necessarily be at home now.

If we assume that 'will' is a modal, it seems plausible to assume that the relation between 'will' and the adverb 'perhaps' in (14a) should be one of modal concord (see Zeijlstra 2008; Geurts & Huitink 2006: "modal concord plays a key role in several recent semantic theories on a variety of phenomena. It is an essential ingredient in Geurts's (2005) account of free choice permission, in Geurts and Nouwen's (2005) analysis of superlative quantifiers like *at least/most three ducks*, and in Huitink's (2005) treatment of sufficiency modal constructions like *you only need to VP*.").[6] The

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[6] As Zeijlstra (2008) puts it:
Modal Concord (MC) is a phenomenon where two modal expressions do not yield a cumulative reading, but yield only one modal operator at LF. Geurts & Huitink (2006) have first observed this phenomenon:
(1)    a.  You *may possibly* have read my little monograph upon the subject.
           'The speaker thinks that it is possible you read his little monograph'
       b.  Power carts *must mandatorily* be used on cart paths where provided.
           'It is obligatory that power carts be used on cart paths where provided'
According to Geurts & Huitink, "There appear to be two main constraints on modal concord. First, two expressions can only participate in a concord construction if they are of the same modal type, i.e., if they are both deontic, epistemic, or whatever. […] so (7) [*John might have to work on Sunday.*] contains one epistemic and one deontic modal. Consequently, the sentence doesn't have a concord reading. […] The second constraint on modal concord is that the modals involved have to have the same, or at least similar, quantificational force. This constraint entails that sentence (8) [*There may certainly have been weapons of mass destruction in Iraq.*] has no concord interpretation, but rather expresses the speaker's certainty that there is a possibility that there were weapons of mass destruction in Iraq".

relation between 'will' and 'perhaps' in (14a) would be analogous to the one between 'must' and 'necessarily' in (14c) above, which is a paradigmatic example of modal concord: the interpretation of (14c) indeed involves just one operator of modal necessity (in spite of the occurrence of two words denoting modal necessity), as it can be expressed through the paraphrase 'It is necessarily the case that John is at home now'. Given that modal concord requires the two items in the concord relation to have the same quantificational force, and given further the existential force of 'perhaps' (as opposed to the universal force of modal adverbs like 'necessarily' and 'certainly'), we are inclined to conclude from (14a) that 'will' has existential force (at least in this particular context). To reinforce this conclusion, at a descriptive level, we can observe that (14a) globally conveys the same modality as (11a) (repeated below), in which the possibility modal 'may' occurs.

(11)    a.  John may be at home now.

Furthermore, epistemic 'will' can occur with other "quantifying" adverbs, as shown in (15a-c) below. No one of the adverbs in (15a-c) seems to have the force of a universal quantifier. Accordingly, if the interpretation of each of these sentences is seen as involving a form of modal quantification (along the lines of the paraphrases reported below), the corresponding quantificational force in the sentence is never universal, but rather: a *most*-force in (15a), a pure *existential* force in (15b), a *few*-force in (15c).

(15)    a.  John will probably / most likely have left the apartment.

            [In most of the possible circumstances compatible with what I know, John has left the apartment.]

        b.  John will possibly have left the apartment.[7]

            [In some of the possible circumstances compatible with what I know, John has left the apartment.]

        c.  John will hardly have left the apartment.[8]

            [In few (if any) of the possible circumstances compatible with what I know, John has left the apartment.]

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[7] Here is a naturally occurring example from the web (the relevant occurrence of 'will possibly' is reported with its full context, to facilitate understanding of the intended reading, which turns out to be an *existential epistemic* reading):

(i)   Pause, too, to think for a moment about "Infant Mortality" – the probability that a child will die between birth and his or her first birthday. Some of us here today *will possibly* have lost infants and young children from our own families. So I hope we can all readily identify with the awful tragedy of lost hope and love that underpins our collective, global, commitment to reduce both the infant and the under five mortality rates.

[8] Here is a couple of naturally occurring examples from the web involving 'will hardly':

(i)   The angry Merseyside response to Hicks' revelation that he had approached Jürgen Klinsmann about the manager's job will hardly have left him "in love" with Liverpool and DIC [Dubai International Capital] may also find encouragement in Hicks' saying in the interview that he finds partisan Liverpool fans an alien entity.

(ii)  It will hardly have gone unnoticed that Step 9 has been crammed with do's and don'ts, all worthy of close revision […]

My provisional conclusion is that 'will' should not be analyzed as a necessity modal. If it is a modal at all, it does not have a specific quantificational force on its own (be it universal, existential, or else), but the type of quantification over alternative possibilities comes from a different source – in the examples overviewed here, from a quantifying adverb co-occurring with 'will'.]

(C2)    The Q-force in future tensed sentences (hereafter, future sentences) comes from the linguistic context in which the future tense is embedded.

(C3)    In epistemic future sentences with epistemic adverbial modifiers (*perhaps, certainly, hardly, etc.*) the Q-force comes from the epistemic adverb.

(C4)    At LF the future tense introduces just a temporal variable, whose value must not precede the evaluation time (a *non-past* temporal variable).

[Comment on (C4). I exploit an analogy with the case of *definite* NPs, as they are analyzed in DRT-like approaches.

First point of the analogy: on such approaches, definites (either descriptions or pronouns) come on the scene with a familiarity condition associated with their felicitous use (see Heim 1982). The definite NP in (11) is used felicitously, as its familiarity condition is satisfied in virtue of the occurrence of an antecedent NP in the previous discourse.

(11)    A man walked in. He was smoking a big cigar.

My claim is that something similar happens with the interpretation of the future tense in (12).

(12)    The Olympic Committee has now deliberated. The next Olympic Games will take place in China.

The future tense in the second sentence could not come out of the blue. It requires that an "antecedent" occur in the preceding discourse. But the analogy cannot be pushed to such a point as to see a case of coreference in (12). The familiarity condition for the future is probably not to be thought of as matching of referents.

Second point of the analogy: according to DRT, definites do not come with a quantificational force of their own, but simply introduce variables that get bound by whatever operator their antecedents are linked to. So, the definite in (11) above is bound by a default (discourse-level) existential quantifier that binds the antecedent NP 'a man' too. In (13), the definite and its antecedent are both bound by the operator corresponding to 'always'.

(13)    If a man walks in the park, he always smokes a cigar.

With the future tense, it is not certain that the relevant "binding" involves an operator-variable structure, though intuitively one always has a binding relation in such cases. Roughly, in (12) above it is the reported fact of the Committee's deliberation which sets out the background against which the interpretation of the ensuing 'will' takes place. But it might well be that in (12) a default (universal) quantifier intervenes to bind some world-variable (not directly the temporal variable introduced by the future tense). Besides, there are cases like (14) in which an overt quantifying expression apparently does the wanted binding.

(14)    If the Olympic Committee ignores the objections raised by the western countries, the next Olympic Games will probably take place in China.

In this case 'probably' could be analyzed as a quantifying adverb which binds a world-variable.]

(C5)    Natural language is sensitive to the distinction between closed past and open future (more exactly, speakers are sensitive to the asymmetry between the unique past and the multiple futures: I assume that they have some conceptual representation of this asymmetry in their cognitive systems, and that their language systems interface with this representation, in particular in correspondence of the Tense and Modality sub-systems). As a consequence, due to the multiplicity of open futures, a non-past temporal variable requires multiple instantiations, i.e. it requires to be instantiated on *every* possible future by default.

A bare future sentence is interpreted by default in such a way as to have the temporal variable of the future tense instantiated on every possible (accessible) future. The default interpretation of a future sentence is thus as a universal quantification over a domain of accessible futures.

[Note: universal quantification is not contributed by the future tense *per se* (see claim [C1] above), but through the interpretation of the global linguistic context in which it is embedded, while the only contribution of the future tense is the non-past temporal variable.]

A future sentence modified by an epistemic adverb winds up with the Q-force of the epistemic adverb (roughly, the SOME-force with *forse*, the ALL-force with *certamente*, the FEW-force with *difficilmente*).

If the event reported by the future sentence occurs at some values of the temporal variable while it does not occur at some other values of the same variable, the statement cannot be evaluated as true, since the event may fail to occur at the relevant time, nor can it be evaluated as false, since the event may occur then. The same situation arises in natural language whenever a potential multiplicity of objects relevant to the semantic evaluation is present. For example, we face one such situation when we use sentences containing vague predicates. Consider the pair of sentences in (15):

(15)     a.   Mount Everest is a high mountain.

         b.   Gran Sasso is a high mountain.

There is a difference between (15a) and (15b). No matter what standard of height for mountains we select, sentence (15a) is certain to wind up true; accordingly, we are inclined to evaluate it as true, regardless of how the context of utterance is. The truth of sentence (15b), however, is contingent on what standard of height for mountains counts as the most relevant standard in the context; accordingly, if we face a multiplicity of potentially relevant standards, we may be unable to evaluate the sentence as true or false, insofar as the standards may vary significantly with respect to each other, and, consequently, the sentence may turn out to be true relative to some standards and false relative to others.

There is an intuitive fact that can be adduced to corroborate the above claims concerning the difference between (15a) and (15b). If we look at sentences (15a, b) out of context, we feel hesitation to accept (15b) as true, but with (15a) we don't have a similar vacillation.

The truth-status of (15b) becomes much clearer as soon as a definite standard of height is referred to, or a restricted class of standards is isolated (in this case the sentence will be evaluated as true if it turns out to be true relative to the strictest standard in the class, hence relative to *any* standard therein).

These considerations on the evaluation of sentences with vague predicates make it clear that the situation we face when we evaluate future sentences is not new: we have a potential plurality of entities that are relevant to the semantic evaluation, and it would be arbitrary for the evaluator to select any one of such entities as the right input for the evaluation. So, the evaluator's strategy is "supervaluational": evaluate as true (or false) just in case the choice of the entity relevant to the evaluation (the future world-history) does not make any difference in the resulting value.

In the case of future sentences, the plurality of possible entities relevant to the semantic evaluation is an ineliminable fact, that is, there is no way for the evaluator to single out a definite world-history as the relevant future in a non-arbitrary way. Moreover, whenever "pure" future contingents are concerned, such as future sentences used to make bets, or future sentences used in contexts in which the hearer puts the speaker's ground for making the assertion into question, the evaluator, according to the "supervaluational" strategy described above, is unable to assign a truth-value to the sentence at the moment of utterance, since she faces a plurality of possible futures which make a difference in the resulting truth-value.

We make the following assumptions with regard to the notation:

(a)      '$h$', '$h_i$' are used as variables ranging over histories.

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(b)     'c' denotes a context of utterance, i.e. a sequence of parameter values such as the moment of utterance c(t).

(c)     'g' denotes a two-place function which assigns a temporal value (i.e., a moment) to any variable of type **i** relative to any world-history—given variable $k$ of type **i** and world-history $h$, g($k$, $h$) is a moment belonging to $h$.

(d)     '^' is reminiscent of Montague's cap operator: it denotes an operator that takes an expression $E$ and yields an expression denoting a function from world-histories $h$ to the extension of $E$ relative to $h$.

(e)     the symbol '∀*' in the leftmost position of an LF denotes the default operation of universal quantification over accessible histories which is triggered by a future tense.

The evaluation function [[ · ]] is relativized to a context, an assignment function, and a circumstance of evaluation. The metalinguistic expression [[ $E$ ]]$^{c,g,w}$ is short for 'the denotation of $E$ relative to context c, assignment g, and circumstance of evaluation w'. When the circumstance w is set up by the context, i.e. when w is the circumstance of the context, then we have the case of *denotation in context*, which for sentential utterances coincides with *truth in context*.

We can now illustrate the analysis by considering the example (16), given along with its surface structure (16$_{SS}$) and LF (16$_{LF}$):

(16)     Mary will come.

(16$_{SS}$)  [$_{TP}$ Mary$_i$ [$_{T'}$ [$_T$ will$_k$] [$_{VP}$ $t_i$ [$_V$ come]]]]

(16$_{LF}$)  ∀* ^[$_{TP}$ will$_k$ [$_{VP}$ Mary come]]

(17)     [[ Mary come ]]$^{c,g,w}$ = λm$_i$. Mary comes at m

[[ will$_k$ ]]$^{c,g,w}$ = λP$_{<i, t>}$: c(t) ≤ g($k$, $h$) ∧ $h$ ∈ w. ∃m [P(m) ∧ m = g($k$, $h$) ∧ m ∈ $h$]

[[ will$_k$ [$_{VP}$ Mary come] ]]$^{c,g,w}$ = {c(t) ≤ g($k$, $h$) ∧ $h$ ∈ w} ∃m [Mary comes at m ∧ m = g($k$, $h$) ∧ m ∈ $h$]

[[ ^[$_{TP}$ will$_k$ [$_{VP}$ Mary come]] ]]$^{c,g,w}$ = λ$h$: $h$ ∈ w. {c(t) ≤ g($k$, $h$) ∧ $h$ ∈ w}. ∃m [Mary comes at m ∧ m = g($k$, $h$) ∧ m ∈ $h$]

[[ ∀* ^[$_{TP}$ will$_k$ [$_{VP}$ Mary come]] ]]$^{c,g,w}$ = ∀$h'$ (λ$h$: $h$ ∈ w. {c(t) ≤ g($k$, $h$) ∧ $h$ ∈ w}. ∃m [Mary comes at m ∧ m = g($k$, $h$) ∧ m ∈ $h$])($h'$) = ∀$h'$ {c(t) ≤ g($k$, $h'$) ∧ $h'$ ∈ w} ∃m [Mary comes at m ∧ m = g($k$, $h'$) ∧ m ∈ $h'$]

Let's now analyse the adverbially modified future sentence (18):

(18)     Perhaps Mary will come.

The difference with respect to the previous sentence is in the occurrence of the adverb 'perhaps'. This adverb is responsible for the existential force of the sentence, as it determines the existential binding of the world-history index (an intuitive paraphrase of the sentence is 'Some possible futures are such that Mary comes in them'). Such existential binding replaces the default universal binding of the previous sentence.

SS of (18):  [$_{TP1}$ Perhaps [$_{TP2}$ Mary$_i$ [$_{T'}$ [$_T$ will$_k$] [$_{VP}$ $t_i$ [$_V$ come]]]]]

LF of (18):  Perhaps ^[$_{TP}$ will$_k$ [$_{VP}$ Mary come]]

[[ Perhaps ]]$^{c,g,w}$ = $\lambda P. \exists h \in$ w $P(h)$

[[ Perhaps ^[$_{TP}$ will$_k$ [$_{VP}$ Mary come]] ]]$^{c,g,w}$ = $\exists h \in$ w $\exists$m [Mary comes at m & m $\in$ h & m = g($k$, $h$)]

In the previous analyses, quantification over world-histories was unrestricted. This was a simplification. For bare future sentences like (16), let's assume that the accessible futures are part of the world-histories overlapping up to the moment of utterance c(t). We borrow an idea from Branching Time: the moment c(t) has a unique past, a sequence of moments temporally ordered with respect to each other, and all preceding c(t), but it has many possible futures, where moments from one future are temporally ordered with respect to each other but temporally unordered with respect to moments from other futures. For any moment m, let $H_m$ be the set of world-histories passing through m: histories in $H_m$ will overlap up to m and diverge only after m. The metaphysically possible futures at c(t) are thus represented as the world-histories in $H_{c(t)}$, being understood that the part of any $h \in H_{c(t)}$ which is past with respect to c(t) is not relevant (note that this part will be the same for any $h \in H_{c(t)}$).

Future sentences are sometimes used to make a bet. An example of future sentence that in normal circumstances is used to make a bet is (19):

(19)    The die will come up six.

The philosophical conception of future contingents, and the related thesis of truth-valueless statements, originates from consideration of such examples as (19). In circumstances in which the die has not been loaded and the conversational participants know this fact, an utterance of (19) would seem to convey a proposition that is not evaluable for truth or falsity at the time of utterance, hence the proposition would seem deprived of a truth-value then. The philosophical conception of a truth-valueless statement has some intuitive basis in such cases.

What is the difference between (16), which was not considered to be truth-valueless, and (19), which one might want to consider truth-valueless instead? Plausibly, the difference is not one of LF. It rather seems that the difference is one of subject-matter. In the case of (16), we might

plausibly be speaking about the future doings of a rational agent, a person who is capable of rational planning, and we might be reporting one of her future actions, as they were prospected by the agent herself. In the case of (19), by contrast, we are speaking about the possible outcomes of a physical process, and we are blindly selecting one of these outcomes as the one which will come into existence. In the first case, the truth of the statement is possibly guaranteed by a background of information relative to the agent's plans (although bet-like uses of (16) are not to be excluded in principle—by using this sentence, one might also be expressing an unfounded guess with regard to the agent's future behaviour). Intuitively, this information will restrict the domain of possible futures to whom the default universal quantifier refers (metaphysically possible futures in which Mary does not come because of an unpredictable accident will be exempted from consideration).

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