Indeterminate actuality and the open future

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Penultimate draft—Please refer to the published version

Abstract: The aim of this paper is to propose a novel supervaluationist theory of 'actually' in the open future. First, I will argue that any adequate theory of actuality in a branching setting must comply with three main *desiderata*. Second, I will prove that none of the actuality operators that have been proposed in the literature is up to the task. Finally, I will propose a novel theory of actuality in the open future combining one of the existing definitions of the actuality operator with a new definition of the historical possibility operator, and argue for its adequacy. The central feature of the theory I will advance is the introduction of an actuality parameter capable of being shifted by the historical possibility operator. I will argue that this account appears to not only be consistent with the idea that the future is genuinely open, but also with the general idea that 'actually' is, in a relevant sense, a 'rigid' operator.

1. Introduction

The branching worlds picture appears to be a highly attractive and intuitive way to model the idea that the future is objectively open, unsettled, or indeterminate. According to this picture, there are many possible worlds, overlapping towards the past and branching towards the future in a tree-like structure. Every moment in the branching tree of

historical possibilities has thus a unique past, but many possible futures, intuitively representing all the ways the future might turn out to be in the Borgesian 'garden of forking paths'. Let us, for simplicity's sake, consider each moment m as a possible context of utterance. Within a standard Kaplanian framework, sentence-truth at a context is defined as follows:

(T0)   A sentence S is true with respect to a context of use c if, and only if, S is true with respect to the point of evaluation $<c,e_c>$

where e_c are the circumstances of evaluation determined by the context of use c against which the proposition that S expresses in c is evaluated. When tense and temporal expressions are parsed as quantifiers and referring terms (as in the supervaluationist theory we shall be concerned with in this paper),[1] circumstances of evaluation can be taken to be simply possible worlds, so that, in a *non*-branching framework, (T0) becomes

(T0*)   A sentence S is true with respect to a context of use c if, and only if, S is true with respect to the point of evaluation $<c,w_c>$

where w_c is the world of the context of use. If the modal space of historical possibilities is branching, however, (T0*) will not do. In such a framework, in fact, there is no such thing as *the* world of the context, each possible context of use c determining at most a set $W(c)$ of worlds overlapping at c. How is, then, the notion of sentence truth at a context to be defined, once the branching worlds picture is assumed?

The supervaluationist theory of truth offers a solution to this problem. Supervaluationist branching-theorists (henceforth: 'supervaluationists') define, in fact, their notion of sentence truth at a context by 'quantifying out' the circumstances-of-evaluation parameter as follows:[2]

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[1] On supervaluationist theories for the open future treating temporal modifiers as referring terms and quantifiers rather than operators see, for instance, MacFarlane (2008).

[2] On supervaluationism and 'quantifying out' see Belnap (2009).

(T1)   *S* is true at *c* if, and only if, *S* is true at <*c,w*>, for every *w* overlapping at *c*;

S is false at *c* if, and only if, *S* is false at <*c,w*>, for every *w* overlapping at *c*;

otherwise, *S* is neither true nor false at *c*.[3]

Given (T1), for every context *c* and sentence *S*, if there are only some worlds *w* overlapping at *c* such that *S* is true with respect to <*c,w*>, then *S* is neither true nor false at *c*, thus taking seriously and accommodating what MacFarlane (2003,2008) has called the 'Indeterminacy intuition', that is the intuition according to which, if the future is genuinely open, then future-contingent statements are neither true nor false, or 'gappy'.

In order to express claims about the branching structure of historical possibility from within the object language, the historical possibility operator 'it is possible at time *t* that' is defined as follows:

($\Diamond$1)   '$\Diamond_t S$' is true at <*c,w*> if, and only if, there is a world *w′* overlapping at *t* with *w* such that *S* is true at <*c,w′*>

Once historical modal operators[4] are introduced, however, the introduction of an *actuality* operator in the object-language appears to be required in order to express statements like:

(1)   All those who are actually rich now could have been poor now

$\exists t(t < t_c \ \& \ \Diamond_t \forall x(\mathbf{A}R(x,t_c) \rightarrow P(x,t_c))$

(where '<' stands for '...is earlier than...' and 't_c' is the time of the context of utterance). Intuitively, in non-branching frameworks the behaviour of the actuality operator is that of always *rigidly* pointing back to the world of the context of utterance, so that, for every possible world *w*, 'It is actually the case that *p*' is true if, and only if, *p* is the case with respect to the world c_w of the context. As John MacFarlane efficaciously put it:

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[3] On the supervaluationist treatment of the open future see, among others, Thomason (1970), and, more recently, MacFarlane (2008).

[4] The historical necessity operator is defined as the dual of $\Diamond_t$:

($\Box$1) $\Box_t S =_{df} {\sim}\Diamond_t{\sim}S$

No matter how deeply embedded we are, no matter how far the world of evaluation has been shifted, the actuality operator returns it to the world of the context of use (MacFarlane, 2008: 98).

This train of thought has lead to defining 'actually' as returning the world of evaluation back to the world of the context of use:

(A0) 'A_0S' is true at $<c,w>$ if, and only if, S is true at $<c,w_c>$[5]

However, (A0) is inapplicable to branching frameworks, since, according to the branching picture, there is no such thing as *the* world of the context of use.

How is, then, the actuality operator to be defined in branching and supervaluationist frameworks? There appear to be at least *three* main definitions of the actuality operator found in the literature that can be added to supervaluationism. In this paper I will argue that, as they stand, all of them are wanting, since they all fall short of three major *desiderata* for any adequate theory of actuality in the open future. In the final part of the paper, however, I will show that one of them can actually comply with all the desired requirements, provided that the historical possibility operator is suitably modified.

The main feature of the theory of actuality in the open future I will be defending is the introduction of an actuality parameter capable of being shifted (within certain limits) by the historical possibility operator. However, as I will argue in the final section of the paper, this theory does not require rejecting the widely held idea that 'actually' is a rigid operator, but only a certain interpretation of the kind of rigidity displayed by 'actually'. As I will claim, in fact, in a 'gappist' open future setting, 'actually' should be thought of as being *indeterminately* rigid, consistently with the idea that the future, and hence, the *actual* future, is objectively open, unsettled, and indeterminate.

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[5] See Kaplan (1989: 545).

2. 'Actually' in the open future: three proposals

There appear to be three main definitions of the actuality operator in the literature that might be added to the supervaluationist theory to accommodate the semantic behaviour of 'actually':

(A1)   'A_1S' is true at $<c,w>$ if, and only if, for all w' overlapping at c, S is true at $<c,w'>$

(A2)   'A_2S' is true at $<c,w>$ if, and only if,:

    (i)   _either:_ w overlaps at c and S is true at $<c,w>$

    (ii)   _or:_ w does not overlap at c and, for all w' overlapping at c, S is true at $<c,w'>$

(A3)   'A_3S' is true at $<c,w,w'>$ (where w is the standard world of evaluation, and w' is the 'actuality parameter') if, and only if, S is true at $<c,w',w'>$

    provided that the notion of sentence-truth at a context is modified as follows:

    (T2) S is true at c if, and only if, S is true at $<c,w,w>$, for every w overlapping at c;

        S is false at c if, and only if, S is false at $<c,w,w>$, for every w overlapping at c;

        otherwise, S is neither true nor false at c.

A_1 is essentially the first of the two operators defined by Belnap et al.(2001), which is also discussed by MacFarlane (2012). According to (A1), the actuality operator behaves as a universal quantifier over the set of worlds overlapping at the context of use. For

every context c and time t, such that t is the time of the context c, $\mathbf{A}_1$ is thus logically equivalent to the historical necessity operator '$\square_t$'.

$\mathbf{A}_2$ is—*mutatis mutandis*—the second operator defined by Belnap et al. (2001) and suggested as a plausible candidate for 'actually' by Dietz and Murzi (forthcoming). When the world of evaluation w is a counterfactual world (that is, a world not overlapping at the context of use), it behaves as $\mathbf{A}_1$. Otherwise, it simply points to w itself.

Finally, $\mathbf{A}_3$ is the operator recently proposed by Loss (2012). In addition to a world of evaluation parameter, (A4) adds an actuality parameter to the points of evaluation, representing the actual world. The actuality operator is thus defined as shifting the world of evaluation to the 'actual' world signalled by the actuality parameter. $\mathbf{A}_3$ requires the definition of sentence-truth to be modified. According to the new definition of sentence-truth at a context, the world of evaluation and the actuality parameter receive the *same* initial value: a world w overlapping at the context of use.

3. *'Actually' in the open future: Three* desiderata

In order to understand whether one of the actuality operators just reviewed can serve the purpose of accommodating actuality-sentences in the open future, it is necessary to understand what the main *desiderata* of any theory of actuality are in a branching and gappist setting. In this section I will argue that any theory of actuality in the open future must comply at least with *three* main *desiderata*, and that none of the operators proposed above are capable, as they stand, to fit the bill. The first two *desiderata* ('Initial Equivalence', 'Live Shiftiness/Dead Rigidity') appear to have already been noticed and defended in the literature. The third one ('Counterfactual Unsettledness'), although clearly closely tied to the first two, seems to have remained unnoticed until now.

3.1. Initial Equivalence

John MacFarlane (2008) has argued that the actuality operator should be intuitively constrained by the principle he calls *Initial Redundancy*

(IR)   An operator ● is *initial redundant* just in case for all sentences *S*, '●*S*' is true at exactly the same contexts of utterance as *S* (equivalently: each is a logical consequence of the other).

which is, in fact, a principle respected by the operator for non-branching settings defined in (A0). He claims:

If 'Actually:' were not initial-redundant, it might sometimes happen that you could truly utter a sentence *S*, but not 'Actually:*S*' (or perhaps vice versa). But that does not seem to be possible. When you can truly say, 'It will be sunny tomorrow', you can truly say, 'It will actually be sunny tomorrow', and when you can truly say, 'It will actually be sunny tomorrow', you can truly say, 'It will be sunny tomorrow'. (MacFarlane, 2008: 98)

It seems indeed highly plausible that any possible account of 'actually' should at least comply with *Initial Redundancy*. However, as argued by Loss (2012) and as suggested by Carpintero (forthcoming), it appears that 'actually' should be constrained by the stronger principle of *Initial Equivalence*, according to which:

(IE)   An operator ● is *initial equivalent* just in case for all sentences *S* and contexts *c*, *S* is true/false/neither-true-nor-false at a context c if, and only if, '●S' is true/false/neither-true-nor-false at *c*.

Consider, in fact, A_1. According to (A1), supposing that the future is now open as to whether it will be sunny tomorrow,

(2)   It will be sunny tomorrow

is *neither true nor false*. However,

(3)   It will actually be sunny tomorrow

is *false*, and, hence

(4)   It is not the case that it will actually be sunny tomorrow

        $\sim \mathbf{A}Sunny(tomorrow)$

is *true*. It follows that, if (A1) were the correct definition of 'actually', we would be allowed to truly say intuitively odd things like

(5)   It is unsettled whether it will be sunny tomorrow, although it is not the case that it actually will be

Initial Equivalence seems thus an intuitively plausible principle constraining the actuality operator in a branching setting. Therefore, $\mathbf{A}_1$ must be rejected.

3.2. Live Shiftiness/Dead Rigidity

Consider the following sentences:

(6)   Yesterday it was still possible that the weather today would be different than it actually would be

(7)   It is still possible that the weather tomorrow will be different than it actually will be.

As noted by Dietz and Murzi (forthcoming), while (6) is intuitively true, under the assumption that yesterday the future was open as to how the weather would be today, (7) strikes as intuitively false: it is *now impossible* that the weather tomorrow will be

different than it actually will be.[6] The falsity of (7) appears to be best explained by saying that in no possible future f such that the weather tomorrow is different than it is <u>in f</u>, while the truth of (6) seems to intuitively depend on the fact that there *was* a live possibility g, differing from the circumstances h that currently obtain, such that the weather in g is different than the weather *in h*. While in a counterfactual situation 'actually' clearly behaves in a branching framework as it behaves in non-branching ones, that is (somehow) returning the world of evaluation to the context of use, when the situation is presently possible (when it is a 'live' possibility), 'actually' appears to be redundant *tout-court*, so to speak, pointing to the very world of evaluation under consideration. In other words, while when live possibilities are concerned, the referent of 'actually' appears to *shift* with the world of evaluation, when counterfactual scenarios are concerned, 'actually' appears instead to *rigidly* point back to the actual context.

I will call this second feature of the actuality operator (according to which it behaves *shiftily* with respect to 'live' possibilities, and *rigidly* with respect to 'dead' ones), *Live Shiftiness/Dead Rigidity.*

The accommodation of *Live Shiftiness/Dead Rigidity* is the second *desideratum* for a theory of actuality in a branching setting. Notice that *Live Shiftiness/Dead Rigidity* entails the validity of the following formula:

(8) $\Box_{now} (p \leftrightarrow \mathbf{A}p)$[7]

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[6] In this framework none of the possible futures is marked as *the* actual future. Given this assumption, the falsehood of (7) appears to intuitively follow. One might argue, however, that if there were a 'thin red line' in the open future (see Belnap and Green, 1994, and Belnap et al. 2001), then (7) would be true since, in that case, there would be a fact of the matter as to which is the actual future, and, being the future open, it would be now-possible for the future to be different than it actually will be. A comparison between these two conceptions of the open future is, however, beyond the scope of this paper.

[7] By the very definition of the historical possibility operator, '$\Box_{now}$' behaves as an universal quantifier over the worlds overlapping at the context of use or, in other words, over all the *live* possibilities, By *Live Shiftiness* we have when the world of evaluation w is a live possibility, then 'actually' refers to w itself. Hence, it is true with respect to every live possibility w that p is the case if, and only if, 'actually, p' is the case. Therefore, 'it is now settled that p if, and only if, actually p' must be valid.

However, it is easy to observe that $\mathbf{A}_1$ and $\mathbf{A}_3$ make (8) invalid. Suppose in fact that p is a future-contingent proposition. In this case, according to (A1) it is true to say today

$$(9) \qquad \Diamond_{\text{now}} (p \mathbin{\&} {\sim}\mathbf{A}_1 p)^8$$

while, according to (A3) it is true today that

$$(10) \qquad \Diamond_{\text{now}}(p \mathbin{\&} {\sim}\mathbf{A}_3 p) \mathbin{v} \Diamond_{\text{now}}({\sim}p \mathbin{\&} \mathbf{A}_3 p)^9$$

Therefore, both $\mathbf{A}_1$ and $\mathbf{A}_3$ must be rejected as plausible candidates for 'actually' in a branching setting.

3.3. Counterfactual Unsettledness

We still have $\mathbf{A}_2$ as a possible candidate for a correct definition of 'actually'. Consider, however, the following scenario:

> PLANE CRASH: A plane transporting all and only the American athletes who will participate in the forthcoming Olympic games has a problem while flying from New York to London. There is a moment (at time T) in which the plane could crash. However, thanks to the pilot, all the persons on board arrive in London safe and sound.

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[8] If p is a future-contingent proposition, then in some, but not all, possible futures p is the case. Therefore, $\mathbf{A}_1$ being an universal quantifier over all possible worlds, '$\mathbf{A}_1 p$' is false, and hence '${\sim}\mathbf{A}_1 p$' is true with respect to every world overlapping at the context of use, and thus also with respect to those worlds in which p is true (which are the worlds making '$\Diamond_t p$' true with respect to the present context).

[9] According to the definition of sentence-truth at a context required by (A3), a sentence S is true with respect to a context c if, and only if, S is true with respect to every point of evaluation $\langle c,w,w\rangle$, where w is a world overlapping at c. On the other hand, $\mathbf{A}_3$ is defined as returning the world of evaluation back to the actuality parameter. Therefore, if w is a p-world, then '$\Diamond_{\text{now}}({\sim}p \mathbin{\&} \mathbf{A}_3 p)$' is true at $\langle c,w,w\rangle$, because—being p a future-contingent proposition—there is a ${\sim}p$-world w' overlapping with w up until the present moment such that '$({\sim}p \mathbin{\&} \mathbf{A}_3 p)$' is true at $\langle c,w',w\rangle$. On the other hand, if w is a ${\sim}p$-world, then '$\Diamond_{\text{now}}(p \mathbin{\&} {\sim}\mathbf{A}_3 p)$' is true at $\langle c,w,w\rangle$, because—being p a future-contingent proposition—there is a p-world w' overlapping with w up until the present moment such that '$({\sim}p \mathbin{\&} \mathbf{A}_3 p)$' is true at $\langle c,w',w\rangle$. Therefore, for every world w overlapping at c, '$\Diamond_{\text{now}}(p \mathbin{\&} {\sim}\mathbf{A}_3 p) \mathbin{v} \Diamond_{\text{now}}({\sim}p \mathbin{\&} \mathbf{A}_3 p)$' is true with respect to $\langle c,w,w\rangle$, and hence, with respect to c.

Suppose that after the plane has arrived in London, someone—perhaps an American, very optimistic about the outcome of the Olympic games—utters:

(11)   All those who will actually win a gold medal could have died together in a plane crash

$\exists t(t<t_c \ \& \ \Diamond_t \forall x \, (\mathbf{A}Wx \rightarrow Dx))$

(where '<' stands for '...is earlier than...' and 't_c' is the time of the context of utterance). How should her utterance be evaluated? We can suppose that in this scenario the future is objectively open as to which country will win which gold medals in the forthcoming Olympic games. Therefore, of no individual i the following is now true

(12) i will actually win a gold medal in the forthcoming Olympic games

$\mathbf{A}Wi$

Nevertheless, supposing that it is now settled that the Olympic games will take place, the following appears to be intuitively true:

(13)   Someone will actually win a gold medal in the forthcoming Olympic games

$\exists x \mathbf{A}Wx$

It appears, therefore, that (11) should be assessed as neither true nor false. On the one hand, the truth-value of (11) depends on whether USA will actually win all the gold medals in the forthcoming Olympics; on the other, it is presently unsettled whether USA will actually win all the gold medals. However, if this train of thought is on the right track, also $\mathbf{A}_2$ must be rejected, since it makes (11) true. As a matter of fact, let c be the present context, and v the counterfactual world in which the plane crash occurs. Since v

does not overlap at c the behaviour of $\mathbf{A}_2$ with respect to the point of evaluation $<c,v>$ is that of universally quantifying over *all* the worlds overlapping at c. However, there is no x such that x will win a gold medal in all possible futures of c (the outcome of the Olympic games is, in fact, still unsettled). Therefore, according to (A2), (11) is (vacuously) *true* at c (since for every individual i the antecedent of the conditional in (11) is false).

The general idea behind PLANE CRASH is the following. In an open future setting it is the very identity of the actual future that appears to be indeterminate (a thought that we have observed to be behind *Initial Equivalence* and *Live Shiftiness*). However, this kind of indeterminacy, if taken seriously, must seep, as it were, also into *counterfactual* scenarios. As a matter of fact, in both branching and non-branching settings, the introduction of an actuality operator in the object-language is called for, among other things, in order to be able to check, so to speak, if there is some counterfactual scenario w in which all the x that are actually F are together G in w. In an open future setting, however, it can be *unsettled* which are the xs that are actually F. Therefore, even if there is a counterfactual world w such that there is some x that is G, since it is unsettled which set of individuals is the set of individuals that are actually F, it follows that it is also unsettled whether w is a scenario in which all the people that are actually F are G. In the plane crash scenario, for instance, v is the possible world in which all the Americans athletes die together in a plane crash. Since it is unsettled whether all the gold medals in the forthcoming Olympic games will be won by American athletes, it follows that it is also unsettled whether v is the counterfactual scenario in which it is true that all those who will actually win a gold medal die together in the plane crash.

The problem with $\mathbf{A}_2$ is, therefore, that, while **actuality**$_2$-sentences can indeed be 'actually unsettled', they are nevertheless *always* 'counterfactually settled'. In fact, according to (A2), when the world of evaluation is a *dead* possibility, then the actuality operator behaves as a universal quantifier over the set $W(c)$ of all the worlds overlapping at the context of use c, rendering thus, matters of actuality with respect to counterfactual

worlds all-or-nothing issues. Therefore, (A2) predicts there to be no kind of *Counterfactual Unsettledness* for what concerns actuality, and must, thus, be rejected.

4. Shiftable actuality

All the operators presented in section 2 must be rejected, as they stand, as not capable of meeting what appear to be the three main *desiderata* for 'actually' in an open future setting. Among them, $\mathbf{A}_3$ has been rejected as not complying with *Live Shiftiness*. However, it is possible to show that its falling short of *Live Shiftiness* is due to an incorrect definition of the historical possibility operator $\Diamond_t$. As a matter of fact, in order to make $\mathbf{A}_3$ comply with all the three *desiderata* reviewed above, it is sufficient to define the operator 'it is possible at *t* that' as capable, within certain limits, of shifting *also* the actuality parameter, as follows ('$W(c)$' is the set of worlds overlapping at *c*, or, in other words, the set of live possibilities with respect to *c*):

(◊2)   '$\Diamond_t S$' is true at $<c,w,v>$ if, and only if, there is a world *u* and a world *z* such that: (i) *u* overlaps with *w* at *t*, (ii) *S* is true at $<c,u,z>$ and (iii)

<u>either</u>:   *u* belongs to $W(c)$ and $z=u$

<u>or</u>:   *u* does not belong to $W(c)$ and $z=v$

From (◊2) and the definition of sentence-truth given in (T2) (requiring the world of evaluation and the actuality parameter to be initialized by the context of use as the same *live* possible world), it follows that the general behaviour of the historical possibility operator is the following:

($\Diamond_t$)   When $\Diamond_t$ shifts the world of evaluation to a *live* possible world *w*, then it

shifts also the actuality parameter to *w*;

when $\Diamond_t$ shifts the world of evaluation to a *counterfactual* possible world *w′*,

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then the actuality parameter is *not* shifted, and keeps its (pre-shift) value of a *live* possible world.

It is easy to prove that, if the historical possibility operator is defined as in ($\Diamond$2), and the notion of sentence truth at a context is defined as in (T2), then $\mathbf{A}_3$ meets all the relevant *desiderata* for 'actually' in a gappist open future setting:

Initial equivalence: Given (A3), Initial Equivalence is guaranteed by the fact that (by T2) the context of use initializes both the world parameter and the actuality parameter, assigning to them the same value. Therefore, we have that:

(i) if '$\mathbf{A}_3 S$' is true(/false) in c, then (by T2) '$\mathbf{A}_3 S$' is true(/false) in every point $<c,w,w>$ such that w is a world overlapping at c; therefore, (by A3) also S is true(/false) in every such point, making thus (by T2) S true in c;

(ii) if S is true(/false) in c, then (by T2) S is true(/false) in every point $<c,w,w>$ such that w is a world overlapping at c; therefore, (by A3) also '$\mathbf{A}_3 S$' is true(/false) in every such point, making thus (by T2) '$\mathbf{A}_3 S$' true in c.

(iii) if '$\mathbf{A}_3 S$' is neither true nor false in c, then, by (T2) it is true only in some worlds overlapping at c. By (A3), it follows that also S is true only in some worlds overlapping at c, and, hence, by (T2), that it is neither true nor false at c.

(iv) if S is neither true nor false in c, then, by (T2) it is true only in some worlds overlapping at c. By (A3), it follows that also '$\mathbf{A}_3 S$' is true only in some worlds overlapping at c, and, hence, by (T2), that it is also neither true nor false at c. QED

Live Shiftiness/Dead Rigidity: By ($\Diamond_t$), we have the following: when $\Diamond_t$ shifts the world of evaluation to a *live* possible world w, then it shifts also the actuality parameter to w; when $\Diamond_t$ shifts the world of evaluation to a *counterfactual* possible world w, then the actuality parameter is not shifted, and retains its (pre-shift) value. However, we have by (T2) that the first value of the actuality parameter (that is, the

value preceding any possible shift effected by the historical possibility operator) is always that of a world overlapping at c. Therefore, whenever the world of evaluation is a live possible world w, the actuality parameter will *also* be w and, therefore, the actuality operator will be redundant *tout-court*, so to speak. If, on the other hand, the world of evaluation is shifted by $\Diamond_t$ to a counterfactual world w', since '$\Diamond_t$' can never shift the actuality parameter to a counterfactual world, and the first value of the actuality parameter is guaranteed by (T2) to be that of a world overlapping at c, the actuality parameter will surely be a world overlapping at the context of use. QED

Counterfactual Unsettledness: ($\Diamond$2), (A3) and (T2) make

(11)   All those who will actually win a gold medal could have died together in a plane crash

$$\exists t(t<t_c \ \& \ \Diamond_t \forall x \,(\mathbf{A}_3 Wx \rightarrow Dx))$$

neither true nor false in c. Let v be the counterfactual world in which the plane crash occurs. For every point of evaluation $<c,w,w>$ such that w is a world overlapping at c, (11) is true with respect to $<c,w,w>$ if, and only if, there is a world w' overlapping with w up to some time t earlier than t_c, such that

(14) $\forall x(\mathbf{A}_4 Wx \rightarrow Dx)$

is true with respect to $<c,w',w>$. Since with respect to every world overlapping at c the set of those who will **actually**$_3$ win a gold medal is non-empty—and so (14) cannot be vacuously true—a necessary condition for (14) to be true in $<c,w',w>$ is that w' be identical to v, that is the world in which the plane crash occurs. However, (14) is true only with respect to those points $<c,v,w>$ such that w—the actuality parameter—is a world in which all gold medals get won by USA athletes. But only in some worlds w overlapping at c USA win all the gold medals. By (A3), (14) is

thus true only in some of the points of evaluation <*c*,*v*,*w*> such that *w* is a world overlapping at *c*, and, therefore, by (◊2), (11) is true only in some of the points of evaluation <*c*,*w*,*w*> such that *w* is a world overlapping at *c*. Therefore, we have—by (T2)—that (11) is neither true nor false in *c*. QED

5. *'Actually' as indeterminately rigid*

The limited shiftability of the actuality parameter dictated by (◊2) appears not only to be perfectly consistent with our intuitions about *Live shiftiness/Dead Rigidity* in a branching framework, but also with the very general nature of actuality in a gappist open future framework. As a matter of fact, while in such a setting it is, in some sense, true to say that there is no such thing as *the* actual world of a context of use *c*, a branching model for the open future appears to be more accurately described by saying that, given that the future is open, unsettled, and indeterminate, then it is *eo ipso* open, unsettled and indeterminate which is the *actual* world, among all the worlds overlapping at the context of use. Therefore, it is, in some relevant sense, also true in the theory presented in this paper that the actuality operator *rigidly* points back to the actual world of the context of use. As a matter of fact, it is true also in this framework that 'no matter how deeply embedded we are, no matter how far the world of evaluation has been shifted, the actuality operator returns it to the world of the context of use' (MacFarlane, 2008: 98). However, since it is unsettled *which* is the actual world, then of no world *w* overlapping at the context of use it is settled that *it* is the actual world, and, hence, there is no world *w* overlapping at the context of use such that 'actually' *always* refers to *w*.

Therefore, both in branching and non-branching framework 'actually' is thus a *rigid* operator, since in both cases it *always* points back to the context of use. However, while in non-branching frameworks, being the identity of the actual world settled and determinate (and, therefore, there being a world *w* such that 'actually' always points back

to it), 'actually' is *determinately rigid*, in a branching and gappist framework, it being indeterminate which is the actual world, 'actually' is *indeterminately rigid*: rigidly pointing back to the context of use, without there being any world *w* such that it is settled and determinate that *it* is *the* actual world of the context.

The theory of actuality I have defended in this paper appears thus not only to meet the three main intuitive *desiderata* of any theory for 'actually' in a non-bivalent open future setting, but also to comply with the kind of rigidity 'actually' is traditionally associated with. What remain to be investigated are the broad philosophical implications that this theory might have in the debate on the open future. However, given the limited aim of this paper, this question must be left for a (possibly actual) future occasion.[10]

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