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## Coming true: a note on truth and actuality

Richard Dietz · Julien Murzi

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**Abstract** John MacFarlane has recently presented a novel argument in support of truth-relativism. According to this, contextualists fail to accommodate retrospective reassessments of propositional contents, when it comes to languages which are rich enough to express *actuality*. The aim of this note is twofold. First, it is to argue that the argument can be effectively rejected, since it rests on an inadequate conception of actuality. Second, it is to offer a more plausible account of actuality in branching time, along the line of David Lewis (Noûs 4:175–88, 1970; Postscripts to ‘Anselm and actuality’, Philosophical papers I, Oxford University Press, Oxford, 1983).

**Keywords** Truth-relativism · Contextualism · Actuality · Future contingents

### 1 Introduction

In his “Truth in the garden of forking paths” (2008), John MacFarlane (MF) presents a novel argument strategy against contextualism and in favour of truth-relativism (if not otherwise specified, page references to MF’s work will henceforth refer to MF (2008)).<sup>1</sup>

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<sup>1</sup> According to MF (pp. 93–94), one may find the argument anticipated—in a nutshell—in some parts of MF (2003). For the sake of clarity, our discussion will focus on his argument in MF (2008).

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*Contextualism* (about certain types of sentences) is the generic view that a sentence type may express different contents, and have different truth-values, in different occasions of use, or ‘utterance contexts’, and that once the utterance context is fixed, there is no room for variation in truth-value left.<sup>2</sup> In other words, contextualism implies that the truth-value of utterances is absolute. *Truth-relativism* (about certain types of sentences), on the other hand, is the generic view that, while still expressing the same content in all utterance contexts, the truth-value of the same sentence-type may vary with assessments, or ‘assessment contexts’.<sup>3</sup>

Arguments for truth-relativism typically draw on the claim that certain linguistic data may be interpreted as instances of faultless disagreement concerning the truth-value of a given utterance.<sup>4</sup> This claim is in many respects controversial. In particular, one may cast doubt on the underlying assumption that ordinary language reports pertain to truth-value assessments of *utterances*. MF’s new argument relies, however, on the seemingly less problematic claim that in ordinary speech, we do sometimes assess the truth-value of the *propositional content* of a given utterance. Specifically, MF contends that the propositional content of utterances may *come true*: whereas a proposition as assessed now may be neither true nor false, it may come true as assessed at a later point of time. He submits that such cases of correct retrospective reassessment cannot be in general accommodated in contextualist terms, if the utterances referred to contain expressions of *actuality*.

The aim of this article is two-fold. First, it is to argue that MF’s argument rests on an inadequate account of actuality, and that if the account is appropriately revised, the argument can be blocked (Sect. 4). Second, it is to offer a more plausible account of actuality in branching time, along the line of Lewis (1970, 1983). On this conception, we suggest, one can effectively rebut MF’s alleged evidence for truth-relativism (Sect. 5). To start with, we give a—somewhat detailed—reconstruction of MF’s argument, and of some general theses that underly the argument (Sects. 2–3).

## 2 MF’s argument from retrospective reassessments

Suppose it is noon and a coin is going to be tossed in five minutes. At noon, it seems in some sense true to say *it is now still unsettled whether the coin is going to land*

<sup>2</sup> The term ‘truth-value’ is used here in a broader sense, not in the strict sense of *semantic values*, which are functions of the semantic values of immediate components and the syntax. Specifically, for supervaluationist frameworks such as the ones discussed by MF, which are a type of modal logics, the modal statuses of ‘necessary truth’ (or ‘determinate truth’), ‘necessary falsity’ (or ‘determinate falsity’), and ‘contingency’ (or ‘lack of determinate truth and lack of determinate falsity’) are treated as ‘truth-values’.

<sup>3</sup> The term ‘truth-relativism’ may be traced back to Egan et al. (2005). Truth-relativism, the view that a sentence’s *truth-value* may vary with the assessment context, should be distinguished from *content relativism*, the view that a sentence’s *content* may vary with the assessment context. For a statement, and defence, of the latter view, see Cappellen (2008).

<sup>4</sup> In cases of the supposed kind, we have a pair of statements  $s_1$  and  $s_2$  where (i)  $s_1$  predicates truth of a given utterance  $u$  while  $s_2$  denies  $u$  to be true, and where (ii) neither  $s_1$  nor  $s_2$  involve any fault on the part of the speaker making the respective statement. This definition, of course, leaves it entirely open whether there are any instances of this kind, and if so, whether we should give a semantic account of faultlessness (as ‘truth’).

*heads*. In other words: *it is now still possible that it is going to land heads, as well as it is still possible that it is going to land tails*. In the same sense, it seems after the toss true to say *it is settled whether at noon that the coin was going to land heads*. In other words, the proposition that, at noon, the coin is going to land heads is unsettled, as assessed at noon, but not so as assessed after the coin has landed. Importantly, since the latter assessment holds independently of what is known, it is suggested that the relevant sense of ‘settledness’ at issue here is not epistemic in kind, but rather metaphysical.

For convenience, let us introduce some terminology and say that any proposition that is unsettled (in the relevant pretheoretical metaphysical sense) as assessed at a moment *c* is a *future contingent (proposition) at c*. Accordingly, any utterance whose semantic content is a future contingent as assessed at the utterance moment is said to be a *future contingent utterance*. Proponents of the *branching-time view* of the open future (henceforth, OF) suggest that future contingency is to be interpreted in a radical metaphysical way. According to this, there is no such thing yet as *the* future history (or ‘course of events’). Rather, the future is only representable by a set of more than one history, each of which is a candidate for eventually turning out to be the future history. Specifically, for every moment, each candidate for being the future history together with the history up to the moment is a *candidate history* at that moment. Up to the present moment, all candidate histories coincide, however with respect to moments lying ahead, they may diverge, or ‘branch out’. As time goes by, the set of alternative candidate histories shrinks down.<sup>5</sup>

Typically, proponents of a branching-time view of the open future endorse a semantic framework that allows for truth-value gaps.<sup>6</sup> The details of the type of contextualist framework discussed (and then adapted in a truth-relativist fashion) by MF will be here only sketched in more general terms. For the full details, the interested reader is referred to the Appendix (see Appendices 1, 2). A particular implication of this approach, which is fundamental to MF’s case for truth-relativism for future contingents right from the start, is the idea that future contingency bears on the semantics of utterances in accordance with the

ARISTOTELIAN VIEW (OF FUTURE CONTINGENTS) (AV): For any moment *c* and sentence *s*, if *s* as uttered at *c* is a future contingent utterance, then *s* as uttered at *c* is neither true (as assessed at *c*) nor false (as assessed at *c*).<sup>7</sup>

<sup>5</sup> We rely here on the pretheoretically given basic notions of a ‘moment’ and a ‘history’—which are to be distinguished from the technical senses in which these terms are defined in the formal semantics, as set out in the [Appendix](#) (see [Appendix 1](#)).

<sup>6</sup> For a survey on this literature, see Øhrstrom and Hasle (2006, Sect. 5).

<sup>7</sup> Two notes are here in order: (i) One may conceive of variants of AV where future contingent utterances are either true or false (as assessed at the utterance moment), but where it is indeterminate (as assessed at the utterance moment) which classical truth-value they have. For a variant of AV in this vein, see Belnap et al. (2001, Sect. 2). MF’s argument as well as our counterargument could be easily reformulated in terms of this variant of AV. For simplicity, we leave the focus here on AV in the introduced sense. (ii) It is rather controversial whether Aristotle himself subscribed to AV. In using the label “Aristotelian View”, we just adopt a common convention.

It ought to be noted that the qualification of utterance truth as being relative to assessment moments (as in AV) itself does not imply truth-relativism. Contextualist approaches also admit of qualifications of utterances as true as assessed at a particular context, though only in the following trivial sense:

TRUTH-ABSOLUTISM (TA): If an utterance  $u$  is true/false (or not true/not false), then for any moment,  $u$  is true/false (or not true/not false) as assessed at that moment.

This brings us to the thesis of MF's argument, which may be factorised into two main claims:

RETROSPECTIVE TRUTH (RT): In ordinary speech, we make sometimes retrospective assessments to the effect that a past utterance  $u$  is true, where  $u$  is a future contingent utterance.

FOLK LINGUISTICS (FL): A semantic theory for a language  $\mathcal{L}$  is accountable to intuitions of competent speakers of  $\mathcal{L}$  regarding the truth-conditions of sentences of  $\mathcal{L}$ .

With AV, RT and FL in place, TA is rejectable, by way of the following (abstract) reasoning:

By RT, there is an utterance made at a moment  $m$  that is (i) future contingent and (ii) truth of which is predicated at some later moment  $m'$  than  $m$ . By (ii) and FL, the said utterance *is* true as assessed  $m'$ . From this and AV, it follows then that there are utterances which are true as assessed at some moment later than the utterance moment but fail to be true as assessed at the utterance moment. Assuming TA, however, the qualifying reference to assessments is idle: if an utterance is true (not true) as assessed at the utterance moment, then so it is (neither is it) as assessed at any other moment. Contradiction.

Or so one may reconstruct the general argument strategy.

MF means to show that any approach that implies TA fails to supply sufficient means of accommodating AV and RT in a way that does justice to FL. OF and AV will be granted here, for the sake of argument. We will return to FL later in Sect. 4.<sup>8</sup> In the next section, we focus on the remaining thesis, RT. Once this thesis is established, assuming FL, there is no escape route left open for a contextualist. So let us have a closer look at MF's motivation for RT.

### 3 MF's sub-argument from actuality to RT

MF distinguishes between two ways of presenting his argument from retrospective assessments by way of two kinds of examples:

<sup>8</sup> That FL is essential for the argument was first observed in Heck (2006).

Yesterday I uttered the sentence “It will be sunny tomorrow.”  
 It is sunny today. (1)  
 So my utterance was true.

and

Yesterday I asserted that it would be sunny today.  
 It is sunny today. (2)  
 So what I asserted was true.

Whereas, in (1), truth is predicated of an utterance, in (2), truth is predicated of a proposition. Now, if some data about ordinary language usage provided clear instances of the form of (1) pertaining to an utterance that is a future contingent as assessed at the utterance moment, there would be a straightforward argument for RT from linguistic evidence. MF takes this very line of argument in MF (2003). In (pp. 93–94), however, he casts doubt on this way of defending truth-relativism, when observing that “people do not apply the predicates ‘true’ and ‘false’ to sentences or utterances, except in areas of philosophical discussion”.<sup>9</sup> Rather, he submits, “in ordinary speech, truth and falsity are almost invariably predicated of propositions”, as in “What he said is true” or “That was a true claim”. In particular, according to MF, there is natural language evidence of the form (2) where the relevant proposition expressed by an utterance may be plausibly regarded as a future contingent assessed at the utterance moment (e.g., recall our above example of the proposition expressed by an utterance of the sentence “It will be sunny tomorrow”).

How to obtain from evidence of this kind an argument for RT? To begin with, we should notice that, for a case in point in favour of truth-relativism, it would not be necessary to show that the contextualist fails to provide means of accommodating *every* plausible case of retrospective correct reassessments of what is said by a past utterance. Rather, *one* case would do, and, according to MF, utterances containing expressions of actuality precisely provide such a case. To explain these—far from straightforward—points, we need to have a closer look at some basic assumptions in play in MF’s argument.

### 3.1 MF’s assumptions

For a start, we need to reconstruct MF’s reasoning to the effect that, if actuality is *not* expressible in the language, contextualists may accommodate retrospective reassessments without being committed to RT-type scenarios (this point will play also a crucial role in his argument for truth-relativism from actuality). The reasoning underlying this concession may be factorised into three assumptions, regarding the notion of ‘what is said’, the semantics of apparent predications of propositional truth, and the notion of utterance truth. Let us consider them in turn.

MF’s approach to the pretheoretical notion of ‘what is said’ by utterances (i.e., their propositional content) takes its guideline from David Kaplan’s account.

<sup>9</sup> For the same point, see Strawson (1950, p. 130).

According to Kaplan, what is said by an utterance of a sentence is explicable as the compositional *semantic value* (in other words, the *semantic content*) of the sentence in the standard technical sense of: entities that determine whether truth (in the language) would be achieved if the respective sentence were uttered in a given context, and which are obtainable from the semantic values of their immediate constituents and the syntax. More specifically, the semantic values in question are thought of as being fixed by sentences and utterances contexts, and as providing information about the dependence of sentential truth on so-called evaluation circumstances (or evaluation indices), that is a certain shiftable features of utterance contexts such as possible worlds or points of time—or so, the Kaplanian account of propositional content may be set out (see Kaplan, 1989).

MF does not subscribe to the Kaplanian account, as it stands, because it does not make room for potential sensitivity of truth-valuations of sentences to assessments. However, he agrees essentially with Kaplan's approach for the limiting case where assessment-sensitivity can be ignored.<sup>10</sup> That is, without begging the question against contextualism, one may put the suggested generalisation of the Kaplanian account as follows:

WHAT IS SAID (WIS): What is said by an utterance of a sentence  $s$  at a context  $c$  is the semantic value (or 'semantic content') of  $s$  at  $c$ ,  $p(s, c)$ , which is subject to the constraint:

$$p(s, c) \text{ is true/false with respect to } e \text{ (relative to } a) \text{ iff} \\ s \text{ as uttered at } c \text{ is true/false with respect to } e \text{ (relative to } a),$$

for any evaluation circumstances  $e$  and assessment contexts  $a$ .

To be more specific, we now need to say something about the contextualist branching-time framework at issue here (without going into formal details, which are set out in the [Appendix](#)).

Utterance contexts are thought of as 'moments', which are ordered in time. Evaluation circumstances, on the other hand, are a different category of entities, labelled as 'histories' (or 'worlds'). As an instance of WIS, it follows that what is said by an utterance of a sentence  $s$  at a moment  $c$  is true with respect to a history  $h$  (relative to an assessment moment  $a$ ) just in case  $s$  is true as uttered at  $c$  with respect to  $h$  (relative to  $a$ ). In a contextualist version of our framework, classical truth-values are assigned to propositions with respect to histories. That is, propositions are sets of histories, i.e., the ones with respect to which they are true. The natural way of modelling historical modality of 'settledness (of truth)' is then as follows: a proposition is settled at a moment iff it is true with respect to all candidate histories at that moment. Future contingency of a proposition at a moment, in this framework, amounts to the case where neither the proposition nor its absolute set-theoretic complement is settled. In MF's truth-relativist adaptation of this framework, the semantic key notion of truth in play in the evaluation of formulas is relativised

<sup>10</sup> MF still disagrees also for this case with Kaplan, as far as the evaluation indices is concerned. Whereas Kaplan includes an index for points of time, to treat tenses as operators, MF can do without an index for points of time, since he favours a quantificational approach to tense; cf. [Appendix](#).

furthermore to assessment contexts, which are also represented by moments. For expository convenience, we mention assessment moments here throughout in parentheses when discussing principles that hold both in the contextualist base framework and in MF's adaptation: as mentioned with regard to the contextualist framework, assessment contexts are just idle wheels, of course.

Now, we should stress that the foregoing technical account of propositional truth is not intended to model the intuitive notion of truth used in linguistic reports of the form such as "What he said is true" or "That was a true claim". On the one hand, such reports involve a one-place predicate of propositional truth, which applies to propositions simpliciter. On the other hand, the technical notion of propositional truth involved in the said instances of WIS has more than one place, applying to propositions only with respect to histories (or, according to truth-relativism, relative to histories and assessment moments). To obtain from such reports evidence regarding propositional truth in the said technical sense, something like a bridge principle linking propositional and utterance truth is required. MF submits that the monadic truth predicate for propositions ('True') in question is governed by the following principle:

MONADIC PROPOSITIONAL TRUTH (MPT): If  $\ulcorner x \urcorner$  as uttered at  $c$  (and assessed at  $a$ ) designates  $p$ , then  $\ulcorner \text{True}(x) \urcorner$  is true as uttered at  $c$  with respect to  $h$  (relative to  $a$ ) iff  $x$  is true with respect to  $h$  (relative to  $a$ ).<sup>11</sup>

There is yet more. Starting from a contextualist version of branching-time framework, there are moments  $c$  that do not uniquely fix an associated history, but rather an associated *set of histories*,  $H(c)$ , which may be interpreted as the set of histories that are still 'candidate histories at  $c$ ', where for any pair of moments  $c_1$  and  $c_2$ ,  $H(c_2)$  is included in  $H(c_1)$  if  $c_2$  is later than  $c_1$ . Utterance truth hence cannot be in general identified with truth of the semantic content with respect to *the* candidate history of the utterance moment'. Rather, the following generalisation is suggested: an utterance counts as true just in case its semantic content is settled at the utterance moment. That is:

UTTERANCE TRUTH–CONTEXTUALIST (UT–C): A sentence  $s$  as uttered at a moment  $c$  is true iff  $s$  as uttered at  $c$  is true with respect to  $h$ , for all  $h \in \mathcal{H}(c)$ .

### 3.2 Retrospective reassessments and actuality

Assuming WIS, MPT and UT–C, it is easy to see how the possibility of retrospective reassessments of what is said by future contingent utterances *can* be accommodated in contextualist terms. To wit, take any utterance of a sentence  $s$  at a moment  $c_1$  the semantic content of which is still unsettled at  $c_1$ , whereas it is settled at some later moment  $c_2$ . Then by WIS, "This claim is true" as uttered at  $c_1$  with reference to the utterance of  $s$  refers to the semantic value of the latter utterance, and by MPT then, the former utterance fails to be true for some candidate history at  $c_1$ ; hence, by UT, the utterance of "This claim is true" is untrue. On the other hand, by

<sup>11</sup> Compare constraint (36) on p. 95.

parity of reasoning, the sentence “That was a true claim” as uttered at  $c_2$  with reference to the earlier utterance of  $s$  is true. Thus, the contextualist may provide an account of the retrospective correct reassessment of what is said by an utterance. Consequently, a contextualism allows for the possibility of retrospective reassessments of what is said by utterances. Importantly, this result does not imply a parallel result regarding the truth-value of utterances: for an utterance to be true, its semantic content is to be true with respect to all histories that are candidate histories at the *utterance* moment—a condition which holds or fails to hold independently of the moment at which we may assess the utterance.

Things change, however, once our language is rich enough to express *actuality*. Then, MF argues, some plausible instances of retrospective reassessment cannot be accommodated in contextualist terms. MF takes it that expressions of actuality are means of expressing utterance truth—or, equivalently, of settledness (of truth) of semantic content at the utterance moment. According to this, sentences of the form ‘actually,  $P$ ’ are indexical, in the sense that their semantic content varies with utterance contexts: as uttered at  $c_1$ , ‘actually,  $P$ ’ is about the truth-value of an utterance of  $P$  at  $c_1$ , whereas as uttered at  $c_2$ , it is about the truth value of an utterance of  $P$  at  $c_2$  (equivalently, one can say that as uttered at  $c_1$ , it is about the historical modal status of the semantic content of  $P$  at  $c_1$ , whereas as uttered at  $c_2$ , it is about the historical modal status of the semantic content of  $P$  at  $c_2$ ). Starting from UT–C, this conception of actuality can be cashed out by way of the following valuation rule for a sentence operator ‘@’ (reading ‘actually’):

ACTUALITY<sub>indexical</sub>–CONTEXTUALIST ( $@_i$ –C) :  $\ulcorner @ (P) \urcorner$  is true as uttered at a moment  $c$  with respect to a history  $h$  iff  $P$  is true as uttered at  $c$  with respect to  $h'$ , for every history  $h' \in H(c)$ .<sup>12</sup>

Assuming  $@_i$ –C, along with the earlier introduced premises WIS, MPT and UT–C, the argument for RT is straightforward.

Take the example discussed by MF (pp. 100–101) and suppose the sentence

It will be sunny tomorrow tomorrow (3)

is uttered at some moment on Monday, as well as the sentence

It will actually be sunny tomorrow. (4)

Now suppose (3) is a future contingent and that, one day later, it is in fact sunny. Then, it seems perfectly correct to say on Wednesday, with respect to the utterance of (4) two days before:

What was said was true. (5)

Assuming an interpretation of (4) on which ‘actually’ is the main operator and (3) the embedded sentence, from  $@_i$ –C, WIS, MPT and UT–C, it follows that the utterance

<sup>12</sup> This type of account was first proposed in Belnap and Green (1994). There is no common ground on the account of actuality for branching-time frameworks, though. For alternatives to the given indexical account, see the discussion in Sect. 4.

of (5) is true only if the utterance of (3) was true.<sup>13</sup> But by assumption, (3) is a future contingent utterance, i.e., it is not true. Hence, (5) is an instance of a retrospective reassessment of the truth-value of a future contingent utterance, which cannot be true, contrary to intuition. This completes the sub-argument for RT from  $@_I\text{-C}$  in conjunction with WIS, MPT and UT-C. Starting from this, however, assuming FL, there is no escape route to the contextualist left (as shown above at the end of Sect. 2).

According to MF, to obtain an effective account strategy for *all* plausible instances of retrospective reassessment, the contextualist key notion of truth that applies to sentences relative to utterance moments and evaluation histories, is to be relativised to assessment moments. Specifically, he suggests two further steps:

1. Utterance truth is made sensitive to assessment moments:

UTTERANCE TRUTH-RELATIVIST (UT-R): A sentence  $s$  as uttered at a moment  $c$  is true relative to an assessment moment  $a$  iff  $s$  as uttered at  $c$  is true with respect to  $h$  relative to  $a$ , for all  $h \in H(c|a)$ —where for any pair of moments  $m_1$  and  $m_2$ ,  $H(m_1|m_2) = H(m_2)$  iff  $H(m_1) \cap H(m_2) = \emptyset$ , and otherwise,  $H(m_1|m_2) = H(m_1)$ .<sup>14</sup>

2. Starting from UT-R and an indexical conception of actuality (as an expression of utterance truth), the valuation rule for actuality is accordingly made sensitive to assessment contexts as follows:

ACTUALITY<sub>indexical</sub>-RELATIVIST ( $@_I\text{-R}$ ):  $\ulcorner @_I(P) \urcorner$  is true as uttered at a moment  $c$  with respect to a history  $h$  as assessed at a moment  $a$  iff  $P$  is true as uttered at  $c$  relative to the assessment moment  $a$ .

Apart from this, the relativised notion of truth is taken to behave just like its contextualist relative.<sup>15</sup> In the discussed version of contextualism, ‘actually’ was interpreted as an expression of utterance truth (or, equivalently, of settledness of semantic content at the utterance moment). MF carries this idea over to his truth-relativist proposal. That is, whereas on UT-C and  $@_I\text{-C}$ , ‘actually’ is interpreted as an expression of *absolute* utterance truth, starting from UT-R and  $@_I\text{-R}$ , it is thought to be an expression of utterance truth *relative to the respective assessment moment* (or, equivalently, of settledness of semantic content at the utterance moment *relative to the respective assessment moment*). As a result, also problematic instances of retrospective reassessment, involving expressions of actuality, can be accommodated. To illustrate, from WIS, MPT, UT-R and  $@_I\text{-R}$ , it follows that the utterance of (5) at a moment  $c$  says that the associated utterance of (3) at  $c$  is true as assessed at  $a$ —which, by UT-R, is consistent with the assumption that (3) is a future contingent utterance. For whereas, at  $c$ , there may be still a candidate history at which it is going not to be sunny on Tuesday, given the weather the day after turns

<sup>13</sup> For further details on the formalisation of these and other examples, see Appendix 4.

<sup>14</sup> In case we assess utterances that might have been made but that in fact, were not made, the relativist notion of utterance truth is no different from the contextualist one. Since this type of case is not relevant for our considerations, it can be ignored henceforth.

<sup>15</sup> For details on the suggested valuation rules for connectives, quantification and historical modalities, see Appendix 1.

out to be sunny, the candidate histories at moments on Wednesday will only include histories at which it is sunny on Tuesday. If UT-R holds, (5) can be evaluated as true, according to intuition.

Let us take stock. MF's case for truth-relativism about future contingents essentially rests on the claim that there are instances of RT, in which case, assuming FL, a contextualism is hardly sustainable. Starting from WIS, MPT and the basic idea that 'actually' expresses utterance truth, as shown above, the existence of RT instances seems hardly deniable, considering the available evidence of apparently correct retrospective reassessments. The question is whether a contextualist is to accept all said premises involved. In what follows, an argument to the contrary is given.

#### 4 Blocking the argument

To start with, two premises in the argument can be put aside. First, assuming that UT-C is definitory for a contextualism in general, it cannot be consistently denied by any proponent of contextualism. For one, it is hard to see how MF's argument could stand or fall with MPT. At least the thesis is only natural, once it is granted that the propositions said by future contingent utterances can be thought of as sets of histories. For another, even if it is doubtful that the pretheoretic notion of 'what is said' is to be cashed out in terms of semantic values, far more than this point would be needed to substantiate the claim that the propositions intended in informal uses of 'what is said' cannot be adequately modelled as sets of histories. Moreover, even if there were a good argument for different accounts of 'what is said', it is hard to see that this revised notion could not be accommodated in a reformulated version of MF's argument. Insofar as this diagnosis is sound, it still leaves three serious targets for the contextualist: WIS, FL, and @<sub>t</sub>-R.

##### 4.1 WIS and FL

To start with WIS, it seems to be highly objectionable indeed. Contrary to what is suggested by WIS, authors like Ziff (1972) and Lewis (1980) have argued that the notion is far from univocal.<sup>16</sup> As Lewis writes, with reference to the locution "what is said":

It can mean the propositional content, in Stalnaker's sense (horizontal or diagonal). It can mean the exact words. I suspect that it can mean almost anything in between. (Lewis, 1980, p. 97)<sup>17</sup>

If observations like this are sound, then the general thesis WIS is rejectable—a point that has been made by Heck against MF, in Heck (2006). However forcefully this point may be made, though, it is questionable whether it may provide an effective escape route to a contextualist from MF's argument. To wit, for MF's argument to

<sup>16</sup> On the varieties of using "what is said" informally, see also Stojanovic (2006).

<sup>17</sup> Speaking in terms of Stalnaker's distinction, semantic contents in Kaplan's sense are horizontal contents. Another witness for the thesis that informal uses of 'what is said' can be adequately modelled by either a horizontal content or, in Dummett (1991)'s terms, by an ingredient sense, is Stanley (1997, p. 577).

go through, what is in fact only required is the claim that in *some* cases of retrospective reassessment of the relevant type, the semantic content is referred to—a claim that is markedly weaker than what follows from WIS, that *any* such reassessment refers to a semantic content. That is, in order to defend the contextualist case against MF's challenge effectively by targetting the underling account of 'what is said', one would need to show that in cases of reassessment of the relevant type, 'what is said' *never* refers to the semantic content.

However, it is hard to see how to warrant such a strong claim.<sup>18</sup> As a parenthetical note, in the light of MF's conception of tense, there is indeed more room for defending the claim that 'what is said' can be identified with the semantic content (or, to speak in terms of Dummett's terminological distinction in Dummett (1991), that the 'assertoric content' can be identified with the 'ingredient sense'). MF assumes that tenses are quantifiers, which makes the resulting semantic values at the same time more variable and simpler than the semantic values that result from standard operator accounts of tenses. Importantly, one may reasonably argue that these simple semantic values may also provide appropriate accounts of 'what is said' by utterances—for a case along this line, see King (2003), which is also referred to in MF (2008, p. 82).

Likewise, FL is far from reflecting an approved position in the philosophy of language and linguistics. While a number of authors seem to take it for granted that linguistic intuitions (i.e., immediate unreflective judgements about the syntactic and semantic properties of linguistic expressions) form the main evidence for linguistic theories. On the other hand, serious objections to this doctrine have been raised, to the effect that there is something other than intuitions linguistic theories are to be true of.<sup>19</sup> In defence of contextualism, one may take the latter line, dismissing premise FL and hence blocking MF's argument—another point that has been made by Heck against MF, in Heck (2006). However (similarly to what was pointed out for WIS), it is doubtful whether this move provides an effective escape route for the contextualist from MF's challenge. To challenge effectively the contextualist position, what is merely required is the claim that *some* instances of retrospective reassessment that do refer to the semantic content of a past future contingent utterance are true to the semantic facts. That is, it would need to be argued that instances of retrospective reassessment of the relevant type are *never* true to the semantic facts. But this seems hard to argue for on the part of the contextualist, without begging the question as to whether utterance truth is absolute.

#### 4.2 Indexical actuality

This brings us to premise @<sub>*t*</sub>-C. On our account, even granted the other mentioned premises, MF's argument can be refuted on the ground that it hinges on an

<sup>18</sup> Perry (1997, p. 17) writes "We can say that in at least the vast majority of cases, the common sense concept of "what is said" corresponds to content <sub>*c*</sub> [i.o.w., the semantic content]." If this is correct, why should 'what is said' in cases of reassessment of the relevant type be bound to refer to something distinct from the semantic content?

<sup>19</sup> Since the literature on this issue is vast, for brevity, the reader is referred here to Devitt (2006, Chap. 7), which offers a critical survey and which argues for distinguishing theories of the syntax/semantics of a language from theories of the language faculty.

inadequate conception of actuality, according to which ‘actually’ is used uniformly in an indexical sense. For a clear case in point against  $@_t\text{-C}$ , we can take the very kind of example that is invoked by MF to demonstrate the existence of RT instances. Suppose an utterance of (3) at a moment  $m$  on Monday is a future contingent. Then, as before, it seems fair to say that an associated utterance of (4) at  $m$  should be a future contingent as well. In every informal sense in which one may truly say at  $m$  *It is still unsettled whether it will be sunny tomorrow*, one can truly say at  $m$  *It is still unsettled whether it will be actually sunny tomorrow*. That is, inasmuch as the interpretation of the utterance of (3) as a future contingent has intuitive force, the same holds for the associated utterance of (4). Consequently, by AV, not only the utterance of (3) but also the utterance of (4) should be untrue and unfalsifiable (as assessed at  $m$ ). However, if the utterance of (3) is untrue (as assessed at the utterance moment), then the associated utterance of (4) is false (as assessed at the utterance moment). For the utterance of (4) says that it is sunny on Tuesday for all candidate histories on Monday (i.e., the utterance moment of (3))—which is not true with respect to any history (relative to any assessment moment), and hence not true either with respect to any candidate history at the utterance moment of (4) (relative to any assessment moment). But this result contradicts the suggested constraint that the utterance of (4) should be a future contingent.<sup>20</sup>

Two points are especially noteworthy here. First, the given inconsistency result essentially hinges, apart from  $@_t\text{-C}$ , on AV, which (as noted earlier) is not in dispute here. That is, neither the problematic premises WIS and MPT nor thesis UT-C (which is disputed by MF) are essential. Second, the given inconsistency argument hits UT-R just as well. For  $@_t\text{-R}$  coincides with  $@_t\text{-C}$  if the assessment moment coincides with the utterance moment, which was assumed to be the case in the given example.<sup>21</sup> Thus, the highlighted inadequacy problem with  $@_t\text{-C}$  is inherited by  $@_t\text{-R}$ .<sup>22</sup> Our point, therefore, does not reveal a problem with contextualism, but with the indexical conception of actuality underlying both  $@_t\text{-C}$  and  $@_t\text{-R}$ , to the effect that occurrences of ‘actually’ can be *generally* interpreted as expressions of utterance truth.

This observation alone—we should note—may do for blocking MF’s argument. However, in the absence of a positive account of actuality in a branching-time framework, the suspicion may remain that there may be room for amending MF’s

<sup>20</sup> It is worth noticing that the same conclusion can be established without having to rely on the—very intuitive, we think, but admittedly disputable—assumption that (4) is neither true nor false if (3) is. The argument could be run assuming a generalisation of MF’s own *initial redundancy* constraint, viz. that  $\ulcorner P \urcorner$  and  $\ulcorner @P \urcorner$  must be true in exactly the same utterance contexts (see MF, p. 98). The generalisation in question additionally requires that  $P$  and  $@P$  also be *false* in the same utterance contexts. It then follows that  $\ulcorner P \urcorner$  and  $\ulcorner @P \urcorner$  must be untrue and unfalsifiable in the same utterance contexts, which, again, is inconsistent with  $@_t\text{-C}$ : on indexical accounts of actuality, if  $\ulcorner P \urcorner$  is a future contingent, then  $\ulcorner @P \urcorner$  must be *false* as assessed at the utterance moment.

<sup>21</sup> More generally,  $@_t\text{-C}$  coincides with  $@_t\text{-R}$  for any sentence  $P$  and utterance moment  $c$  and assessment moment  $a$  if either the semantic content of  $P$  or its set-theoretic complement is settled at  $c$  relative to  $a$ . Consequently, we do not even to assume that the assessment moment and the utterance moment are identical. What is merely required is the assumption that the difference between the utterance and the assessment moment does not make a difference with respect to the historical modal status of  $P$ .

<sup>22</sup> It deserves mentioning here that MF has taken this point (p.c.).

argument on the basis of a tenable alternative approach to actuality. The following considerations are meant to dispel such qualms, and to suggest that MF's case for truth-relativism collapses, if MF's underlying conception of actuality is abandoned and replaced by an approach that is in the spirit of Lewis' (1970, 1983).

## 5 Actuality reconsidered

As MF notes (pp. 98–99), @<sub>*t*</sub>-C and @<sub>*t*</sub>-R are adaptations of Lewis' 'indexical' (or 'unshifty') account of actuality for a branching-time framework, given in his (1970, 1983). Lewis discusses the notion of actuality for a standard possible worlds framework, where each utterance is supposed to fix uniquely an associated possible world, and where propositions are thought of sets of possible worlds.<sup>23</sup> He distinguishes between two senses of expressions of actuality: an *indexical* sense in which they refer rigidly to the world of utterance even in a context where another world is under consideration, and a *shifty* sense in which they shift their reference to the world that is under consideration. More formally, for a three-place notion of truth, applying to triples of sentences *P*, worlds of utterance *w* and worlds under consideration *w'* (or, in Kaplan's terms, 'circumstances of evaluation'), the indexical sense is given, for 'actually', by:

$$\begin{aligned} \ulcorner @ (P) \urcorner \text{ is true as uttered at a world } w \text{ with respect to } w' & \\ \text{iff } P \text{ is true as uttered at } w \text{ with respect to } w. & \quad (\text{indexical}) \end{aligned}$$

Speaking in terms of a Kaplanian framework, as used in the indexical sense, 'actually' expresses utterance truth.<sup>24</sup> The shifty sense, on the other hand, is given by:

$$\begin{aligned} \ulcorner @ (P) \urcorner \text{ is true as uttered at } c \text{ with respect to } w \text{ iff } P \text{ is true as uttered} & \\ \text{at } c \text{ with respect to } w. & \quad (\text{shifty}) \end{aligned}$$

In Lewis' view, 'actually' is ambiguous between the indexical, or primary, sense, and the shifty, or secondary sense. The distinction is already introduced, as a 'complication', in his 'Anselm and Actuality' (1970, p. 19), where Lewis officially endorses an indexical treatment of 'actually', but realises, at the same time, that it cannot be the whole story. There are uses of 'actually' that are not covered by the indexical interpretation; hence, Lewis concludes, linguistic evidence suggests that 'actually' must have more than one sense. He considers examples such as 'If Max ate less, he would be thinner than he actually is', for the indexical, or primary, sense, and 'If Max ate less, he would actually enjoy himself more', for the shifty, or secondary, sense. In his later postscript, he adduces more examples, and stresses that 'this ambiguity deserves more emphasis than I gave it, for without it the indexical analysis is indefensible' (1983, p. 22). He writes:

<sup>23</sup> Lewis' own views on how to accommodate the intuitive asymmetry between an 'open future' and a 'closed past' in terms of a standard possible worlds framework (set out in Lewis 1979) and his criticism of branching-time views of the open future (in Lewis 1986, pp. 199–209) can be put aside, since AV is taken for granted here, for the sake of argument.

<sup>24</sup> Note that in Kaplanian semantics, utterance truth of a sentence amounts to its truth as uttered at the context and as evaluated with respect to the utterance world.

Consider these sentences:

1. The following is contingent: in the actual world, Caesar is murdered.
2. Let 'Alpha' name the actual world; Alpha might not have been actual.
3. Let 'Beta' name some nonactual world; Beta might have been actual.
4. There could have been objects other than those there actually are.
5. I could have been richer than I actually am.

Each of these sentences, I take it, is true on a natural reading. But if "actual" always has its primary, unshifty [i.o.w., indexical] sense, how can (1)–(3) be true? If, on the other hand, it always has its secondary, shifty sense, how can (4)–(5) be true? Neither sense will serve for all cases. We need both. Lewis (1983, p. 22)

Lewis' thought here seems clear enough: if 'actually' were not ambiguous, shifty uses of 'actually' could be adduced as counterexamples to the indexical treatment defended in Lewis (1970).<sup>25</sup> Surprisingly, to our knowledge, Lewis' ambiguity thesis has not yet found entrance in the previous discussion of 'actuality' for branching-time frameworks.<sup>26</sup> As we show, once the thesis is adopted for branching-time frameworks, MF's argument cannot be only blocked, but also effectively rejected.

To begin with, for all examples invoked as cases in point by MF, our account of the relevant uses of 'actually' disagrees with MF's indexical analysis. We submit that in all these examples, 'actually' is used in a sense in which it is truth-conditionally redundant—that is, deletable without the truth-conditions of the sentence being affected. Specifically, we suggest that in a contextualist branching-

<sup>25</sup> Lewis' ambiguity thesis has been recently endorsed by Wehmeier, who also mentions the following shifty use of 'actually': "Under certain circumstances, no-one would believe in aliens, though there would actually be aliens" (2005, p. 195, n. 6). Kai F. Wehmeier further suggests that 'there is a contextual feature determining which world will be invoked by this adverb: viz., the mood of the predicate to which it is attached.' To wit, according to Wehmeier, indexical uses are mandated by predicates in the *subjunctive* mood, whereas shifty uses are mandated by predicates in the *indicative* mood. Humberstone (2004, p. 29) briefly mentions Lewis' ambiguity thesis, and writes of the shifty uses adduced by Lewis and Wehmeier that 'one would want to make sure that [the shifty uses involve] the logical operator 'actually' and not ... the use of this word as a merely rhetorical device – say, for emphasis or contrast. Indeed one would like some justification for the claim that these are different uses of the [same] word' (2004, p. 59, n. 14). Wehmeier's conjecture indeed supports the assumption that future contingent statements such as (4), where an indicative mood attaches to the predicate, actuality can be only used shiftily. But notice that Humberstone's suggestion that the examples of shifty uses of 'actually' may involve a different word altogether—not what he calls the logical operator 'actually'—is also consistent with our main claim in the text below, viz. that not all uses of the English word 'actually' are indexical, and that some uses only have pragmatic force: 'actually' here does not modify the truth-conditions of the (contents expressed by the) sentences in which it occurs.

<sup>26</sup> Belnap and Green (1994) suggest that the meaning of 'actually' is captured by @<sub>r</sub>-C alone. Brogaard (2008), by contrast, suggests that 'actually' is always used shiftily, when arguing that it is used across the board merely as a pragmatic device, which does not affect the semantic content of utterances in which it is used. Belnap et al. (2001, pp. 246–247) mention, further to an indexical account, as another option a hybrid account that combines both an indexical and a shifty interpretation. According to this, 'actually' is used in the shift sense in contexts where histories are considered that are still candidate histories at the utterance moment, and used in the indexical sense otherwise. Leaving aside the problem that the resulting account looks gerrymandered, it is easy to see that it is too restrictive. E.g., suppose we just tossed a coin, with the coin landing heads. We can then truly say "A short while ago, it was still possible that tails would actually be the outcome". On the hybrid account, however, this statement must be in any event false.

time framework, all said cases can be in fact modelled in terms of the following counterpart valuation rule to Lewis' shifty sense:

ACTUALITY<sub>shifty</sub>-CONTEXTUALIST (@<sub>s</sub>-C):  $\ulcorner @ (P) \urcorner$  is true as uttered at a moment  $c$  with respect to a history  $h$  iff  $P$  is true as uttered at  $c$  with respect to  $h$ .<sup>27</sup>

For instance, to come back to (4), it should agree with (3) in truth-value, whatever truth-value the latter has. The same point is to be made for MF's second example (p. 101), an utterance of:

Either it will actually be sunny tomorrow or it will actually be cloudy tomorrow. (6)

It appears that the occurrence of 'actually' is redundant here: it makes no difference whether we say (6), or simply

Either it will be sunny tomorrow or it will be cloudy tomorrow. (7)

We can argue likewise for MF's last example (p. 101), an utterance of:<sup>28</sup>

It is still possible that the weather tomorrow will be different than it actually will be. (8)

Again, it seems that the semantic content of this utterance and those of an associated utterance of

It is still possible that the weather tomorrow will be different than it will be, (9)

are the very same, and that, contrary to what follows from the indexical account, its semantic content cannot be even retrospectively said to be 'True'. But notice, this requirement can be perfectly accommodated in contextualist terms: since every utterance of (9) is false with respect to any candidate history at the utterance moment, so it is, a fortiori, with respect to any candidate history at any later moment—hence, the same for (8).<sup>29</sup>

Two points are crucial here. To begin, insofar as the above observations are sound, they suggest not only that there is no need for an indexical account of 'actuality' in the said examples. They suggest furthermore that the indexical account is not of any use, in that—for either example—it has implications that are patently false. Second, to the extent 'actuality' is used in a shifty sense, MF's argument

<sup>27</sup> MF (p. 99, n. 20) mentions in passing also the possibility of a shifty account, dismisses this account though with the comment that there is need for a non-shifty account of 'actually'—thereby, it seems, suggesting that 'actually' is not ambiguous.

<sup>28</sup> MF's original example sentence begins with the temporal adverb 'today'. We leave it out here since it makes no difference for MF's point nor for the point we are going to make.

<sup>29</sup> Our suggestions regarding the sense in which the notion of 'actuality' is used in certain types of utterances are backed by both by considerations on language use and by considerations on 'folk-linguistic' evidence: e.g., in support of an interpretation of 'actually' in (8) as a redundant operator, one may submit that a report of the form (8) should be assented to just in case the same obtains for (9), and the same for dissenting behaviour; or, that what is said by an utterance of (8) just comes to the same as what is said by an utterance of (9). Both types of reasoning are defeasible, of course. However, in the absence of undermining or even rebutting evidence, it is fair to say that our counterargument poses a serious challenge to MF's univocal indexical conception of actuality.

strategy is not applicable. For, even if such uses allow for retrospective reassessment of ‘what is said’, MF himself grants (see our Sect. 3.2) that retrospective reassessments of what is said by future contingent utterances such as (3) can be perfectly accommodated in contextualist terms. That is, once the point that MF’s examples in fact only involve shifty uses of ‘actuality’ is taken, MF’s argument to the effect that those examples are instances of RT can be refuted in his own terms. Consequently, all examples given by MF are in fact no good cases in point for his case.

One can easily make Lewis’ point in support of a non-shifty sense by way of examples that involve historical modalities. To see the motivation for a counterpart valuation rule that captures Lewis’ indexical sense, consider examples such as

Yesterday it was still possible that the weather today would be different than it actually would be. (10)

or

Before the dice was thrown four times, it was still possible that the numbers which were actually tossed in the series would not be tossed (11)

If ‘actually’ were used across the board in a shifty sense, utterances of those sentences would be truth-conditionally equivalent to associated utterances of

Yesterday it was still possible that the weather today would be different than it would be (12)

and

Before the dice was thrown four times, it was still possible that the numbers which were tossed in the series would not be tossed. (13)

respectively. However, whereas (12) and (13) are, patently, trivial falsities, (10) and (11) may be truly uttered in some circumstances.<sup>30</sup> The shifty account of actuality is

<sup>30</sup> One might object that not too much weight should be put on such sentences, which—one might argue—are rather odd things to say outside a philosophical context. Moreover, one might add, ‘actually’ can be even omitted *salva veritate* in sentences such as (10) and (11), which, therefore, fail to provide evidence for introducing a non-shifty actuality operator. To this potential concern, we respond that the examples originally introduced at the end of the 1970s for motivating the introduction of an actuality operator in the context of the metaphysical modalities, e.g. (to borrow a more recent example from Wehmeier (2005))

It is possible that all the astronauts who actually flew to the moon didn’t fly to the moon. (14)

can be easily adapted to the case of the historical modalities, as in

Before 1969, it was still possible that all the astronauts who actually flew to the moon wouldn’t fly to the moon. (15)

Similar sentences, we suggest, effectively call for a non-shifty interpretation of the actuality operator, *irrespective of whether ‘actually’ is actually used in English*. That is, we agree that ‘actually’ may be omitted *salva veritate* in (10), (11) and (15), though we maintain that such uses are elliptical, and that a proper semantic (and charitable) interpretation of such uses requires a non-shifty actuality operator, or

thus of no avail, as far as certain utterances of sentences like (10) and (11) are concerned. Specifically, in cases where we can truly utter the said sentences, it appears that ‘actually’ is used as a means of contrasting what was still an open possibility up to some moment in the past with what is meanwhile settled to be true. Speaking in terms of our branching-time framework, in cases of the mentioned type, ‘actually’ may be interpreted in the indexical sense: more precisely, in contexts where a ‘counterfactual’ history is under consideration, i.e., a history that is no longer a candidate history at the utterance moment, ‘actually’ may serve as a means of shifting back to the historical modal perspective of the utterance moment.<sup>31</sup> Insofar as this evaluation generalises, we suggest that, as modeled in a branching-time framework, ‘actually’ is ambiguous between a shifty sense, as given by  $@_s-C$ , and an indexical sense.

The simplest way of cashing out the indexical conception is given by  $@_I-C$ . However, one may argue for a more refined formulation of the indexical sense. To wit, in all given clear instances of a shifty use of ‘actually’, the operator is used in a context where no counterfactual history is under consideration. This suggests that ‘actually’ may be used indexically only in contexts where a counterfactual history is under consideration. Cashed out in terms of our framework, this account leads to a modified indexical valuation rule that is also considered (without being argued for) in Belnap et al. (2001, p. 246):

ACTUALITY<sub>indexical\*</sub>-CONTEXTUALIST ( $@_{I*}-C$ ):  $\ulcorner @ (P) \urcorner$  is true as uttered at a moment  $c$  with respect to a history  $h$  iff (i)  $P$  is true as uttered at  $c$  with respect to  $h$ , if  $h \in H(c)$ , and (ii)  $P$  is true as uttered at  $c$  with respect to  $h'$ , for all  $h' \in H(c)$ , if  $h \notin H(c)$ .<sup>32</sup>

Or so one may carry over Lewis’ idea of a non-shifty sense to a branching-time framework. For a non-shifty use of ‘actuality’ to give rise to an instance of RT, the relevant utterance would need to fail to be true, with its semantic content being settled to be true at a later moment. However, we have suggested, MF’s claim that

Footnote 30 continued

some logically equivalent device. We finally note that any worry about sentences such as (15) as a motivation for introducing an actuality operator in the context of the historical modalities would transfer, by parity of reasoning, to sentences such as (14) used as a motivation for introducing an actuality operator in the context of the metaphysical modalities. In keeping with Hazen (1976, 1979), Davies and Humberstone (1980), Wehmeier (2005), Fara and Williamson (2005), we take sentences such as (14) and (15), and also (10) and (11), to provide compelling evidence for introducing a non-shifty actuality operator in modal logic. We thank an anonymous referee for raising this potential concern.

<sup>31</sup> The most natural way of shifting historical modal perspectives in English seems to be to use tense in combination with historical modalities: that  $p$  is not possible, but it was possible that  $p$  at some point in the past. MF’s discussion is simplifying in that it ignores the interaction of actuality with tense—which is a bit surprising, considering that he takes a stance on the semantics of tenses earlier on in his paper. For a tentative thought on how to model an indexical sense that furthermore takes into account tense in accordance with MF’s line, see n. 35 in the Appendix.

<sup>32</sup> In fact, MF (p. 99, n. 20) mentions  $@_{I*}-C$ , without explaining why he dismisses it in favour of  $@_I-C$ .

(4), (6) and (8) may provide examples of non-shifty uses with this property should be rejected. If this is correct, the burden of proof that there are such uses of ‘actuality’ is now on the truth-relativist’s part.

## 6 Conclusion

MF (2008) presents a novel argument strategy in favour of truth-relativism that is seemingly less problematic than the standard case for truth-relativism in that it seems to do more justice to available ‘folk-linguistic’ evidence. For establishing a connection between informal reassessments of the truth-value of propositions and the truth-value of related utterances, however, MF makes essential use of the claim that the pretheoretic notion of ‘actuality’ is used across the board in an indexical sense, that is also in plausible instances of retrospective reassessments of ‘what is said’ by past utterances. But this claim is refutable in two respects. Pace MF, ‘actuality’ is not used in an indexical sense across the board. Rather, it is ambiguous between a shifty sense and (some sort of) an indexical sense. In particular, pace MF, the examples of retrospective reassessment he presents as instances of RT are cases where ‘actuality’ is used in fact in a shifty sense—that is, cases for which MF’s argument can be effectively rejected in his own terms.

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## Appendix

MF’s outlines of the truth-relativist framework he has in mind are rather sketchy. This may be cause for concern that his position might be flawed at an even more fundamental level than we suggest and that it cannot be even soundly implemented in formal semantic terms. To dispel such concerns, MF’s proposal is cashed out in more exact terms (Appendix 2), along with the intended contextualist base semantics, i.e., a supervaluationist branching-time semantics (cf. Thomason 1970; Belnap et al. 2001) (Appendix 1). The intended base framework deviates from the standard branching-time frameworks in that predicates are indexed to moments—a natural prerequisite for modelling tenses not (the standard way) as operators but as quantifiers.<sup>33</sup> Because tense is not essential for MF’s argument, however, we will follow MF in omitting the semantics of tense. Historical modalities are accordingly

<sup>33</sup> See p. 82, where MF endorses a quantificational approach to tense. For a defence of this approach, e.g., see King (2003).

indexed to moments as well. MF's way of analysing temporal adverbs such as 'tomorrow' or of locutions like 'the weather tomorrow' may not be the most elegant one, but to make sure that our reconstruction does not deviate essentially from his suggestions, we will enrich the syntax accordingly—modelling temporal adverbs like 'tomorrow' as indexical terms designating moments, and phrases like 'the weather tomorrow' as indexical functions that take individuals as values for moments as arguments. With the introduced contextualist base framework in place, the crucial flaw in MF's argument can be pinpointed (Appendix 3). Finally, we give formalisations of the examples that are presented by MF as cases in point for instances of RT—which are in the line of MF's accounts and only with regard to the indexical valuation rule for 'actuality' (Appendix 4).

### 1. Supervaluationist branching-time semantics

To set the stage, we start with the syntax, semantics and logic of a language  $\mathcal{L}$  of predicate logic with identity, historical modality and actuality.

#### Syntax

The lexicon of  $\mathcal{L}$  has the following ingredients:

- logical connectives:  $\neg$  (negation) and  $\wedge$  (conjunction)
- an existential quantifier:  $\exists$
- identity:  $=$
- a countable set of moment variables:  $\text{MOM-VAR}_{\mathcal{L}} = \{z_1, z_2, \dots\}$
- a countable set of moment constants:  $\text{MOM-CON}_{\mathcal{L}} = \{g_1, g_2, \dots\}$
- a countable set of individual variables:  $\text{IND-VAR}_{\mathcal{L}} = \{x_1, x_2, \dots\}$
- a countable set of individual constants:  $\text{IND-CON}_{\mathcal{L}} = \{c_1, c_2, \dots\}$
- a countable set of individual functor constants:  $\text{IND-FUNCT}_{\mathcal{L}} = \{f_1, f_2, \dots\}$
- a countable set of  $n$ -place predicate constants:  $\text{PRED}_{\mathcal{L}}^n = \{F_1^n, F_2^n, \dots\}$
- an operator of 'historical necessity':  $\Box$
- an operator of 'actuality':  $@$
- parentheses: ( and )

The set of moment terms of  $\mathcal{L}$ ,  $\text{MOM-TERM}_{\mathcal{L}}$ , is given by  $\text{MOM-VAR}_{\mathcal{L}} \cup \text{MOM-CON}_{\mathcal{L}}$ . The set of individual functor terms of  $\mathcal{L}$ ,  $\text{IND-FUNCT-T}_{\mathcal{L}}$ , is given by the smallest set that contains  $f(t)$ , for any  $f \in \text{IND-FUNCT}_{\mathcal{L}}$  and any  $t \in \text{MOM-TERM}_{\mathcal{L}}$ . The set of individual terms of  $\mathcal{L}$ ,  $\text{IND-TERM}_{\mathcal{L}}$ , is given by  $\text{IND-VAR}_{\mathcal{L}} \cup \text{IND-CON}_{\mathcal{L}} \cup \text{IND-FUNCT-T}_{\mathcal{L}}$ .

The set of atomic formulas of  $\mathcal{L}$ ,  $\text{ATFORM}_{\mathcal{L}}$ , is given by the smallest set such that:

1. If  $F \in \text{PRED}_{\mathcal{L}}^0$  and  $t \in \text{MOM-TERM}_{\mathcal{L}}$ , then  $F_t \in \text{ATFORM}_{\mathcal{L}}$ ;
2. If  $F \in \text{PRED}_{\mathcal{L}}^n$ , for any  $n \geq 1$ ,  $t \in \text{MOM-TERM}_{\mathcal{L}}$ , and  $i_1, \dots, i_n \in \text{IND-TERM}_{\mathcal{L}}$ , then  $F_t(i_1, \dots, i_n) \in \text{ATFORM}_{\mathcal{L}}$ ;
3. If  $i_1, i_2 \in \text{IND-TERM}_{\mathcal{L}}$ , then  $i_1 = i_2 \in \text{ATFORM}_{\mathcal{L}}$ .

The set of formulas of  $\mathcal{L}$ ,  $\text{FORM}_{\mathcal{L}}$ , is the smallest set such that:

1.  $\text{ATFORM}_{\mathcal{L}} \subseteq \text{FORM}_{\mathcal{L}}$

2. If  $\varphi \in \text{FORM}_{\mathcal{L}}$ , then  $\neg\varphi \in \text{FORM}_{\mathcal{L}}$
3. If  $\varphi, \psi \in \text{FORM}_{\mathcal{L}}$ , then  $(\varphi \wedge \psi) \in \text{FORM}_{\mathcal{L}}$
4. If  $x \in \text{IND-VAR}_{\mathcal{L}}$  and  $\varphi \in \text{FORM}_{\mathcal{L}}$ , then  $\exists x\varphi \in \text{FORM}_{\mathcal{L}}$
5. If  $\varphi \in \text{FORM}_{\mathcal{L}}$  and  $t \in \text{MOM-TERM}_{\mathcal{L}}$ , then  $\Box_t(\varphi) \in \text{FORM}_{\mathcal{L}}$
6. If  $\varphi \in \text{FORM}_{\mathcal{L}}$ , then  $\@(\varphi) \in \text{FORM}_{\mathcal{L}}$

Other symbols can be defined as follows:

- disjunction:  $(\varphi \vee \psi) := \neg(\neg\varphi \wedge \neg\psi)$
- material conditional:  $(\varphi \rightarrow \psi) := (\neg\varphi \vee \psi)$
- universal quantifier:  $\forall x\varphi := \neg\exists x\neg\varphi$
- historical possibility:  $\diamond_t\varphi := \neg\Box_t(\neg\varphi)$

*Semantics*

A frame for  $\mathcal{L}$  is a triple  $\langle \mathcal{M}, <, \mathcal{D} \rangle$ , where

- $\mathcal{M}$  is a non-empty class (of ‘moments’);
- $<$  is tree-like ordering relation (of ‘being earlier than’) on  $\mathcal{M}$ , i.e., a relation on  $\mathcal{M}$  that is (i) transitive and (ii) backwards-linear (i.e., for all moments  $m_1, m_2$  and  $m_3 \in \mathcal{M}$ , if  $m_1 < m_2$  and  $m_3 < m_2$ , then  $m_1 < m_3$ , or  $m_3 < m_1$ , or  $m_1 = m_3$ );
- $\mathcal{D}$  is a non-empty class (of ‘individuals’).

Given a frame  $\mathcal{F} := \langle \mathcal{M}, <, \mathcal{D} \rangle$ , the set of ‘histories’ for  $\mathcal{F}$  is given by:  $\{h|h \text{ is a maximal chain}^{34} \text{ on } \langle \mathcal{M}, < \rangle\}$ .

A model for  $\mathcal{L}$  is a quadruple  $M := \langle \mathcal{M}, <, \mathcal{D}, i \rangle$ , where  $\mathcal{F} := \langle \mathcal{M}, <, \mathcal{D} \rangle$  is a frame, with  $\mathcal{H}$  being the associated set of histories, and where  $i$  is an interpretation for the non-logical constants of  $\mathcal{L}$  at moments  $m \in \mathcal{M}$  in the frame  $M$  such that:

- For every  $g \in \text{MOM-CON}_{\mathcal{L}} : i_{\langle m, M \rangle}(g) \in \{k|k : \mathcal{H} \rightarrow \mathcal{M}\}$ .
- For every  $c \in \text{IND-CON}_{\mathcal{L}} : i_{\langle m, M \rangle}(c) \in \{k|k : \mathcal{H} \rightarrow \{d\}, \text{ where } d \in \mathcal{D}\}$ .
- For every  $f \in \text{IND-FUNCT}_{\mathcal{L}} : i_{\langle m, M \rangle}(f) \in \{k|k : \mathcal{M} \rightarrow \mathcal{D}\}$ .
- For every  $F \in \text{PRED}_{\mathcal{L}}^0 : i_{\langle m, M \rangle}(F) \in \{k|k : \mathcal{M} \rightarrow \{0, 1\}\}$ .
- For every  $F \in \text{PRED}_{\mathcal{L}}^n$  (for any  $n \geq 1$ ) :  $i_{\langle m, M \rangle}(F) \in \{k|k : \mathcal{M} \times \mathcal{D}^n \rightarrow \{0, 1\}\}$ .

Assignment functions in a model  $M$  are functions  $v$  on  $\text{VAR}_{\mathcal{L}}$  such that: (i) for variables in  $\text{IND-VAR}_{\mathcal{L}}$ , it takes values in  $\{k|k : \mathcal{H} \rightarrow \{d\}, \text{ where } d \in \mathcal{D}\}$ , and (ii) for variables in  $\text{MOM-VAR}_{\mathcal{L}}$ , it takes values in  $\{k|k : \mathcal{H} \rightarrow \{m\}, \text{ where } m \in \mathcal{M}\}$ . To introduce some notation for interpretations of terms and predicates at moments  $m \in \mathcal{M}$  relative to an assignment  $v$  in a model  $M = \{\mathcal{M}, <, \mathcal{D}, i\}$ , we say:

- terms:
  1.  $I_{\langle m, v, M \rangle}(c) = i_{\langle m, M \rangle}(c)$ , if  $c \in \text{MOM-CON}_{\mathcal{L}} \cup \text{IND-CON}_{\mathcal{L}}$ .
  2.  $I_{\langle m, v, M \rangle}(c) = i_{\langle m, M \rangle}(f) \circ i_{\langle m, M \rangle}(t)$ , if  $c \in \text{IND-FUNCT-T}_{\mathcal{L}}$ , being composed of an  $f \in \text{IND-FUNCT}_{\mathcal{L}}$  and a  $t \in \text{MOM-TERM}_{\mathcal{L}}$ .

<sup>34</sup> A chain on a set  $\mathcal{M}$  ordered by a relation  $<$  is any subset of  $\mathcal{M}$  such that for all  $m_1, m_2 \in h$ , if  $m_1 \neq m_2$ , then  $m_1 < m_2$  or  $m_2 < m_1$ . A chain  $h$  on  $\langle \mathcal{M}, < \rangle$  is maximal iff for all chains  $g$  on  $\langle \mathcal{M}, < \rangle$ , if  $h \subset g$ , then  $h = g$ .

$$3. I_{\langle m,v,M \rangle}(x) = v(x), \text{ if } x \in \text{MOM-VAR}_{\mathcal{L}} \cup \text{IND-VAR}_{\mathcal{L}}.$$

- predicates:

$$I_{\langle m,v,M \rangle}(F) = i_{\langle m,M \rangle}(F), \text{ if } F \in \text{PRED}_{\mathcal{L}}^n.$$

Let  $\langle \mathcal{M}, <, \mathcal{D}, i \rangle$  be a model for the language  $\mathcal{L}$ , variable ‘ $h$ ’ range over the associated set of histories, and  $v$  be an assignment function. The relation  $\langle m, h, M \rangle \models \varphi[v]$ , reading ‘ $\varphi$  as uttered at a moment  $m$  is true relative to a history  $h$  in a model  $M$  relative to assignment  $v$ ’, is then defined inductively for  $\mathcal{L}$ , as follows:

- atomic formulas:

1. for any  $F \in \text{PRED}_{\mathcal{L}}^0$ , any  $t \in \text{MOM-TERM}_{\mathcal{L}}$  :

$$\langle m, h, M \rangle \models F_t[v] \text{ iff } I_{\langle m,v,M \rangle}(F)(I_{\langle m,v,M \rangle}(t)(h)) = 1.$$

2. for any  $F \in \text{PRED}_{\mathcal{L}}^n$ , for any  $n \geq 1$ , any  $i_1, \dots, i_n \in \text{IND-TERM}_{\mathcal{L}}$ , any  $t \in \text{MOM-TERM}_{\mathcal{L}}$  :

$$\langle m, h, M \rangle \models F_t(i_1, \dots, i_n)[v] \text{ iff } I_{\langle m,v,M \rangle}(F)(I_{\langle m,v,M \rangle}(t)(h), I_{\langle m,v,M \rangle}(i_1)(h), \dots, I_{\langle m,v,M \rangle}(i_n)(h)) = 1.$$

3. for any  $i_1, i_2 \in \text{IND-TERM}_{\mathcal{L}}$  :

$$\langle m, h, M \rangle \models i_1 = i_2[v] \text{ iff } I_{\langle m,v,M \rangle}(i_1)(h) = I_{\langle m,v,M \rangle}(i_2)(h).$$

- formulas:

1. negation:

$$\langle m, h, M \rangle \models \neg\varphi[v] \text{ iff } \langle m, h, M \rangle \not\models \varphi[v].$$

2. conjunction:

$$\langle m, h, M \rangle \models (\varphi \wedge \psi)[v] \text{ iff } \langle m, h, M \rangle \models \varphi[v] \text{ and } \langle m, h, M \rangle \models \psi[v].$$

3. existential quantification:

$$\langle m, h, M \rangle \models \exists x\varphi[v] \text{ iff } \langle m, h, M \rangle \models \varphi[v'], \text{ for some assignment } v' \text{ that differs from } v \text{ at most with respect to } x.$$

4. historical necessity:

$$\langle m, h, M \rangle \models \Box_t\varphi[v] \text{ iff } \langle m, h', M \rangle \models \varphi[v^*], \text{ for some } h' \text{ such that } I_{\langle m,v,M \rangle}(t)(h) \in h', \text{ where } v^* \text{ differs at most from } v \text{ in that } v^*(z) = I_{\langle m,v,M \rangle}(t), \text{ for all } z \in \text{MOM-VAR}_{\mathcal{L}}.$$

5. actuality<sub>indexical</sub>-contextualist ( $@_t\text{-C}$ ):<sup>35</sup>

<sup>35</sup> The natural way of extending these valuation rules to tenses, e.g., for past tense, may run as follows:  $\langle m, h, M \rangle \models \text{past } z(\varphi)[v] \text{ iff } \langle m, h, M \rangle \models \varphi[v^*]$ , for some  $v^*$  that differs at most from  $v$  in that for any history  $h^*$ ,  $v^*(z)(h^*) < v(z)(h^*)$ , where  $z$  is a moment variable.

$\langle m, h, M \rangle \models @\varphi[v]$  iff  $\langle m, h', M \rangle \models \varphi[v^*]$ , for all  $h'$  such that  $m \in h'$ , where  $v^*$  differs at most from  $v$  in that  $v^*(z)$  takes for any history,  $m$  as value, for all  $z \in \text{MOM-VAR}_{\mathcal{L}}$ .

With this in place, the notion  $\langle m, M \rangle \models \varphi$ , reading ‘ $\varphi$  is true (simpliciter) as uttered at  $m$  in model  $M$ ’ is defined in a supervaluationist fashion in terms of the relativised notion  $\langle m, h, M \rangle \models \varphi[v]$  as follows:

**Utterance Truth–Relativist (UT–R):**  $\langle m, M \rangle \models \varphi$  iff  $\langle m, h, M \rangle \models \varphi[v]$ , for all  $h$  such that  $m \in h$ , for any assignment  $v$  such that  $v(z)$  takes  $m$  for any history, for all  $z \in \text{MOM-VAR}_{\mathcal{L}}$ .

Suffice it to say here that this suggests an associated natural account of logical consequence in terms of preservation of utterance truth (for all moments in all models).<sup>36</sup>

## 2. A truth-relativist adaptation

MF’s proposed truth-relativist framework essentially differs in the suggested valuation rule for actuality, and along with this, with the suggested account of utterance truth. Truth-relativist models though are no different from models in the contextualist base framework (as given in Appendix 1). To make room for potential assessment-sensitivity on the level of valuation-rules for formulas, the contextualist two-place notion of an interpretation for non-logical constants is accordingly replaced by a three-place notion of ‘truth at a moment  $m$  (of utterance) and a moment  $a$  (of assessment) in a model’. That is, starting from a model  $M = \langle \mathcal{M}, <, \mathcal{D}, i \rangle$ , we replace  $i_{\langle m, M \rangle}$  by  $i_{\langle m, a, M \rangle}$ , with ‘ $a$ ’ ranging over  $\mathcal{M}$ —where the third place notion is defined as a trivial extension of the contextualist counterpart notion, i.e.: for any non-logical constant  $c$  in  $\mathcal{L}$ , we have for all  $a \in \mathcal{M}$ ,  $i_{\langle m, a, M \rangle}(c) := i_{\langle m, M \rangle}(c)$ . With an associated relativised notion of an interpretation of non-logical constants at a moment  $m$  (of utterance) and a moment  $a$  (of assessment) relative to an assignment  $v$  in a model  $M, I_{\langle m, a, v, M \rangle}$ , in place, we obtain an associated generalisation notion of  $\varphi$  being true at a moment  $m$  (of utterance), a history  $h$ , and a moment  $a$  (of assessment) in model  $M$  relative to an assignment  $v'$ ,  $\langle m, h, a, M \rangle \models \varphi[v]$ . The only valuation rule that essentially deviates from its contextualist counterpart rule concerns the indexical account of actuality:

**actuality<sub>indexical</sub>–relativist (@<sub>i</sub>–R):**  $\langle m, h, a, M \rangle \models @(\varphi)[v]$  iff  $\langle m, h', a, M \rangle \models \varphi[v]$ , for all  $h' \in H(m|a)$ .<sup>37</sup>

UT–R is accordingly revised as follows:

<sup>36</sup> See Thomason (1970). The details can be left aside, since nothing in MF’s argument hinges on provisos on the logic of the object-language.

<sup>37</sup> For the two-place function  $H$ , see Sect. 3.1 in this paper.

**Utterance Truth–Relativist (UT–R):**  $\langle m, a, M \rangle \models \varphi$  iff  $\langle m, h', a, M \rangle \models \varphi[v]$ , for all  $h' \in H(m|a)$ , for any assignment  $v$  such that  $v(z)$  takes the value  $m$  for any history, for all  $z \in \text{MOM-VAR}_{\mathcal{L}}$ .

### 3. MF's argument blocked

To cash out the remaining premises in MF's argument, the relevant instances of WIS can be precisified as follows:

**What Is Said '(WIS)'**: What is said by the utterance of a sentence (in the here relevant fragment of English),  $p$ , can be modelled as follows: for some model  $M := \langle \mathcal{M}, <, \mathcal{D}, i \rangle$  of  $\mathcal{L}$ , with the associated set of histories being called  $\mathcal{H}$ , for some  $m \in \mathcal{M}$ ,  $p$  is identifiable with the set  $\{h \in \mathcal{H} | \langle m, h, M \rangle \models \varphi[v]\}$ , for any assignment  $v$  such that  $v(z)$  takes the value  $m$  for any history, for all  $z \in \text{MOM-VAR}_{\mathcal{L}}$ .

On MPT, we don't need to revise the notion of frames nor the syntax of  $\mathcal{L}$  to model truth-predications of propositions. Hence we are free to assume for any frame  $\langle \mathcal{M}, <, \mathcal{D} \rangle$ , with  $\mathcal{H}$  being the associated set of histories, that there is an associated frame  $\langle \mathcal{M}, <, \mathcal{D}^* \rangle$ , where  $\mathcal{D}^* := \mathcal{D} \cup P(\mathcal{H})$  (i.e., the union of  $\mathcal{D}$  and the powerset of  $\mathcal{H}$ ). Since  $P(\mathcal{H})$  represents the set of propositions that are definable in terms of any frame with the domain  $\mathcal{M}$  (of moments) and the ordering  $<$ , the assumption that propositions are included in the domain of individuals is hence safe. Now, with a frame in place where the domain of individuals includes all relevant propositions, we can precisify MPT as follows:

**Monadic Propositional Truth '(MPT)'** Let  $\langle \mathcal{M}, <, \mathcal{D}, i \rangle$  be a model of  $\mathcal{L}$  with  $\mathcal{H}$  being the associated set of histories, where  $\mathcal{D}$  includes the associated set of propositions,  $P(\mathcal{H})$ . Then any monadic predicate  $F$  of  $\mathcal{L}$  is a predicate of truth for propositions iff its interpretation satisfies the following constraint: For any  $m \in \mathcal{M}$ ,  $i_{\langle m, M \rangle}(F) \in \{k | k : \mathcal{M} \times \mathcal{D} \rightarrow \{0, 1\}\}$ , where for any pair of a moment  $m \in \mathcal{M}$  and any  $d \in P(\mathcal{H})$ ,  $k$  takes the value 1 just in case  $m \in d$ .

With these provisos in place, MF's argument for instances of RT runs as follows: Suppose  $u_0$  is a future contingent utterance of a sentence  $s$ . Speaking in terms of a model  $\langle \mathcal{M}, <, \mathcal{D}, i \rangle$  of  $\mathcal{L}$ , with  $\mathcal{H}$  being the associated set of histories, this case can be represented by a formula  $\varphi$  of  $\mathcal{L}$ , where for some moment, representing the 'moment of utterance',  $m_0$ ,  $\langle m_0, M \rangle \models \varphi$  and  $\langle m_0, M \rangle \not\models \neg\varphi$ . Let  $u'_0$  be another utterance that was made at the same time, where the sentence uttered has the logical form of  $@(\varphi)$ . Now consider a later utterance  $u_1$  that predicates truth of what is said in  $u'_0$ . Assuming WIS',  $u_1$  predicates truth of the semantic content of  $@(\varphi)$  at  $m_0$ , that is, the set  $\{h \in \mathcal{H} | \langle m_0, h, M \rangle \models @(\varphi)[v]\}$ , for any assignment  $v$  such that  $v(z) = \{h \rightarrow \{m_0\}\}$ , for all  $z \in \text{MOM-VAR}_{\mathcal{L}}$ —call this set  $p$ . Starting from MPT', we can represent  $u_1$  in our model by an atomic formula of  $\mathcal{L}$ ,  $F_t(c)$ , such that for some moment  $m'$  later than  $m$ : (i)  $F$  is a monadic predicate of  $\mathcal{L}$ , where (for every assignment  $v$ )  $I_{\langle m_1, v, M \rangle}(F)$  satisfies the constraint for truth-predicates of propositions as given in MPT'. (ii)  $t$  is a moment term of  $\mathcal{L}$ , where

(for every assignment  $v$ )  $I_{\langle m_1, v, M \rangle}(t) = k : \mathcal{H} \rightarrow \{m_1\}$ . (iii)  $c$  is an individual term of  $\mathcal{L}$ , where (for every assignment  $v$ , )  $I_{\langle m_1, v, M \rangle}(c) = k : \mathcal{H} \rightarrow \{p\}$ . From this, by UT-R and @<sub>t</sub>-C, it follows that for  $u_1$  to be true,  $u_0$  is to be true as well: for  $\langle m_1, M \rangle \models F_t(c)$  only if  $\langle m_0, M \rangle \models \varphi$ .<sup>38</sup> However, since, by UT-R, assessment moments are just idle wheels, if  $u_0$  is true as assessed at a later moment, then so it is assessed at the utterance moment, that is, it should fail to be a future contingent. Contradiction.

On our account, the argument is valid. However, we argued that it fails to be sound, in that it essentially rests on the premise @<sub>t</sub>-C. We submit that in the examples discussed, @<sub>s</sub>-C is to be adopted instead. Specifically, in the given framework, this comes to:

$$\text{actuality}_{\text{SHIFTY}}\text{-contextualist}(@_s\text{-C}) : \\ \langle m, h, M \rangle \models @\varphi[v] \iff \langle m, h, M \rangle \models \varphi[v]$$

On this supposition, though,  $u_1$  can be true without  $u_0$  being true. Precisely, for the outlined framework, it is easy to see that this is the case whenever the semantic content of  $u_0$ ,  $p$ , is neither settled to be true nor settled to be false at the moment of  $u_0$  whereas  $p$  is settled to be true at the moment of  $u_1$ .

#### 4. MF's 'cases in point'

MF gives the following formalisation for (4):

$$@(\text{Sunny}_{\text{tomorrow}}),$$

where 'Sunny' is zero-place predicate and where 'tomorrow' is a term that as used at the utterance moment designates some later moment relative to each candidate history.<sup>39</sup> By parity of reasoning, he analyses (6) as:

$$@(\text{Sunny}_{\text{tomorrow}}) \vee @(\text{Cloudy}_{\text{tomorrow}}),$$

with 'Cloudy' being another zero-place predicate. (8) is analysed as:

$$\diamond_{\text{today}}(\exists x \exists y((x \neq y \wedge \text{Weather}(\text{tomorrow}) = x) \wedge @(\text{Weather}(\text{tomorrow}) = y))),$$

where 'today' functions like 'tomorrow' in the preceding examples, and where 'Weather' is an individual functor term. On our account, the occurrences of '@' are all deletable, since 'actuality' is used shiftily in the given examples.

<sup>38</sup> In fact, one can strengthen this point and show that for  $u_1$  to be *unfalse* (i.e., true with respect to some candidate history at the utterance moment),  $u_0$  is to be true. Since this epicycle does not make any difference for our points, we do not pursue this line further here.

<sup>39</sup> If days are for the present purposes identifiable with moments, 'tomorrow' should designate the immediate successor to the utterance moment, with respect to each candidate history at the utterance moment. Otherwise, further constraints would need to be introduced to make sure that 'tomorrow' can be modelled as an indexical moment constant.

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