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Comments welcome)

## Finding one's way in the labyrinth of forking paths. (The Semantics of the future tense: Part I.)<sup>1</sup>

*Abstract.* According to the “actualist” point of view, the core meaning of a future-tensed statement is based on the reference to the state of the world that *will be actualized*. Thus, what is crucial, in this theoretical approach, is the temporal content of such statements.

On the other hand, what characterizes “modalism” is the idea, made familiar by A. Prior, that the meaning of the future tense is essentially based on the notion of *settledness*, which involves a plurality of possible courses of events.

On the proposal I intend to discuss, actualism and modalism can be seen as two distinct, but *related*, attitudes that speakers can have when dealing with the future. Thus, in the final section I sketch a compositional semantics in which a *unified* treatment of both (families of) interpretations is based on a revised notion of settledness. The main features of this approach are the following: (i) in branching structures, a world can be represented not by a single course of events, but by a node *u* in the tree, where *u* itself is seen as the cluster of courses of events passing through it; (ii) the utterance time is uniquely fixed; (iii) the utterance world is *not* uniquely fixed; (iv) because of (iii), an utterance-event is associated not to a single context, but to a plurality of contexts, depending on which world we are considering as the utterance world. As a consequence, if a future-tensed sentence  $\phi$  is uttered at *u* and its truth (falseness) is *already* a settled issue at *u* itself, then the sentence is true (false) at *u*; otherwise the sentence is neither true nor false at *u* and, to get a definite truth value, we must wait *until* settledness is reached in a different context. Since what is crucial, in both cases, is the reference to a given state of information, such a treatment can be extended to other intriguing uses of the future tense, starting from the epistemic reading. These uses will be topic of a related paper.

“Par nature, le monde des possibles m’a toujours été plus ouvert que celui de la contingence réelle.” M. Proust, *La Prisonnière*.

### 1. Preliminary question: the future as the mirror image of the past.

The term “factivity” is often used by linguists to characterize the behaviour of some operators. In this sense, an operator **O** is factive if, for any sentence  $\phi$ , the truth of ‘**O** $\phi$ ’ entails the truth of  $\phi$ . It is immediate to see that, if past and future are associated to suitable operators (e. g. ‘**P**’ and ‘**F**’ respectively<sup>2</sup>), these operators cannot be factive tout court: of course, the truth, at a time *t*, of ‘it was (will) be the case that  $\phi$ ’ does not entail the truth, at *t*, of  $\phi$ . But a notion of “shifted” factivity is available in these cases. In particular, it is quite natural to associate the simple past to “backward factivity”, that is to the idea that the truth of ‘**P** $\phi$ ’, at a given time *t*, entails the truth of  $\phi$  at a time *s* preceding *t*. Such a requirement is made explicit in the classical truth conditions for the (simple) past tense<sup>3</sup>:

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<sup>1</sup> The oldest parts of these notes, concerning a “contextual” interpretation of the so-called Peircean approach, trace back (alas) to a talk delivered in 1979 at a Logic Colloquium organized by the Italian Society of Logic and Philosophy of Science. (See Bonomi, 1980.) After a long period of latency, they were taken up in a 2001 seminar on tense logic at the University of Milan and in a 2005 seminar at the University of Siena.

<sup>2</sup> ‘**P** $\phi$ ’ = ‘It was the case that  $\phi$ ’; ‘**F** $\phi$ ’ = ‘It will be the case that  $\phi$ ’.

<sup>3</sup> In the so-called  $W \times T$  framework, a model is a structure  $M = \langle W, T, <, D, I \rangle$  where  $W$  is a set of worlds,  $T$  is a set of times,  $<$  is a *linear* order on  $T$  ( $x < y$  means that  $x$  is earlier than  $y$ ),  $D$  is the domain of individuals and  $I$  is a function from  $\mathbf{P}^n \times W \times T$  to sets of  $n$ -tuples of individuals ( $\mathbf{P}^n$  is the set of  $n$ -place predicate letters).

In the last section this framework will be replaced by a genuine branching structure.

(1)  $[\mathbf{P}\varphi]^{M,w,t,c} = 1$  iff there is a time  $s$  such that  $s < t$  and  $[\varphi]^{M,w,s,c} = 1$ .

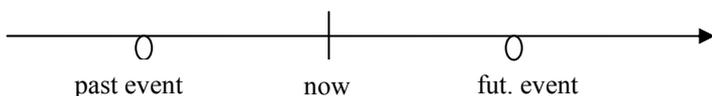
In most versions of formal semantics the same kind of reasoning is applied to the future tense, whose truth conditions are often expressed by definitions like:

(2)  $[\mathbf{F}\varphi]^{M,w,t,c} = 1$  iff there is a time  $s$  such that  $s > t$  and  $[\varphi]^{M,w,s,c} = 1$ .

(2) is obtained from (1) by a simple inversion in the time direction. To use a metaphor exploited by Prior: the semantic representation of the future is here the mirror image of the semantic representation of the past. The idea is, of course, that the former is symmetrical with respect to the latter. Let us call such an assumption *symmetry hypothesis*.

This approach is nicely pictured by a familiar way of representing the time flow: an oriented line which stands for a *single* course of events (i. e. the world where the utterance event occurs) and where events are located before or after a given point (which in the simple cases is the utterance time = now).

Fig. 1



Hopefully, this kind of representation should be particularly appropriate at least for those languages, like Italian, in which the future tense is associated not to a modal periphrastic construct, but to a simple flecional form, exactly as the past tense, and in which a purely temporal interpretation is expected to be the most natural one. Yet, it is easy to verify that this expectation is not borne out by facts, because there are well-known uses of the future tense that must be characterized in terms of their *modal*, rather than temporal, import. Here are some examples.

There is someone knocking at the door, and I say:

(3) SARÀ Leo. (It be [fut. tense] Leo: *epistemic use*).

Frege's principle:

(4) La relazione di identità VARRÀ solo fra un individuo  $a$  e  $a$  stesso. (The identity relation hold [fut. tense] only between an individual  $a$  and  $a$  itself: *law like statement*.)

Such a use is similar to the one illustrated, in English, by a remark concerning, ironically, the future tense itself in Fleischman's book (1982: 153):

(5) Future as a grammatical category WILL involve temporality, aspect and modality. The more modal (or aspectual) a form becomes, the less temporal it WILL be, and vice versa.)

A passage in the Italian version of these notes:

(6) CHIAMEREMO *fattività in avanti* questa proprietà. (We call [fut. tense] this property *forward factivity: performative use*.)

Italian translation of the comment made by the editor who rejected Proust's *Recherche*:

(7) Sarò forse duro di comprendonio, ma non riesco proprio a capire come un signore possa impiegare trenta pagine per descrivere come prende sonno (I be [fut. tense] dull-witted [= I may be dull-witted], but I can't understand the reason why a gentleman needs thirty pages to describe how he gets to sleep: *concessive use*.)

## 2. The multiple-choice paradox.

The examples I have just mentioned are not marginal cases, but rest on a modal import which is still alive even in apparently flecational forms<sup>4</sup> and which makes the symmetry hypothesis inadequate as a general principle. In Prior (1957) the symmetry hypothesis is rejected for philosophical reasons and stronger truth conditions are adopted for future-tensed statements: 'F $\phi$ ' is true at time t not only if  $\phi$  is true at a future time, but also if there are *present* facts, at t, that make the truth of  $\phi$  at a future time already *settled* at t.

One of the reasons that motivated this turning-point is Prior's reflection on what I call the multiple-choice paradox<sup>5</sup>, illustrated by the following example:

(MCP) Suppose A and B are being pushed towards the edge of a cliff, and there will be no stopping this process until there is only room for one of them. Then we may be able to say truly that it will definitely be the case that A or B will fall over, even though we cannot say truly that A will definitely fall or that B will definitely fall over. (Prior, 1957: 85.)

In this passage Prior is discussing statements concerning *contingent* future events (such as being pushed towards the edge of a cliff and falling over). What he is considering is the existence of *present facts* as an appropriate criterion to distinguish, among the future-tensed statements, those that are *definitely* true (at the utterance time) from those that are not<sup>6</sup>. As we have just seen, in his example this point is illustrated by the statement:

(8) A or B will fall over

which, according to Prior, turns out to be definitely true in the circumstances described above, whilst *neither* 'A will fall over' *nor* 'B fall over' are definitely true. (This is the apparent paradox.) In other words, in the above passage Prior seems to assume that the evaluation of future-tensed statements as definitely true or false depends on the existence of *present* facts or circumstances. A statement like 'x will  $\phi$ ' is now true, in this sense, if the truth, in the future, of 'x is  $\phi$ ing' is already *settled*. Let us call *settledness* condition such a requirement<sup>7</sup>.

It is also clear, from his example, that settledness is a property of statements that *depends on time* in this sense: what is not settled at time t can *become* settled at a later time t' in view of new facts. (In the original example: at the beginning of the process, that A or B will fall over is not settled, but it *becomes* settled at some point in the process.) This point is made explicit, in connection with the so-called Peircean approach, in Prior (1967: 129): "Will" here means "will definitely": "It will be

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<sup>4</sup> Actually, this modal import should be no surprise in view of well-known diachronic considerations: late Lat. *cantare habeo* [I have to sing] > old It. *cantare ao* > It. *canterò*.

<sup>5</sup> I use this term because Prior's example is a future-tensed version of the "multiple-choice paradox" discussed in Bonomi (1997: 181-184) with respect to the progressive. Unfortunately, at that time I was convinced that this kind of argument should not apply to the future tense since I had in mind only its "plain" temporal use, without considering its modal import. Moreover, as I will try to show, Prior's example, as it stands, is not very convincing from an empirical point of view, even though the essential point, concerning the settledness condition, comes out quite clearly from the argument.

<sup>6</sup> See Prior (1968: 38) for a further illustration of the principle of settledness: 'Nothing can be said to be truly "going-to-happen" (futurum) until it is so "present in its causes" as to be beyond stopping; until that happens neither "It will be the case that p" nor "It will not be the case that p" is strictly speaking true.'

<sup>7</sup> In Øhrstrøm and Hasle (1995: 265) Prior's point of view is associated to the following principle:

(P) The proposition F(n)p is true now if and only if there exist now facts which make it true (i. e. which will make it true in due course).

that *p*” is not true *until* it is in some sense settled that it will be the case, and “It will be that not *p*” is not true *until* it is in some sense settled that not-*p* will be the case.’ (Italics mine.)

From this point of view, forward factivity, and the symmetry hypothesis in general, is no longer a sufficient condition for the truth of a future-tensed statement: the fact that A eventually falls over is *not* a sufficient condition for the truth of the statement ‘A will fall over’ in the given scenario, where *only* the truth of (8) is settled.

To implement this idea, elsewhere Prior himself suggested to reason in terms of the *possible* courses of events that are compatible with the current state of the world (i. e. with past and present events): a statement is settled, at a time *t*, if it turns out to be true, at *t*, in *all* these courses of events, i. e. no matter what the future is like.

Is this a plausible requirement as concerns the truth conditions of the future tense in natural languages? To be sure, there really are special situations in which the existence of present (and past) facts makes the truth of a future-tensed statement settled in the sense analyzed by Prior. For example, if I say:

(9) Fra quindici giorni sarà il compleanno di Leo (Within a fortnight it be [fut. tense] Leo’s birthday)

the fact that today it is April 8 and that Leo was born on April 23 makes (9) *definitely* true at the utterance moment. In the theoretical framework sketched above, this means that (9) is true in *every* course of events compatible with the current state of the world.

The problem, in general, is that for most future-tensed statements in our everyday language, that is for most statements about future, but *contingent*, issues, there are no facts whose presence would entail the future occurrence of a particular event as something *already* settled, at least in the sense that any possible course of events in which that event does not occur is definitely ruled out.

Indeed, consider Prior’s example again, where the definite truth of (8) is explained by resorting to the existence of facts that are supposed to *settle* the issue. Yet, although these facts are taken for granted, how can we rule out the possibility that some unexpected event will prevent *both* A and B from reaching the edge of the cliff? For example, an earthquake might destroy the cliff itself before the event of pushing is completed: however remote this possibility may be, it is nonetheless a *real* possibility. Of course, one might try to point out further restrictions in order to make the given scenario definite enough to make the truth of (8) already “settled” at the utterance moment. But further unexpected events might be mentioned to contrast the idea that the outcome at issue (i. e. the fact that A or B will fall over) is already “settled”.

This kind of argument would apply to most situations in which contingent events are concerned.

Thus, with the exception of logical truths or statements like (9), if *objective* (i. e. physical or metaphysical or historical<sup>8</sup>) “settledness” is assumed as a necessary condition for the truth of a future-tensed sentence, then some statements that we are willing to consider as intuitively true (e. g. sentences such as (10) and (13) below) would be evaluated as false (or neither true nor false)<sup>9</sup>.

It should be remarked that, in discussing Prior’s example, my task was *not* to question his idea that forward factivity is not a sufficient condition for the truth of a future-tensed statement, but his idea that it should be replaced by the notion of *objective* or *historical* settledness (as a necessary and sufficient condition). Thus, the problem I have in mind can be expressed in this form: how should we characterize the notion of settledness in order to make it relevant in the truth conditions for future-tensed statements?

To answer this question notice that Prior’s approach sounds much more plausible if, instead of considering the *mere* facts and the totality of future possibilities compatible with them, we consider the facts *with respect to* a suitable state of information, i. e. in the light of a background of

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<sup>8</sup> The term ‘historical necessity’ is used in Thomason (1984).

<sup>9</sup> As stressed in Øhrstrøm and Hasle (1995: 267), if principle (P), as stated in note 7, is accepted, it follows that any proposition about the contingent future is false.

assumptions. So, what is relevant here is the set of *possible* courses of events that are assumed to be compatible with this background. Accordingly, the kind of “necessity” that the idea of settledness seems to suggest would be interpreted *relative* to such a context: roughly speaking, being settled would mean to be entailed by a relevant set of assumptions, i. e., in the theoretical framework under discussion, to be true in all the courses of events that are compatible with those assumptions.

### 3. Settledness.

In other terms, what counts as a settled issue is a *contextual* matter. To see this consider the following examples.

Suppose that I am an official who, as an anonymous traveller, is testing the efficiency of two booking-clerks, Leo and Teo, at the Central Station in Milan. So I ask Teo at what time the 9.15 train will arrive in Rome. After consulting the schedule, he correctly replies:

(10) The train will arrive in Rome at 13.45.

Unfortunately, Leo is not very expert in consulting schedules, so that his answer is the following:

(11) The train will arrive in Rome at 15.15.

In these conditions, it is quite probable that in my final report I will qualify answer (10) as *true* and answer (11) as *false* (even if, because of an unexpected strike, on the day of my inquiry the train arrived in Rome at 15.15). The intuition, here, is that, unlike (11), (10) is true because it correctly describes *what is provided for* by the relevant schedule, *independently* of the occurrence, in the future, of the event at issue: which shows, among other things, that in such cases forward factivity *cannot* be considered as a *necessary* condition for the truth of the statement (do not forget that, because of the strike the train did *not* arrive in Rome at 13.45.) After all, I did not ask the booking-clerk to appeal to some improbable art of divination, but (more reasonably) to show his skill in consulting a schedule. In this sense, a future-tensed statement like (10) is roughly equivalent to a statement like

(12) The train must arrive in Rome at 13.45.

where the modal content (in terms of conformity to what is provided for by the schedule) is made explicit.

A further example where the relevant source of information has a crucial role to play is the following.

Imagine that Leo has violated some traffic law. So, I ask his lawyer what the law specifies in such cases. After consulting the last edition of *Rules of the road*, she answers:

(13) Leo will be punished with the seizure of the car or with the withdrawal of the driving licence.

Once again, the intuition is that the lawyer has said something *true* in view of a particular set of legal norms. Since these norms are often expressed in the future tense, the lawyer’s answer is simply based on the following elementary argument: (i) This is what is stated by *Rules of the road*: For any x, if x has violated rule *a*, x will be punished with the seizure of the car or with the withdrawal of the driving license; (ii) Leo has violated rule *a*; (iii) Leo will be punished with the seizure of the car or with the withdrawal of the driving license.

Significantly, the Italian verb ‘prevedere’ (‘to predict’) has two different uses, illustrated, respectively, by the following examples: (i) Lisa PREVEDE che Lampo vincerà la corsa [= What Lisa foresees is that Lampo will win the race]; (ii) La legge PREVEDE che Leo sia punito con

un'ammenda [= What the law provides for is that Leo be punished with a fine]. In the former case, the use of 'prevedere' has a genuine temporal import, in the latter it simply expresses conformity to a given set of rules, norms, directions, and so on. The idea is that the future tense, too, is related to these two kinds (or families) of notions.

Two points should be stressed here. First of all, like in the station example, the truth (or falsehood) of the agent's answer is determined by *what is provided for* by a relevant set of statements (norms, in this case): if we stick to *this* point of view, her answer remains true even if, by chance, amnesty is granted by the government and Leo's infraction is cancelled (which means that forward factivity cannot be considered, in general, as a *necessary* condition in the relevant truth definition).

Secondly, like in Prior's example (but in a more plausible scenario), we have here a further illustration of the multiple-choice paradox<sup>10</sup>: if, for instance, the choice between the two punishments is in the judge's discretionary power, (13) entails neither of the following statements:

(13a) Leo will be punished with the seizure of the car

(13b) Leo will be punished with the withdrawal of the driving licence.

#### 4. The dissymmetry hypothesis.

Let us reflect for a while on the consequences that the multiple-choice (apparent) paradox may have on the theoretical framework adopted so far. In a nutshell, what we need is a formal framework in which, as required by our intuitions about such phenomena, the truth of a sentence like (13) does *not* entail the truth of (13a) or (13b). If, as in Fig. 1, we look *only* at a *single* course of events there is no plausible way to get this result. This is so because, under the assumption that (13) is true in the selected course of event, it follows that in *this* course of events either (13a) or (13b) must be true. Thus, if we want to avoid this conclusion, it is at least plausible to refer to a *plurality* of courses of events (namely, the set of courses of events compatible with the norms at issue, where the choice between the two kind of punishment is left to the judge) and to look at what happens in all these worlds instead of considering only the actual world: in some of them the car is seized, in other the driving license is withdrawn. This is essentially Prior's strategy.

In this connection, there seems to be a clear dissymmetry between the way the past is represented in language and the way the future is represented. As a matter of fact, the kind of Priorean argument developed in the case of (13) does *not* hold any longer with a different temporal orientation:

(14) Leo è stato punito con il sequestro dell'auto o con il ritiro della patente. [Leo was punished with the seizure of the car or with the withdrawal of the driving licence.]

(14a) Leo è stato punito con il sequestro dell'auto. [Leo was punished with the seizure of the car.]

(14b) Leo è stato punito con il ritiro della patente. [Leo was punished with the withdrawal of the driving licence.]

The intuitive idea is that if (14) is true, then either (14a) or (14b) must be true. Thus, an approach based on branching time suggests an easy explanation for this difference between the two cases: there are *many* futures, but only *one* past. Let us call such an assumption, for brevity, *dissymmetry hypothesis*. In a branching time framework this hypothesis can be expressed by the fact that the past

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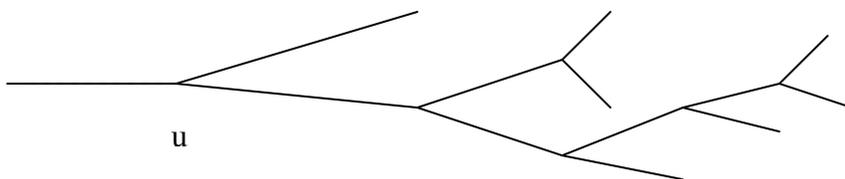
<sup>10</sup> A similar example is discussed in Condoravdi (2002), with existential quantification replacing disjunction:

(a) Leo will meet with one senior administrator.

What is settled, here, is that Leo will meet the dean or the provost, even if it has not been decided yet who he will meet with. So, (a) can be true, at the utterance moment, although neither 'Leo will meet with the dean' nor 'Leo will meet with the provost' is true.

moments, but *not* the future ones, are linearly ordered; which means that, given any moment *u*, there is only one course of events stemming from *u* towards the past, whilst there is a plurality of courses of events stemming from *u* towards the future:

Fig. 2



Further evidence for the dissymmetry hypothesis is provided by an argument involving the notion of possibility. Consider the following statements (uttered at a given moment *u*):

- (15) Leo potrebbe pagare il conto, domani sera (visto che ha appena ricevuto lo stipendio).  
 [Leo may [condit., pres. = might] pay the bill (since he has just received his salary) tomorrow night.]
- (16) Ma non lo farà (conosco la sua avarizia...).  
 [But he will not pay. (I know his stinginess...)]

The most natural interpretation of (15), in this context, involves a “root” modal, not an epistemic one. Because of the present tense of the modal, what I mean is that, at the utterance time, there are aspects of reality, i. e. facts, which, in principle, make the event of Leo’s paying the bill possible. The point is that making a prediction on *contingent* issues (as in (16)), a prediction based for instance on personal convictions, is perfectly compatible with the awareness that *alternative* courses of events (with respect to that prediction) cannot be ruled out, as stated in (15). This is why the latter sentence is perfectly consistent with the former.

Crucially, the plurality of courses of events which is relevant to evaluating (15) at the utterance time *u* has to do with the state of the world, *not* with the state of my beliefs. What is not ruled out by considering some relevant facts (as stated by (15)), may be ruled out by considering these facts *plus* further assumptions (as stated by (16)). This is why the sequence at issue does not sound odd.

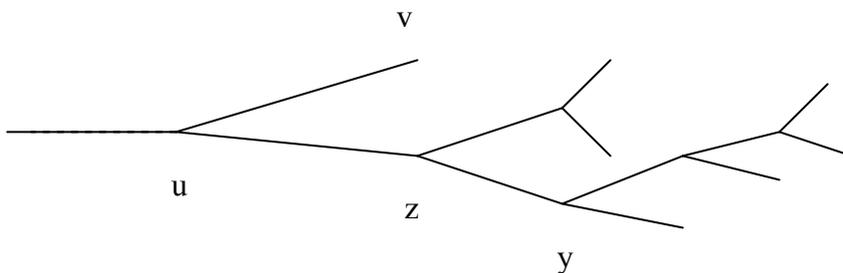
But take these other statements (uttered at *u*):

- (17) Leo potrebbe avere pagato il conto, ieri sera.  
 [Leo may [condit., pres. = might] have paid the bill yesterday night.]
- (18) Ma non lo ha fatto.  
 [But he did not pay.]

Why does this sequence sound odd? Once again, the evaluation time is the utterance time *u*. Thus, as before, I am speaking of the possibilities available at *u* (in a more technical jargon: this means that we should consider the alternative courses of events accessible from *u*). Were the past the mirror image of the future, I might reason as follows. In the case of (15) the set of possible courses of events relevant to evaluating the modal operator includes not only the course of events that *will* become actualized, but also those that *will not* become actualized. Similarly, in the case of (17) the set of possible courses of events relevant to evaluating the modal operator should include not only the course of events that *has been* actualized, but also those that *have not been* actualized, as suggested by the symmetry hypothesis. Thus, the sequence (17) – (18) should be perfectly acceptable. But it is not, against such a hypothesis.

A possible explanation is the following. The basic assumption of branching-time is that the past, unlike the future, is associated to a single course of events. So, consider the following scenario: the dinner ends at *u*; at *v*, when asked, Leo pays the bill; at *z*, when asked, he does not pay the bill. Suppose, also, that the event of uttering (17) is located at *y*. So, because of the present tense of the modal, *y* is the relevant evaluation time. Since there is a *single* path stemming from *y* towards the past (i. e., *there is no branching towards the past*), and since *v* (a possible but not actualized moment in the future of *u*) is *not* on this path, *v* is not “accessible” from *y*: *it is no longer an open option* at *y*. This is why the modal occurring in (17) is not a root modal and the *only* possible reading is the epistemic one: whether Leo paid the bill or not is a settled issue at *y*, but I am unable to say if he did. Unfortunately, this epistemic reading of the modal in (17) is not compatible with (18), because to treat the possibility that Leo paid the bill as a live option (relative to the information available to me) and, at the same time, to assert (sincerely) that he did not pay is definitely inconsistent: hence the oddity of the sequence (17)-(18).

Fig. 3



Interestingly enough, if in (17) the present tense of the modal verb is replaced by the past tense the resulting combination is perfectly acceptable:

- (19) Leo avrebbe potuto pagare il conto, ieri sera.  
 [Leo may [condit., past = might] have paid the bill yesterday night.]  
 (20) Ma non lo ha fatto.  
 [But he did not pay.]

In this case, thanks to the *time shift* determined by the past tense of the modal verb, the evaluation time does not coincide with the utterance time *y* any longer; it coincides with a time earlier than *y*, namely *u*, and at that time it *was* still possible that Leo should pay the bill, even if such a possibility has not been actualized in the end. More exactly, *v*, as a live option, is “accessible” from *u*, the relevant evaluation time, so that the modal in (19) can be interpreted as a root modal and the oddity disappears.

The dissymmetry we have just discussed, concerning the behaviour in the presence of modal concepts, is a very general phenomenon which involves not only tenses, but also adverb phrases. For example, consider the opposition between 'after' and 'before'. To use a metaphor, the intuition is that 'after' looks *backward*, in the sense that, if *u* is the moment at which the event described in the main clause occurs, the event described in the after-clause must be located in the *past* of *u*. On the contrary, 'before' looks *forward*: if *u* is the moment at which the event described in the main clause occurs, the event described in the before-clause must be located in the *future* of *u*. Once more, this difference in the temporal orientation provides an explanation for an interesting phenomenon involving modals.

Consider the following statements:

(21) The demonstrators withdrew before a possible fight with the police. According to the instructions, the cops were to intervene at four o'clock.

? (22) The demonstrators withdrew after a possible fight with the police. According to the instructions, the cops were to intervene at four o'clock.

The natural reading of (21) locates the end of the demonstration before a possible, *although unactualized*, event (the fight with the police), that is before four o'clock. But the corresponding reading is not available with (22), which sounds very odd. Why? Under the symmetry hypothesis, according to which the future is simply the mirror image of the past, the contrast at issue sounds mysterious, whilst it is easily explained under the opposite hypothesis: since 'before' "looks towards the future" a set of alternative courses of events is available (at the evaluation time), whilst in the case of 'after', which "looks towards the past", only one course of events is available (the actual one). Thus, a reading based on possible but unactualized courses of events is allowed in the former case but not in the latter.

## 5. Actualism.

In the last section we saw some arguments which make the dissymmetry hypothesis, and branching time structures, plausible not only for philosophical reasons (in connection with indeterminism), but also for *linguistic* reasons (in connection with the use of modal expressions). Yet, this hypothesis is questioned by actualism, whose basic assumption is the following: even if we assume that there are many *possible* futures, *only one* of them is relevant to evaluating the truth of a future-tensed statement; it is "our" future or, as we might also say, the "actual" future. David Lewis argued for this assumption, for instance, in the following passage: 'The trouble with branching exactly is that it conflicts with our ordinary presupposition that we have a single future. If two futures are equally mine, one with a sea fight tomorrow and one without, it is nonsense to wonder which way it will be – it will be both ways – and yet I do wonder. [...] Our future is the one that is part of the same world as ourselves.' (Lewis, 1986: 207-208.)

If this point of view is adopted, the truth conditions in (2), repeated here,

(2)  $[\mathbf{F}\phi]^{M,w,t,c} = 1$  iff there is a time  $s$  such that  $s > t$  and  $[\phi]^{M,w,s,c} = 1$

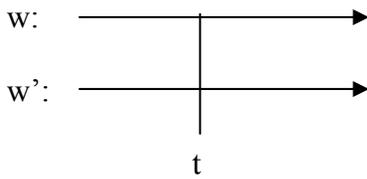
are perfectly adequate. In fact, suppose that ' $\mathbf{F}\phi$ ' is a "simple" sentence like 'Lea will leave' which does not involve any shifting of the evaluation world. In such cases the evaluation world coincides with *the* utterance world, whose identification is assumed to be unproblematic in Lewis' theoretical framework.

As a matter of fact, such a framework is often (implicitly) associated to the following assumption:

(P1) any world  $w$  in  $W$  is *temporally complete*, in the sense that, for any time  $t$ , in  $w$  it is specified what happens at  $t$ , before  $t$  and after  $t$ .

For example, if we consider an utterance-event  $e$  occurring at time  $t$ , we can refer to a very simple schema where two worlds  $w$  and  $w'$  are represented as parallel, *complete* courses of events:  $w$  and  $w'$  coincide up to and including  $t$ , in the sense that, for any proposition  $p$  and any time  $t'$  such that  $t \geq t'$ ,  $p$  is true in  $w$  at  $t'$  if and only if  $p$  is true in  $w'$  at  $t'$

Fig. 4



At this point a preliminary question must be addressed: what about  $e$ ? Shall we assume that it belongs to *both* worlds or shall we rule out this possibility because for any individual  $x$  (where  $x$  is an event, a person, a river, etc.) there is exactly one world  $w$  such that  $x$  belongs to  $w$ ?

Lewis' answer (on which the above quotation is based) is that there is only one course of events in which  $e$  belongs (let us say that, in our example, it is  $w$ ). Thus, a second presupposition must be taken into account:

(P2) Among the courses of events considered there is exactly one where *we* are located and where *our* utterances are located<sup>11</sup>. This is *the actual world*.

If (P2) is accepted, what Lewis calls *our* future can be identified as the future of *this* world, i. e. the actual world mentioned in (P2). In the example under discussion, it is the segment of  $w$  following  $t$ . Notice that, once the uniqueness postulate (P2) has been accepted (so that, for any utterance  $u$ , there is only one world  $w$  such that  $u$  belongs to  $w$ ), it is possible to make a further assumption:

(P3) 'Actually' is an *indexical* expression that involves a reference to *the* world of the utterance.

This means that the course of events such an operator refers to is the one selected by the *context* of the utterance (exactly as the reference of indexical expressions like 'I' or 'now' is selected by that context). Thus, if a formal language, like Kaplan's, is provided with the actuality operator 'A', its semantics can be specified as follows (here  $c(w)$  is the world of the utterance context  $c$ ):

(A)  $[\mathbf{A}(\phi)]^{w,t,c} = 1$  iff  $[\phi]^{c(w),t,c} = 1$ .

Interestingly, adopting this kind of operator allows us to express an interpretation of the future tense that was discussed in connection with the plain temporal future, and with Lewis' quotation. The idea is that, on this interpretation, a future-tensed statement of the type 'It will be the case that  $\phi$ ' should be read as 'It will *actually* be the case that  $\phi$ '. In other words, since a single (complete) course of events is available as the *the world of the utterance* (the actual world), the purely temporal interpretation of the future tense is accounted for by the reference to this world.

To sum up, if an utterance-event  $e$  occurring at time  $t$  is *uniquely* located in some particular course of events  $w$  and  $w$  is a *complete* world (with a given past and a given future), it is possible to refer to a segment of this world as *the* future (of a given time  $t$ ). And only *this* world (where the utterance at issue takes place) and *its* future are relevant for evaluating at  $t$  a future-tensed statement. As we have just seen, this world might even be referred to by *indexical* terms like 'the actual world' and its future by definite descriptions like 'the actual future'. And since '*our* future' is just a segment of the actual world, an utterance (in  $w$ , at  $t$ ) of a sentence like ' $\mathbf{F}\phi$ ' might be interpreted as 'It will *actually*

<sup>11</sup> Lewis assumes that only one world is selected by our own location among the worlds: 'If we take an a priori point of view and ignore our own location among the worlds, the big difference between the actual world and other worlds should vanish. That is not because we regard all worlds as equally actual but rather because if we ignore our own location among worlds we cannot use indexical terms like "actual".' (Lewis, 1983: 20.)

be the case that  $\phi$ , and in this case there is no need to refer to a plurality of worlds (unless some explicit modal operator is present, of course).

## 6. Which course of events?

At this point, the crucial questions to be addressed are the following: is such an analysis of the future tense empirically justified? Should the theoretical principles on which it is based, namely assumptions (P1)-(P3), be taken for granted?

As for the former issue, in the first part of these notes (when discussing the condition of forward factivity) I have already remarked that referring to a single course of events might be insufficient even to account for simple “disjunctive” statements like those occurring in the multiple-choice paradox. Moreover, the examples in (3)-(7) show that in a number of circumstances of use the modal content of the future tense is not compatible with the “actualist” approach described above. So, the obvious conclusion is that this approach is unable to account for the *full* range of readings illustrated by those examples.

Let us turn to the second problem, concerning principles (P1)-(P3).

First of all it should be noticed that a consequence of these principles is that, for any time  $t$ , we can refer to the single, actual future of  $t$  as something *specified by the context* of the utterance (as, for instance, the speaker, the time, the place of the utterance), i. e. as something denoted by expressions like ‘the future of *this* world’ or ‘the future of the *actual* world’, and so on. Is this plausible?

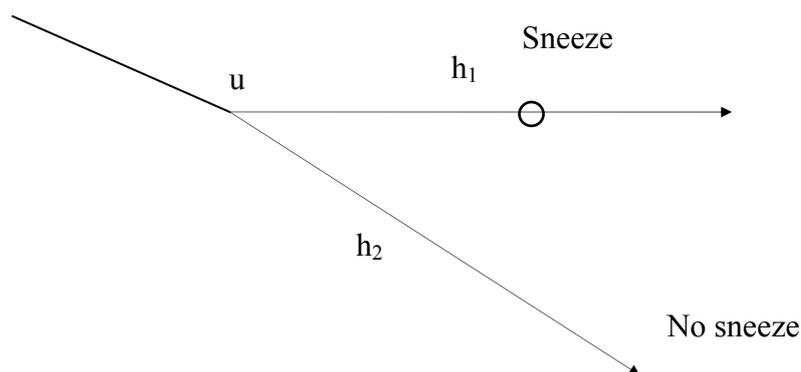
I am not sure that it is. To justify this doubt, I will begin by discussing a consequence of (P1) and (P2), i. e. the claim that there is only one *complete* course of events where we are located and where our utterances are located.

Take fig. 4, where  $u$  is the moment at which the utterance-event  $e$  takes place.

As any utterance-event,  $e$  can be *uniquely* associated to a speaker, a time, a place (to some extent), etc. This is why we can say that all these are *contextual* features with respect to the given utterance. Thus, the question is: is it equally plausible to say the same thing in the case of the “world” of the utterance, i. e. to say that it is a feature of the context as the speaker or the utterance time?

To answer this question, consider a different way of picturing the situation:

Fig. 5



Suppose that, at 15.45 P. M., in the living room of his apartment, Leo says ‘I feel hot here’ and that  $e$  is the utterance-event at issue. The contextual information is sufficient to specify a number of relevant features: for example, the speaker (Leo), the time (15.45 P. M.) and the place (the living room) of the utterance. Suppose, also, that  $u$  is the moment (the state of the world) at which  $e$  takes place and that  $h_1$  and  $h_2$  are two complete courses of events: they coincide before and after  $u$ , until, at some point in  $h_1$ , but not in  $h_2$ , an event of Leo’s sneezing takes place. Question: under the assumption that, in general, the context of the utterance selects a complete course of events as *the*

world of the utterance, which of the courses of events at issue will be selected in this particular case? Is there any reason to say, for instance, that  $h_1$  is the relevant world?

Lewis' answer to such a question is simple: in virtue of principle (P2), there is only one world in which the utterance-event  $e$  is located. And that is the end of the story. From this standpoint, asking whether  $h_1$  or  $h_2$  is the world of the context (i. e. the course of events denoted by indexical expressions like 'the actual world') is a silly question: it is as if we should ask whether Leo or Lea is the agent of the context (i. e. the person denoted by the indexical term 'I'). To be sure, it is perfectly possible that we do not *know* which of these worlds is the one where  $e$  is to be located, *even if* there is such a world. But this is no surprise: the same happens in the case of the speaker, because it is perfectly possible that we do not know who uttered the sentence 'I feel hot here' (for example if this sentence is written on a sheet of paper by an anonymous guest) even if *there is* a particular person who uttered it, and it is this person that the indexical expression 'I' denotes. As we have just seen, this kind of answer is based on a close parallelism between two different features of the context like the world and the speaker (or the place, the time, etc.) of the utterance. But is such a parallelism justified? Let us see.

Leo is the person who uttered 'I feel hot here'. Had a different person (say Lea) uttered that sentence, we would have a *different* utterance. The identity of the speaker is something *inherent* to the utterance: it is fixed once and for all once the utterance-event has taken place. One may ignore the identity of the speaker, *but this is possible only if one has no direct access to the utterance-event* (if, for example, one reads the sentence 'I feel hot here' on a sheet of paper without being provided with the relevant information).

Now consider the situation described in Fig. 5. I can be *part* of the utterance-event  $e$  (if, for instance, Leo is talking to me), so I have direct access to  $e$ , and still I am *in principle* unable to say whether  $e$  is to be included in  $h_1$  or  $h_2$ . In view of this indeterminacy, I have no difficulty in saying that  $e$  *might* be part of  $h_1$ , or that it might be part of  $h_2$  as well, whilst it would make no sense to say that the speaker might be Leo, or that it might be Lea as well. More exactly, such claims about the speaker would make sense *only* if the intended interpretation is the epistemic one (e. g. if I have no direct access to the utterance event), whilst the parallel claims about the world do not have such a limitation: the utterance-event  $e$  is compatible with the fact that Leo sneezes, and it is also compatible with the fact that Leo does not sneeze, which means that  $h_1$  and  $h_2$  can be seen as *alternative* worlds where  $e$  might be located. *And this is so even though I have direct access to the utterance event.* But  $e$  is not compatible with the existence of alternative speakers.

If one accepts (as indeterminists do) the idea that the future is open and that, as a consequence, an utterance-event  $e$  can be located in different worlds, one must admit that a context as such is unable to select a particular course of events as *the* future of the utterance event (whilst it is perfectly able to select a particular person as *the* agent of that event). In other words, the least one can say is that the belonging of an utterance-event  $e$  to a complete course of events, including a future segment, is something *underdetermined* in terms of the familiar contextual attributions.

Interestingly enough, Lewis rejects branching structures like the one pictured in Fig. 5 for the same reason why this kind of representation is the favourite one from the point of view of indeterminism: in both cases, the idea is that branching is not compatible with the existence of something like '*the* (actual) future', '*our* future', and so on.

Indeed, indeterminism is crucially based on the idea that, for any state of the world  $u$ , it does not make sense to use an expression like '*the* future of  $u$ ' to denote a particular course of events in a branching-time picture such as Fig. 5. The fact that an utterance-event  $e$  is located at  $u$  does not entail that there is a particular branch stemming from  $u$  where  $e$  can be located, because  $e$  belongs to *all* these branches. There is no complete history that can be designated by indexical expressions like '*the* actual history (world)', '*the* world to which  $e$  belongs' and so on.

Objection: in our everyday language we happen to use definite descriptions such as ‘our world’, ‘the actual world’, ‘the real world’, and so on. (The same with the future.) Does your “antactualist”<sup>12</sup> analysis entail that such idioms should be ignored as totally misleading?

No, on the contrary they raise interesting problems that will be addressed in the next section.

For example, one might argue that the property of being actual is satisfied by a single course of events as far as the past and the present are concerned (that is, up to and including a given time *t*).

As for the future, lots of possible developments (with respect to *t*) should be taken into account.

Thus, one might say that, strictly speaking, indexical expressions such as ‘the actual world’ denote only a limited segment of a (complete) world: the segment including past and present events. Or one might say that, like in the case of idioms such as ‘*the world of Madame Bovary*’, the definite description ‘the actual world’ does not refer to a single course of events but to a set of courses of events that, intuitively speaking, coincide in the past and in the present but not in future. As we shall see in a moment, in this case the property of being actual must be relativized to time.

Let me conclude this short digression with a simple remark about the nature of the discussion<sup>13</sup>. Not surprisingly, some semantical considerations on the behaviour of the future tense in a natural language like Italian has induced us to address philosophical problems concerning the consequences that different ways of representing the temporal phenomena can have. And if the analysis developed here is correct, the moral we can draw from the data discussed at the outset is that the modal component of the future tense, which rests on the *relevance* of alternative courses of events, is hardly compatible with a model in which one single course of events is made relevant.

## 7. If actuality depends on time ...

So, there seems to be a tension between the following points.

(i) On the one hand, the above discussion has shown that the location of an utterance-event *e* in a complete “history” or course of events, including a future segment, is something *underdetermined* with respect to the available contextual information. Terms like ‘the actual future’ or sentences like ‘It will actually be the case that  $\varphi$ ’, as indexical expressions, seem to refer to a kind of information that the context is unable to give.

(ii) On the other hand, we cannot forget that *indexical* predicates or operators like ‘actual’ and its cognates are not dispensable. (In Lewis (1983) some examples are discussed which seem to entail the presence of a hidden operator of this kind.) We cannot get rid of an expression like ‘the actual future’, or ‘It will actually be the case that  $\varphi$ ’, as a simple nonsense.

How to eliminate the apparent tension between (i) and (ii)? (For a different, but related issue, see the “assertion problem” in Belnap, Perloff and Xu, 2001: 156-160 and MacFarlane, 2003<sup>14</sup>.)

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<sup>12</sup> The logical implications of the debate between Actualists and Antactualists are discussed in Burgess (1980).

<sup>13</sup> See Belnap, Perloff and Xu (2001: 205-209) for an extended discussion.

<sup>14</sup> For reasons of space, I will not discuss the elegant solutions to this problems proposed by Belnap et al. and MacFarlane. Just one short remark.

The approach proposed in *Facing the Future* is essentially based on “double time reference”: ‘The content of “*Will*: (the coin lands heads)” is the sort of thing that can be borne out or not, depending upon what comes to pass ... Time will tell whether we arrive at a moment at which the truth value (at the moment of assertion of “*Will*: (the coin will land)” becomes settled.’ (Belnap, Perloff and Xu, 2001: 175.)

MacFarlane (2003: 330) resorts to a more elaborated notion of context, to the effect that a context consists of (inter alia) a moment of utterance *and* a moment of assessment: ‘We are going to need sentence-truth to be doubly relativized, to a *context of utterance* and a *context of assessment*. That is, we need the postsemantics to define *truth at a context of utterance and context of assessment*, instead of merely *truth at a context of utterance*.’

As we shall see, on my proposal, a *simple*, but dynamic, notion of context is preserved, so that a standard two dimensional semantics is adopted. The idea is that an utterance can be associated to *different* worlds (and, as a consequence, to different contexts), depending on the time flow. This choice is motivated by the Principle of persistence. Instead of considering two worlds as relevant (the utterance world, which is fixed, and the assessment world), I consider a single world as relevant: the utterance world. But this world is not the same at different times.

The problem, here, does *not* concern only the fact that, given an utterance moment *u*, there is no way of selecting any *single* (complete) course of events in the tree (with a future segment stemming from *u*), as *the* actual world (with respect to the utterance at issue). Indeed, as suggested above, we will conceive of the actual world, at time *u*, as a particular subtree (i. e. a *plurality* of courses of events) with a single past and many possible futures (exactly as we speak of “the world” of *Madame Bovary* although we associate the novel to a plurality of possible situations). In this sense, at any moment *u*, the description “the actual world” would denote a particular subtree branching after *u* but linearly ordered up to *u*, so that it would denote *different* subtrees at *different* instants, as illustrated in fig. 6-7, where the hatched line stands for the segment that has *already* been actualized<sup>15</sup>. The idea is that the domain of actual events at *z* is an extension of the domain of actual events at *u*:

Fig. 6

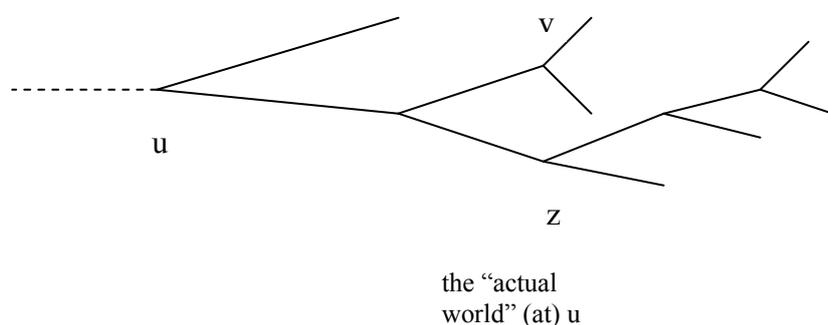
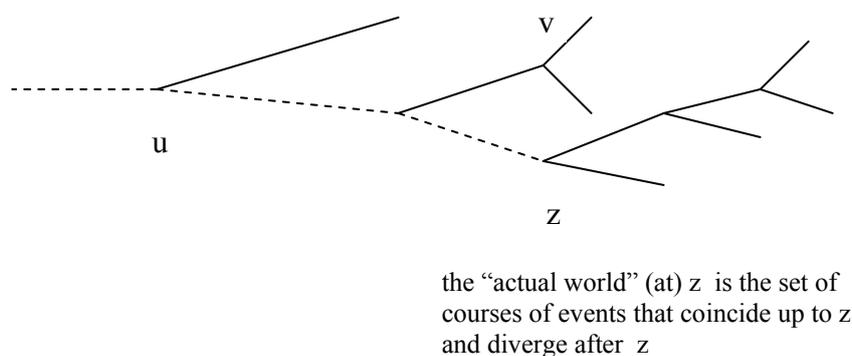


Fig. 7



A reasonable proposal, at this point, is to adopt this pluralistic notion of actual world, so that the expression ‘the actual world’ denotes a particular *cluster of courses of events*, where different clusters are associated to different moments. We can even identify a moment *u* with a world in *this*

<sup>15</sup> In fig. 6-7, being actual means lying on the hatched line. See McCall (1976: 342) for a similar idea: ‘We thus have not one but many universe-pictures, each one being a complete state-description of the universe at a time. Every picture has the form of a tree [...] the trunk containing all past and present events (relative to the time in question), and the branches representing all physically possible course of future events. [...] All branches are equally real, and nothing indicates which branch will eventually form part of the trunk in a later universe-picture. The universe (at each time) is the whole tree; trunk and branches together.’ According to this type of representation, being actual means being in the trunk.

sense, according to which the world  $u$  is simply the set of courses of events to which  $u$  belongs. (Needless to say, at this point the terms ‘world’ and ‘course of events’ – ‘coe’ from now on – have clearly distinct denotations from a technical point of view: a world, in the sense I have just clarified, can coincide with a moment  $u$  seen as the set of coes passing through  $u$ .)

A last remark, on this issue, is the following.

On this proposal, moments or world-states in  $U$  have a *double* role to play, according to whether we consider the tree on which they are arranged (i) on the vertical axis or (ii) on the horizontal axis.

(i) A moment  $u$  can be seen as a *world*, i. e. a point (which is alternative to other points) in a *logical* space. (For example, in Fig. 6  $v$  and  $z$  are alternative outcomes of the node that precedes them.)

From this point of view,  $u$  can be uniquely associated to a *plurality* of coes: the coes that coincide up to  $u$  and diverge starting from that point (recall the parallel with “the world” of a novel, which is often identified with the set of situations compatible with the content of the novel).

(ii) But, of course, a moment  $u$  is also associated to *temporal* information and can be seen as a particular time, because it is “earlier than”, for instance,  $z$ .

To sum up, the idea is simple: ignoring other relevant features, a context consists of a pair of moments  $\langle u, v \rangle$ , where  $u$  and  $v$  play distinct roles, because they are associated to the utterance time and to the utterance world (in the intended sense), respectively. (An interesting illustration of this point is the pair  $\langle u, u \rangle$ , where the same moment plays these two roles.)

To grasp the intuition underlying such an approach, suppose that a sentence  $\phi$  is uttered at moment  $u$ . Thus, the utterance time is fixed once and for all: it is  $u$  itself. But what about “the world” of the utterance? Surely, at the moment  $u$ ,  $u$  itself can be considered as a world (in the pluralistic sense defined above) in which the utterance event can be located, i. e. as the “actual” world, or the world of the context. Yet, as time goes by, *other* worlds become available: for example world  $z$  (or, alternatively, world  $v$ ), because the utterance event at issue belongs to *this* world, too. An obvious *principle of persistence* can be stated in this connection:

(PP) For any event  $e$  and for any moments  $u$  and  $v$ : if  $e$  belongs to  $u$  and  $u \leq v$ , then  $e$  belongs to  $v$ .

Thus, whilst the utterance time remains fixed, different worlds (e. g.  $u$  itself, or  $v$ , or  $z$ , and so on) can in turn be considered as the “actual” world, as “the world of the utterance”. Crucially, since principle (PP) guarantees that the utterance event (with the agent, the place, etc. of that event) belongs not only to  $u$ , but to any  $v$  such that  $u \leq v$ , referring to a standard definition of *proper* context (such as the one in Kaplan, 1977: 509) is sufficient to show the following *Conservativity Principle* (CP):

Let a *proper* context for an utterance event  $e$  be a quadruple  $\langle u, x, p, t \rangle$  such that  $e$  belongs to world  $u$  (the world of  $e$ ),  $x$  (the speaker of  $e$ ) is located at  $p$  (the place of  $e$ ) at the time  $t$  (the time of  $e$ ). (See Kaplan 1977: 509). For any context  $c$ , let  $c(w)$  the world of  $c$ . With these definitions, it is immediate to see that (PP) entails (CP):

(CP) If  $e$  is an utterance event and  $c$  is a proper context for  $e$ , then  $c'$  is a proper context for  $e$ , too, where  $c = c'$  except that  $c(w) \leq c'(w)$ .

That is, if in a proper context for an utterance event  $e$  the world of the context  $c(w)$  is replaced by a “development” of  $c(w)$ , what we obtain is still a proper context for  $e$ . This fact will play an important role in the analysis which will be developed in the next sections and which is based on the idea that *the context underdetermines the relevant world*, or, to put it in another way, on the idea that, due to this indeterminacy, *a family of contexts should be associated to the utterance at issue*, depending on which world is made relevant by the time flow.

Fig. 7 can be helpful to illustrate this point. For the sake of simplicity, as specified above let us consider contexts as ordered pairs of type  $\langle u, v \rangle$ , where  $u$  plays the role of the utterance time and  $v$

the role of the utterance world, respectively (do not forget that, in such an analysis, the same kind of entity can play two distinct roles). So, suppose that a sentence *S* is uttered at *u*, which means that one feature of the context is fixed once and for all: it is *u* itself. But *u* is also available to fix the second feature of the context: as a consequence, a first available context is represented by the pair  $\langle u, u \rangle$ . Yet, in the light of principle (CP), *other* available contexts become available as time goes by, for instance  $\langle u, z \rangle$ , and so on.

To sum up, let us survey the main features characterizing the present approach.

- (i) The parameters composing a context are the *usual* ones (utterance time and world time, in the simplified framework used here).
- (ii) As imposed by the adoption of branching structures, a world is represented not by a single *coe*, but by a moment *u*, *seen as a cluster of coes* (i. e. the *coes* passing through *u*).
- (iii) The utterance time is uniquely fixed.
- (iv) The utterance world is *not* uniquely fixed.
- (v) Because of (iv), an utterance is associated not to a single context, but to a plurality of available contexts. More exactly, for any utterance *e* and moment *u* such that *u* is the utterance time, the class of *available contexts* for *e* is the set of pairs  $\langle u, v \rangle$  such that  $u \leq v$ .

So, such an approach diverges from the traditional view because of (ii) and, perhaps, (iv), but it agrees with this view in keeping the notion of context unmodified, as specified in (i). On the other hand, it diverges from the so-called relativistic approach because of (i) and (iv). Indeed, (iv) is a crucial characteristic of the proposal under discussion: the idea is that, even adopting a “pluralistic” notion of “world” (as stated in (ii)), different worlds can be associated to the same utterance event.

## 8. Taking turns (closed and open parameters).

What I suggested, in the informal remarks made above, is that the usual characterization of the actual world as the world of the utterance can be endorsed in the theoretical framework adopted here. But there is a significant peculiarity in this case, consisting in the fact that, due to the time flow, different moments can *in turn* play the role of “the world of the utterance”. On the face of it, such a move might sound *ad hoc*, for it is part of the received wisdom to conceive of the elements of classical contexts as fixed once and for all together with the utterance itself: it is in this sense that one speaks of *the* speaker of the utterance (to account for the occurrences of the pronoun ‘I’), of *the* place of the utterance (to account for the occurrences of the pronoun ‘here’), and so on. So, it is quite natural, at this point, to wonder whether there are other cases in which *a feature of the context is deliberately left open*, e. g. situations in which different actors, in turn, can play the role associated to an indexical.

Here is a first example.

Imagine that Leo, the computer engineer of your department, after realizing that a dangerous virus is lurking in the LAN of the Students Room, hangs a poster on a wall in this room, which bears the alert message (23).

(23) (There is a dangerous virus in the LAN of this room.) *Your computer, here, might be attacked.*

There is a sense in which the act of hanging the poster counts as an utterance: by hanging the poster, Leo utters the alert message (14), and ‘hanging the poster’ and ‘uttering the alert message’ are just two different descriptions of the same act. A proper part of this utterance is the utterance of the second sentence of (14), which contains an occurrence of the indexical pronoun ‘your’. Given standard (Kaplanian) assumptions about indexicals, we face the question of what referent is assured for ‘your’ by the context of Leo’s utterance. As soon as we analyze the utterance situation described above, we realize that some of the parameters defining utterance contexts get a definite value at the time of utterance (the agent is fixed as Leo, the place as the Students Room, and so on), but other parameters do not (in particular, the addressee is not fixed once and for all). We say that the former

are “closed” parameters, whilst the latter are “open”. For the second sentence in the poster to say *something true or false* at any time, there must be a person who reads it; and the truth (or falsehood) of the original utterance depends on *who* is the reader (for example, if the reader has a MacBook, which cannot be attacked by viruses, the utterance comes out false, if he has a PC the utterance comes out true, and if he has no computer at all, the utterance comes out neither true nor false).

In such cases, one might say that there are *different* contexts of use in correspondence with different addressees (the other contextual features remaining fixed), i.e. one has a new context *whenever* a person reads the poster. Notice that if a student reads the poster at the exact moment at which Leo hangs it on the wall (the utterance moment), this is not the end of the story: if other students read the poster later, other contexts come into being. To sum up: we would have here a *changing* context of utterance, depending on the *addressee* we are considering, that is a case in which a feature of the context (the addressee) is left open. Our suggestion is that something similar happens in the case of future sentences, where the *changing* context of utterance depends on the *world* in which the utterance can be located.

In general, open parameters can be defined as follows:

### *Open parameters*

Let a context for a given utterance  $e$  be a sequence of parameters as defined above. We will say that  $e$  is associated to an open parameter  $\pi$  if there are contexts  $c$  and  $c'$  such that both  $c$  and  $c'$  are contexts for  $e$ , and  $\pi_c \neq \pi_{c'}$ .

In standard theories of context, only closed parameters are admitted, under the assumption: one utterance, one context. Yet, in the light of the definition above, different contexts can be associated to the same utterance in the presence of an open parameter. In example (13), the open parameter is that for the addressee,<sup>16</sup> while in the examples we have previously discussed the open parameter is the utterance world<sup>17</sup>.

Phenomena of this kind are familiar in the semantic literature.<sup>18</sup> What is new here is the idea that the “open” parameters of contexts may include the world parameter.

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<sup>16</sup> At least if one admits that the act of hanging the poster counts as an utterance. One may not accept this assumption, and object that there is a different utterance (and a difference proposition expressed) for each reader. In this case, the similarity with the examples we discuss in the text would probably vanish. However, we reply to this objection by advocating a theory of utterances according to which these are events defined by three essential features, namely agent, position, and time. This is a theory also advocated by Israel and Perry (1994). According to such a view, neither the addressee nor the world count as essential features of an utterance.

<sup>17</sup> The difference between the case of (13) and the cases of interest for us is that in the former the openness of the relevant parameter (the addressee) induces variability of the semantic value of a sentence constituent (the indexical ‘your’), whilst in the latter the openness of the relevant parameter (the world) does not do that, insofar as there are no sentence constituents that are indexical on that parameter.

<sup>18</sup> See, on this point, the “attributive” reading of indexicals discussed in Nunberg (1993: 22), where the test that is proposed for attributive readings is ‘being able to append the qualification *whoever that may be* or some such to the assertion’. In this connection, one might also say that, on our proposal, the Wait and See interpretation we will characterize in the next section might be associated to the “attributive” reading of the indexical expression ‘the actual world’ (‘the utterance world’): It will be the case that  $\phi \Rightarrow$  It will be the case that  $\phi$  in the actual world, *whatever that may be*.

To account for examples like ‘I am not here now’ (i. e. a recorded message in an answering machine), Predelli (1998) resorts to a distinction between context of utterance and context of interpretation. This is close, of course, to MacFarlane’s distinction between context of utterance and context of assessment mentioned above. In both cases, the notion of truth in context is based on a complex notion of context (context of utterance + context of interpretation/assessment). On our analysis, we have simple but variable contexts.

## 9. Finding one's way in the labyrinth<sup>19</sup> of forking paths.

The future tense, in natural languages, has often been associated with two kinds, or families, of interpretations.

According to the “actualist” point of view, the core meaning of a future-tensed statement is based on the reference to the state of the world that *will be actualized*. Thus, what is crucial, in this theoretical approach, is the temporal content of such statements.

On the other hand, what characterizes “modalism” is the idea, made familiar by the branching time theorists, that the meaning of the future tense is essentially based on the notion of settledness, which involves a plurality of *possible* courses of events.

Historically, thanks to Prior's reconstruction, these theoretical perspectives have been illustrated by referring to ideas foreshadowed, respectively, in the so-called Okhamist tradition and in C. S. Peirce's writings.

On the proposal I intend to discuss, these two interpretations should be accounted for in a *unitary* framework, for actualism and modalism can be seen as two distinct, but *related*, attitudes that speakers can have when dealing with the future. As we have just remarked, the notion of an “actual” future is necessarily underspecified with respect to contextual information (in Kaplan's sense). To overcome this difficulty, we can assume a “wait and see” attitude and focus on the states of the world that, *at different times*, happen to be actualized, as required by the “Okhamist” point of view. Alternatively, we can stick to the *current* state of information in order to verify whether the truth (falsehood) of the statement at issue is *already* settled. And this is the core meaning of the “Peircean” approach.

A little more exactly, we have two (families of) readings:

(i) SSR: *sic stantibus rebus*. The occurrence of the event at issue characterizes all the courses of events compatible with a given state of information: intuitively speaking, this means that with respect to the relevant background of information the occurrence of this event is considered as a necessary outcome, as a settled issue. From this standpoint, a sentence like ‘The train will arrive in Rome at 13.45’] in the example discussed in (10), is roughly equivalent to a modal sentence like ‘The train must arrive in Rome at 13.45’, for it expresses a “necessary” relation between a given background of assumptions (a timetable, in this case) and an expected event, no matter what possible course of events is eventually actualized. In a sense, what is mostly relevant in such statements is the reference to the *present* state of information, as shown by the reinterpretation of the settledness condition discussed above. As I have already suggested, treating this modal content as *basic* in the interpretation of the Italian future tense nicely fits some diachronic considerations, according to which the current flecational morphology evolved from a periphrastic construction of the type *have (to) + infinitive*. (Of course, the idea is that the settledness condition must be associated to the “have” component.)

(ii) W&S: *wait and see*. If the “settledness” condition is not satisfied by the current state of information, then the occurrence of the relevant event will *not* characterize all the courses of events in the corresponding context set. In this case, we have to wait until settledness is reached, i. e. to wait until the moment at which the relevant event takes place (or it cannot take place any longer). Unlike modalism, actualism is based on the idea that ‘what determines the truth of any statement of the form “it will be the case that *p*” is not whether *p* is true in some possible future, or in all, but whether *p* is true in *the actual* future. That is, in the branch that becomes history.’ (McCall, 1979: 489). Thus, if you agree with indeterminism in rejecting the presupposition that there *is* such a

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<sup>19</sup> As is well-known, Borges' short story *The Garden of Forking Paths* is a vivid representation of a “branching” conception of the future (Øhrstrøm and Hasle, 1995). Somewhere, in the story, Borges speaks of a labyrinth, too. To exploit this metaphor, in the present notes I suggest that the path to follow, in the labyrinth, is simply pointed out by the time flow: just wait and see which course of events will be actualized.

branch, a plausible idea is ‘that there is only one way to evaluate the truth or falsehood of a future contingent statement, namely by waiting and seeing.’<sup>20</sup> (Ibid., 490.)

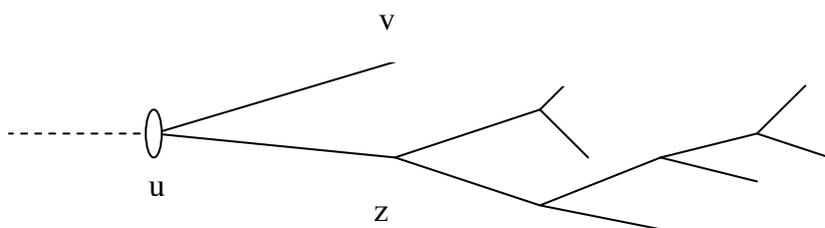
What is crucial, in *both* cases, is the notion of *settledness*, which is relative to a relevant state of information. Thus, in what follows these two readings will be accounted for in a *unitary* framework, which means that a single logical form is involved, whilst the difference between the SSR reading and the W&S reading is just a matter of context. Roughly speaking, the idea is that if a future-tensed sentence  $\phi$  is uttered at  $u$  and its truth (falsehood) is *already* a settled issue at  $u$  *itself*, then the sentence is true (false) at  $u$ ; otherwise the sentence is neither true nor false at  $u$  and, to get a definite truth value, we must wait *until* settledness is reached. In short, and more exactly: being true, on the SSR reading, means being true in a context of type  $\langle u, u \rangle$ ; being true, on the W&S reading, means being true in a context of type  $\langle u, v \rangle$ , where  $u < v$ . In both cases, truth is determined by settledness with respect to the relevant context (a world as a set of coes).

### 10. Sketch of a compositional semantics. [To be developed.]

As we have just seen, a moment or world-state in the tree is associated to two different roles in a context, because it serves to specify the utterance time *and* the utterance world (the “actual” world, in the sense analyzed above), respectively. The idea is that, given an utterance event  $e$  occurring at moment  $u$ , a proper context for this utterance is a pair consisting of  $u$  itself (because the utterance time is determined once and for all) and a second moment  $x$  ( $u \leq x$ ) seen as the world of the utterance, which can change in function of the time flow. As a result, a sequence of contexts is available for the same utterance event.

To brush up a venerable example, suppose that a sentence such as ‘There will be a sea battle 24 hours from now’ is uttered at  $u$ . Suppose, also, that  $v$  and  $z$  are the two moments whose temporal distance from  $u$  is 24 hours, and that a sea battle takes place at  $z$  but not at  $v$ .

Fig. 8



Thus, if a sentence like ‘There will be a sea battle 24 hours from now’ is interpreted, à la Prior, as meaning ‘It is *settled* that there will be a sea battle 24 hours from now’, we get the following schema:

The proposition expressed by an utterance, at moment  $u$ , of ‘There will be a sea battle 24 hours from now’ is:

- (i) neither true nor false at moment  $u$  itself seen as a world (i. e. in the context  $\langle u, u \rangle$ );
- (ii) true at moment  $z$  seen as a world (i. e. in the context  $\langle u, z \rangle$ );

<sup>20</sup> McCall (1979: 489). As desired, ‘this view does not require the existence of an ontologically distinguished future’ and is based on the idea that at time  $t$  a given future-branching model structure would have a certain tree-like form, whilst at time  $t'$  (where  $t < t'$ ) ‘it would have lost some branches and its main stem would be longer’.

(iii) false at moment  $v$  seen as a world (i. e. in the context  $\langle u, v \rangle$ ).

As we saw, the relevant assumption here is that whilst the time parameter is fixed and coincides with  $u$ , the world parameter is variable, so that it can be associated to different worlds at different times, starting from  $u$  itself.

This seems to be a proper way of reconstructing an intuitive idea, discussed at the outset: when dealing with a future-tensed sentence about contingent issues, we are concerned not only with what will possibly happen, but also with what will *actually* happen. Making actuality *relative* to time, i. e. considering the utterance event at issue as *part of different states of the world* (as time goes by), is a reasonable<sup>21</sup> option in a branching framework, in order to preserve indeterminism.

As a consequence, if actuality depends on time, to evaluate the utterance of a sentence we have to start from the state of the world  $u$  in which that utterance event occur and to follow its destiny in a changing world, by checking, at different times, which world *becomes* actual.

Coming to the formal definitions, a model is a structure  $S = \langle U, <, D, I \rangle$  where  $U$  is a set of moments (world-states),  $<$  is a *partial* order on  $U$ ,  $D$  is the domain of individuals and  $I$  is a function from  $\mathbf{P}^n \times U$  to sets of  $n$ -tuples of individuals.

$<$  is such that the structure is right-branching but not left-branching (that is, branching towards the future but not towards the past).

A course of events (coe) is a maximal  $<$ -chain on  $U$ .  $H$  is the set of all coes in  $S$ .

For any  $u \in U$ ,  $H_u$  is the set of coes containing  $u$ .

A “referential” treatment of tense<sup>22</sup> is assumed in what follows, in the sense that the temporal modifiers are associated with time variables, which can be bound by suitable quantifiers or can be free. (In the latter case the value of the variable, which in the simplest situations coincides with the *utterance time*, is determined by the context).

For any context  $c$ ,  $c(w)$  is the world of  $c$  and  $c(t)$  is the time of  $c$ .

As in other two-dimensional approaches, a world can be referred to both as an element of the *context* (to account for indexical expressions) and as an element of an *index* (where an index is a collection of shiftable parameters required to account for the operators of the language). Since a referential approach to tense is presupposed here, there are no temporal operators, so that the set of shiftable parameters in an index will *not* include the time parameter<sup>23</sup>. Thus, for the present purposes an index can be identified with a world in the sense specified above, i. e. a moment  $u$  in  $U$ . To simplify things, in what follows the role of assignments will be ignored.

A simple definition of *truth in a context* will be suggested.

*Step 1: truth of a sentence  $\phi$  in a world  $u$  (given a context  $c$ )*

Here are some examples:

$\llbracket \text{Leo} \rrbracket^{c,u} = \text{Leo}$

$\llbracket I \rrbracket^{c,u} = \text{the speaker of context } c$

$\llbracket \text{now} \rrbracket^{c,u} = \text{the time of context } c \text{ (a moment in } U)$

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<sup>21</sup> Reasonable, because of the principle of persistence stated above: that I was born at some place at a given time was true 24 hours ago, is true now and will be true 24 hours from now. In other terms, the event of my birth is part of the world as it was 24 hours ago, as it is now and as it will be 24 hour from now. Similarly, in the sea battle example, the utterance event at issue, occurring at  $i_u$ , is part not only of  $u$  itself, but also of  $v$  and  $z$ .

As we saw, the principle of persistence guarantees the conservativity of the property of being a proper context (for an utterance event  $e$ ) when the world of the context is replaced by a “development” of it.

<sup>22</sup> Of the type, for instance, specified in Zucchi (forthcoming).

<sup>23</sup> Anyway, the approach I intend to discuss is independent of this choice.

$[\text{leave}]^{c,u}$  = the set of the persons leaving at  $u$

$[\mathbf{P}^n t_1 \dots t_n]^{c,u} = 1$  iff  $\langle [t_1]^{c,u}, \dots, [t_n]^{c,u} \rangle \in [\mathbf{P}^n]^{c,u} = 1$

In addition to the usual rules for connectives and quantifiers, we have a rule for the future tense, considered as a *modal* operator expressing settledness:

$[\mathbf{F}\varphi]^{c,u} = 1$  iff  $c(w) \leq u$  and  $\forall h' \in H_u \exists v \in h'(c(t) < v \wedge [\varphi]^{c,v} = 1)$   
 $[\mathbf{F}\varphi]^{c,u} = 0$  iff  $c(w) \leq u$  and  $\forall h' \in H_u \forall v \in h'(c(t) < v \rightarrow [\varphi]^{c,v} = 0)$   
otherwise  $[\mathbf{F}\varphi]^{c,u}$  is undefined.

*Step 2: truth of a sentence  $\varphi$  in a context  $c$*

$[\varphi]^c = 1$  iff  $[\varphi]^{c,c(w)} = 1$   
 $[\varphi]^c = 0$  iff  $[\varphi]^{c,c(w)} = 0$   
otherwise  $[\varphi]^c$  is undefined.

*Examples*

(i) The sea battle.

It is possible to show what follows (where  $S$  is the sentence ‘There will be a sea battle 24 hours from now’ and the temporal distance between  $u$  and  $v$ , and between  $u$  and  $z$ , is 24 hours):

Take fig. 8. As desired, if  $c = \langle u, u \rangle$ , then  $[S]^c$  is undefined; if  $c = \langle u, v \rangle$ ,  $[S]^c = 0$ ; if  $c = \langle u, z \rangle$ , then  $[S]^c = 1$ . In other terms, the utterance at issue is considered on the background of *different* worlds (utterance worlds), whilst the utterance time remains fixed. Which of two alternative worlds is actualized is determined by the time flow.

(ii) The multiple-choice paradox.

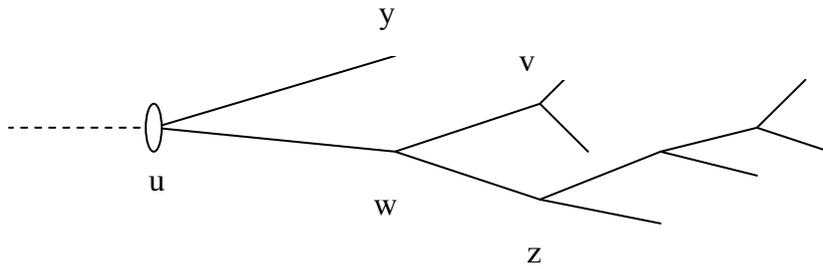
An example from Condoravdi (2002), modified here:

- (24) Leo will meet with the dean or the provost
- (25) Leo will meet with the dean
- (26) Leo will meet with the provost.

The scenario (fig. 9):

- (i) the three sentences above are uttered at moment  $u$ ;
- (ii) in all coes passing through  $y$  Leo meets neither the dean, neither the provost;
- (iii) the decision that Leo will meet with the dean or the provost is made at moment  $w$ ;
- (iv) Leo meets with the dean at moment  $v$ ;
- (v) Leo meets with the provost at moment  $z$ .

Fig. 9



As desired, according to the above truth conditions, we have:

$[(24)]^c$  is undefined, if  $c = \langle u, u \rangle$ ;  $[(24)]^c = 0$ , if  $c = \langle u, y \rangle$ ;  $[(24)]^c = 1$ , if  $c = \langle u, w \rangle$ ; that is, in the sense made explicit by Prior's argument: (24), as uttered at  $u$ , "becomes" true at  $w$ <sup>24</sup>;

$[(25)]^c$  is undefined, if  $c = \langle u, u \rangle$  or  $c = \langle u, w \rangle$ ;  $[(25)]^c = 0$ , if  $c = \langle u, z \rangle$ ;  $[(25)]^c = 1$ , if  $c = \langle u, v \rangle$ : that is, (25) "becomes" true at  $v$ ;

$[(26)]^c$  is undefined, if  $c = \langle u, u \rangle$  or  $c = \langle u, w \rangle$ ;  $[(26)]^c = 0$ , if  $c = \langle u, v \rangle$ ;  $[(26)]^c = 1$ , if  $c = \langle u, z \rangle$ : that is, (26) "becomes" true at  $z$ .

<sup>24</sup> Actually, without other contextual restrictions the decision, at  $w$ , that Leo will meet with the dean or the provost is not sufficient, by itself, to rule out the worlds in which he will meet neither with the provost nor with the dean, as required to evaluate (24) as true at  $w$  itself. (See, on this point, the discussion on Prior's example in sect. 2.) A suitable restriction of the set of relevant worlds is presupposed here: to make it explicit, the simplified notion of context presented in this paper must be replaced by a more complete characterization.

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