The Truth of Future Contingents:
An Analysis of Truth-Maker Indeterminacy

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Abstract

I argue that the semantics of sentences expressing future contingent propositions is best viewed as being based on a clear distinction between a time at which a proposition is true and a time at which a state of affairs that makes it true gets actualized. That a prediction is true here and now *means* that its truth-maker gets actualized later. This is not to say that if a contingent proposition *p* concerning the future is true at *t*, it acquires the truth-value *true* at *t* only retrospectively, at a later moment. Nor must this be seen as suggesting that it is a settled, unpreventable fact at *t* that *p* is true at *t*. It just means that the reason for its present truth is something that happens later on: the future happens to evolve in such a way as to make a truth-maker of *p* obtain. In this case, then, it can be said that at *t*, *p* is truth-maker indeterminate, or that it has an indeterminate truth-maker. I develop a formal semantics based on this analysis in the follow-up article 'A Formal Framework for Future Contingents'. Here, I lay down the conceptual framework and indicate Boethius and Abelard as precursors of the view I wish to defend.

1. Introduction

The following *problem of future contingents* has been an object of philosophical debate for over 2300 years now: Can a proposition about a contingent future event obey the principle of bivalence? Or is it rather so that a proposition predicting a future event is true or false only if the event is not contingent, while if the predicted event indeed is contingent, the proposition is neither true nor false? More generally, the problem concerns all contingent propositions about the future (all *future contingents*), whether they pertain to a future 'event' or not.[1] Like any genuine philosophical problem, there is no

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[1] An *event* of a given type is contingent if it is not settled that an event of this type will occur, nor settled that an event of this type will not occur. A future contingent *proposition*—a 'future

chance that the problem of future contingents will ever be solved or dissolved, because any attempt to solve or dissolve a problem will proceed from nontrivial background assumptions, which can always be called into question, and always eventually will—unless the proposal is simply ignored. The more involved the proposed solution is, the easier it is to dismiss it. If one nevertheless feels tempted to comment on a given problem, the best one can do is to operate with rather robust concepts and to attempt establishing illuminating connections among them.[2]

In what follows, I will operate with the concepts of truth and truth-condition. More specifically, I will be interested in the (temporal) relationship between a circumstance of evaluation in which a proposition is true and an actualized state of affairs that makes the proposition true.[3] The relevant observation is embarrassingly simple: the relationship need not amount to *simultaneousness*: the truth of a proposition here and now may consist of a certain state of affairs getting realized later. This insight has been notably developed in the context of recent scholarly debates on Aristotle, in connection with the so-called 'non-standard interpretations' of Aristotle's

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contingent'—is a contingent proposition that concerns the future of its moment of evaluation. Being contingent, its truth is not settled, and the truth of its negation is not settled either. Future contingents may but need not be *about an event*. E.g., the proposition *that there will be a sea battle* is about an event, while the proposition *that Socrates will henceforth remain in Athens* is not. For details, see Subsection 2.2.

[2] I take *propositions* (not indicative *sentences*) to be bearers of truth-values. A proposition assigns to all relevant *circumstances of evaluation* a *truth-value*. Propositions are *contents* that indicative sentences express, possibly depending on the context of use of these sentences. If a sentence does *not* involve indexical expressions, the content expressed does not depend on the context of use, and we may simply speak of the 'proposition expressed by the sentence' (the context does not affect what is expressed). I take it that grammatical tenses are not indexical expressions and that the circumstance of evaluation of a proposition expressed by a grammatically tensed indexical-free sentence must specify a *moment* of evaluation. (No specific moment is inbuilt into the proposition expressed, as would be the case with propositions expressed by sentences involving temporal indexicals.) I follow, then, the analysis of linguistic meaning of Kaplan (1989), but in this paper the distinction between linguistic meaning (character) and proposition plays no essential role, since grammatical tenses are not construed as indexical expressions.

[3] States of affairs can be viewed on the one hand as repeatable *types*, and on the other hand as *occurrences* bound to a specific time. Whenever the proposition *that Socrates is sitting* is true, it is made true by a state of affairs of the type *Socrates's sitting*, but on each occasion its truth-maker is a distinct temporally specific occurrence of this type.

comments in *De Interpretatione* ch. 9, and discussed especially by Mario Mignucci and Gerhard Seel.[4] By contrast, philosophers commenting on the problem of future contingents from a systematic but not historically informed viewpoint have tended to shift attention from truth-conditions of propositions (expressed by sentences) to success conditions of utterances of sentences, thereby in effect giving up the quest for a purely semantic response to the problem. Different examples of the latter variety are found, for example, in works of Nuel Belnap, Mitchell Green, John MacFarlane, Corine Besson, and Anandi Hattiangadi.[5] This article is meant to be read in conjunction with my paper 'A Formal Framework for Future Contingents'.[6] The latter text—to which I will refer conveniently as 'the follow-up paper'—develops formally the proposal described in the present article. In the remainder of this introductory section, I develop the mentioned observation in a way that should allow getting a good enough grip of why future contingents indeed can be reasonably taken to obey bivalence. At this point, many notions are left less than fully articulated. In subsequent sections, and notably in the follow-up paper, the requisite clarifications are then made.

In the present paper, I assume what Nuel Belnap calls *objective indeterminism*. *Moments* are thought of as instantaneous events. There is an objective *causal ordering* among the moments, independent of any epistemic considerations. I follow Belnap and his collaborators in referring to the causal ordering otherwise as the 'temporal *earlier than* relation'. Qualifying the relation as causal is meant to stress that it is a relation among concrete events regulated by causal laws, not a relation among abstract instants. It is *not*

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[4] See Mignucci (1998), Seel (2001b, c). According to the 'standard' or 'traditional' interpretation, future contingent propositions about specific events are neither true nor false before the event to which they refer takes place. There are different 'non-standard interpretations'; according to the one that interests me here, such a proposition indeed obeys the principle of bivalence, being true or false *indefinitely*—meaning that it is true or false in the plain sense, but for the moment, no state of affairs obtains that makes it have this or that truth-value. For different interpretations of the aporia that Aristotle presents in *De Int.* 9, see Seel (2001a).

[5] See Belnap & Green (1994); Belnap *et al.* (2001), especially chs. 6 and 8; MacFarlane (2003); Besson & Hattiangadi (2014). In Subsection 3.1, I briefly comment on the approaches of these authors. The demarcation between semantics and pragmatics may not be easy. However, an account of sentences is 'purely semantic' in the sense intended here if it describes a relation between propositions expressed by sentences and those aspects of the extralinguistic reality that render those sentences true, and does this without reference to actions of language users or their epistemic states.

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meant to suggest that t standing in the causal ordering relation to t' (i.e., t being earlier than t') amounts to the event t causing the event t'.[7] According to objective indeterminism, the set of successors of a given moment is normally *not linearly* ordered by the causal ordering; it normally admits of several incomparable successors. In the 'future of possibilities' of a moment t_0, there are normally distinct moments t_1 and t_2 which are not mutually related by the causal ordering: we have $t_0 \prec t_1$ and $t_0 \prec t_2$, but neither $t_1 = t_2$ nor $t_1 \prec t_2$ nor $t_2 \prec t_1$.[8] The totality of moments structured by the causal ordering constitutes 'our indeterminist world'. This world is inherently 'modal' in the sense that it comprises, for any given moment, a variety of alternative future courses of events. In this connection, we may study the notions of 'historically possible' and 'historically necessary'. The former qualifies, at a given moment t_0, propositions that are true at t_0 in *at least one* 'history' passing through t_0, whereas the latter similarly qualifies propositions true at t_0 in *all* histories passing through t_0. (A *history* is a maximal 'course of events', a maximal set of moments linearly ordered by the causal ordering.) Here, all considerations are confined to 'our world'. No further worlds are considered, and correspondingly no other modalities except for the historical ones are studied.[9]

If a proposition is true at t_0 and is made true by the obtaining of a state of affairs at t_1, there is not a slightest reason why we should have $t_0 = t_1$. Indeed, if the proposition is about a past event, then $t_1 \prec t_0$. At t_0, it is true that there was a sea battle on the previous day iff[10] the unique world history, as it is determined when t_0 has become present, involves a moment t_1 falling within the day preceding the day to which t_0 belongs, such that at t_1, a sea battle took place. The state of affairs *a sea battle's taking place* obtained, then, at t_1— and this is why at t_0, it is true that there was a sea battle on the previous day. Similarly, if a proposition about a future event is true at t_0, it is made true by a state of affairs that has as yet not got realized, but will obtain at a moment t_1 with $t_0 \prec t_1$.

Appearances notwithstanding, there is, notoriously, a crucial asymmetry between propositions about past events and those about future events—and

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[7] Cf. Belnap *et al.* (2001), p. 180.

[8] Here '$\prec$' stands for the relation of temporal precedence (the causal ordering, the *earlier than* relation among moments).

[9] For the notions of *moment*, *causal ordering*, and *our world*, see Belnap & Green (1994), pp. 370–372; Belnap *et al.* (2001), pp. 139–141.

[10] Here and henceforth, 'iff' abbreviates 'if and only if'.

this is why future contingents pose a problem. Namely, given objective indeterminism, there are in general many ways for the future to unfold starting from t_0, though there is a unique course of events that has led to t_0. The past of t_0 is determined, the future of t_0 is not. Since from the perspective of t_0 none of the possible future courses of events has metaphysical priority over the others, just saying that t_1 follows t_0, or is later than t_0, leaves too much unsaid. This leads attention merely to states of affairs that *might* obtain in the future, though we should concentrate on those that actually *will* obtain. It is not enough that t_1 lies on *some* possible course of events passing through t_0. It must belong to *the* course of events that actually will unfold—though for the time being, at t_0, it is entirely undetermined which possible course of events that will be. In the case of propositions concerning past events, there is no such difficulty, since the past of t_0 is determined and thereby the totality of (occurrences of) states of affairs that have, so to say, already come into being is fixed.

Does the mentioned asymmetry entail, then, that the proposition expressed by a future contingent sentence 'It will be the case that *p*' (in symbols, *Fp*) cannot be true in its circumstance of evaluation? To be sure, the most immediate reason for thinking it cannot is based on a fallacy. One may be tempted to conclude from the fact that the proposition *Fp* currently *has no truth-maker* that it cannot currently be true. That is, one may feel that if none of the states of affairs that have by now come into being makes *Fp* true, then *Fp* cannot be true. Such reasoning is perfectly fine in connection with propositions about present events, and even in connection with past events.[11] However, a true proposition about a future event has the specificity that it expresses a prediction, and as such—by the very meaning this proposition encodes—its truth-maker is yet to be realized. Under the assumption of objective indeterminism, if such a proposition could be made true by an already available state of affairs, it would either not be genuinely about future or else it would not be contingent.

So *if* a proposition about a future event ever is true, *then* it is made true by a state of affairs that *will* obtain but does not. It must be stressed that a future contingent's being true does not mean that its truth is currently *knowable*. Nor does it even mean that *there is* something in the present state of the reality (or its past history) that would render it true. However, none of this

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[11] Past and present states of affairs have got selected, so to say, by the passage of time. By contrast, by objective indeterminism, it is as yet entirely open which states of affairs will get realized in the future.

blocks it from *being* true. And its being true does not mean that the future event will *necessarily* or *inevitably* occur. If indeed the proposition is true, then the future will unfold so as to contain an event of a certain relevant type. If the future does not thus unfold, the proposition is false. Either way, the truth-value it indeed has, here and now, is based on something that is not yet determined—but this is just to be expected, since the proposition expresses something of what is not yet determined but will be. It expresses that when enough time will have passed so that the future has got actualized to a sufficient degree, then it will have turned out that so-and-so is the case.

The sense of paradox vanishes when one realizes that an entity can have a property in one context due to something happening in another context—in this case the entity being a proposition, the property being truth, the happening being the coming into being of a state of affairs, and the contexts being moments in time. In fact, saying that a proposition about a future event is true just means that there is some duration such that *if* we let time evolve that much, then an event of a suitable type occurs. It is not particularly paradoxical that a proposition involving such a conditional can hold here and now.

If a proposition p is true at t_0 and has at t_0 a truth-maker that will obtain, but no truth-maker that currently does, it might be tempting to describe this condition by saying that p is *indeterminately true* or, alternatively, that it has an *indeterminate truth-maker*. Both manners of speaking can be helpful to some extent, but they both are also very easily misconstrued. Both have in fact been employed in discussions of future contingents, as will be seen in Section 2. If we choose to say that p is indeterminately true, it must be borne in mind that an indeterminately true proposition is simply *true* in the one and only semantically relevant sense. The adverb 'indeterminately' does not, according to the relevant usage, really qualify the truth of a proposition, but expresses the fact that proposition is *made true* by a state of affairs that has not yet come into being at the time the truth-ascription is correctly made. If, again, we say that p has at t_0 an indeterminate truth-maker, the risk is that this is read as fixing attention to an entity (an occurrence of a state of affairs) existing at t_0, which is, then, affirmed to have the feature of being indeterminate. However, what is meant is not that at t_0, *there is*—in an ontologically committing sense of 'there is'—a state of affairs that at t_0 has the feature of being indeterminate (and making p true at t_0). What is meant is just that at t_0, *it is indeterminate* which state of affairs will make p to have the truth-value that it in fact has at t_0. When speaking generally of states of

affairs (in particular, of truth-makers of p), we use ontologically non-committing quantification over states of affairs (ones materialized at one time or another). Just like we may say without self-contradiction that there are non-existing objects of thought,[12] we can say that there is at t_0 a non-obtaining state of affairs whose future obtaining renders p true at t_0, and that at t_0 such a truth-maker is indeterminate. With a diminished risk of misconstrual, we might describe the condition under discussion by saying that at t_0, p is true but *truth-maker indeterminate*.

2. Historical antecedents: Boethius and Abelard

2.1 Truth based on indeterminate states of affairs
Boethius attempted to interpret the remarks that Aristotle put forward on future contingents in *De Interpretatione* ch. 9 by proposing to use qualified truth-value ascriptions in terms of the characteristics *definitely* (or *determinately*) true or false and *indefinitely* (or *indeterminately*) true or false, instead of employing plain ascriptions.[13] He took Aristotle to hold that propositions about future events need not be definitely true or definitely false. In this way, commitment to determinism was supposed to be avoided. Interpreters of Boethius do not agree on what he meant by *indefinite* truth of a proposition (or a sentence). One option is that Boethius denied that future contingents are antecedently true or antecedently false (in order to be one or the other, they would have to have a definite truth-value). Instead, so this proposal goes, their future truth-value is 'indefinite' in a sense entailing that they can presently be said to have merely the disjunctive truth-value true-or-false. Another option is of more interest to us here; it could be described as being based on a link between truths and truth-makers.[14] Those propositions are indefinitely true at moment t_0 whose truth-makers are not yet determined at t_0. Such truth-makers will obtain later, but do not obtain at t_0.[15] Nevertheless, under these conditions the proposition qualifies as simply true, not merely as true-or-false.

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[12] For non-existent intentional objects (objects of thought), see Crane (2013), especially ch. 2.

[13] For Boethius's commentaries on *De Interpretatione*, see Boethius (1877–1880). His commentaries on ch. 9 are translated into English by Norman Kretzmann, see pp. 129–191 in G. Seel, ed. (2001).

[14] For these interpretive options, see, e.g., Seel (2001a), pp. 34–35, Knuuttila (2010), p. 79.

[15] Cf. Lewis (1987), Mignucci (1998), Seel (2001c). For a general discussion, see Knuuttila (2010).

Abelard's view on future contingents was influenced by Boethius and based on the notion of determinacy.[16] In Abelard's analysis, there are two types of *bearers of determinacy*, namely sentences and *dicta*, the latter being the primary bearers of determinacy.[17] Now, sentences signify, first, mental items that Abelard refers to as understandings (*intellectus*) and second, they further signify external items to which understandings bear likenesses. These external items are identified as *dicta*. What are they, then? Neil Lewis suggests that *dicta* are best viewed as playing the double role of *propositions* (contents expressed by sentences) and *states of affairs*. He proposes, moreover, that Boethius uses the notion of *res* in such a way as to function as a precursor of Abelard's *dictum*, having a two-sided character and resembling at the same time propositions and states of affairs.[18] In Boethius, *res* are bearers of truth-values and modalities. Boethius maintains, however, that the qualifier 'determinate' does not apply to sentences or to *res* as such; instead, 'determinate' is predicated of the *truth* of sentences or of the *eventus* of *res*. Lewis suggests that in Boethius, *eventus* is related to *res* in the same way as truth is related to sentences. Thus, *eventus rei* amounts to the status of a state of affairs as *obtaining*—the obtaining of a state of affairs. By comparison, Abelard hesitates whether to attribute determinacy to *dicta* or rather to concrete events or things (*res ipsa*). In his usage, 'determinate' may be predicated of a *dictum* without presupposing it obtains, but the consequences of a *dictum* being determinate are in any case articulated in terms of obtaining.[19]

Now, like the truth of a proposition, also the obtaining of a state of affairs is relative to a time. A state of affairs that fails to obtain at one time may obtain at another. In particular, from the vantage point of a fixed temporal perspective, it can happen that a proposition was true, that it is true, or that it will be true—just as it can happen that at no time it is true, but it could have been true or might be true. Similarly, from a fixed temporal perspective, it can happen that a state of affairs obtained, that it obtains, or that it will obtain—just as it can happen that at no time it obtains, but it could have obtained or might obtain. Restricting attention to those states of affairs that as a matter of fact obtain at one time or another, the 'ontological status' of their *eventus* depends on the temporal relation of the time at which they obtain to

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[16] See *Logica 'Ingredientibus'* (Abelard 1919–1927), *Dialectica* (Abelard 1956).

[17] See Lewis (1987), p. 88.

[18] *Ibidem*, pp. 86–87.

[19] Here, see *ibidem*, pp. 87–88 (for Boethius) and pp. 90–92 (for Abelard).

our temporal perspective. The qualifiers 'determinate' and 'indeterminate' are supposed to describe the *mode of actualization* of states of affairs, so to say.

Boethius and Abelard attempt to clarify the idea of a determinate *eventus rei* or determinate *dictum* somewhat unfortunately in epistemic terms (what is 'known to nature' or 'knowable of itself' though perhaps not actually known to us). The non-epistemic cash value of their characterization seems to be as follows: an *eventus rei* is determinate, if either it has obtained or is obtaining (so that its determinacy is based on its past or current presence), or else it will obtain out of a certain kind of necessity (its determinacy being based on natures of things).[20] Thus, if the state of affairs *Socrates's eating* once obtained or currently obtains, it is determinate for its mode of actualization: the passage of time has actualized it. Further, while Socrates is alive, the state of affairs *Socrates's dying* is determinate as well, but for quite a different reason. Even when the state of affairs *Socrates's dying* does not yet obtain, it is a physical necessity regarding men in general and Socrates in particular that men die. Out of necessity, the state of affairs *Socrates's dying* will obtain, and consequently this state of affairs is already determinate for its mode of actualization. While the future is indeterminate in many ways, it does not leave open the option that actual men fail to die as the future evolves. Properties of actual individuals serve to rule out certain combinatorial future possibilities and thereby render certain future states of affairs regarding them determinate already from the present viewpoint. By contrast, any remaining states of affairs that will obtain are *indeterminate* for their mode of actualization. These are states of affairs that will obtain, although their future obtaining is in no way necessitated by the present. Nothing in the passage of time, as it has evolved by now, forces such states of affairs to obtain in the future, and yet the time so evolves that they will obtain.

2.2 Complications

I take the main outcome of the preceding historical discussion to be that it makes perfect sense to consider that a proposition is true at moment t_0, while a state of affairs that makes it true at t_0 will be actualized only later—without this latter fact rendering the truth of the proposition at t_0 inevitable. At t_0, various future courses of events are genuinely possible. The passage of time will single out, for any duration, a specific future course of events of that

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[20] See *ibidem*, pp. 83, 88–90.

duration beginning at t_0. Retrospectively, once n time units have passed after t_0, a unique course of events will have got specified out of the plurality of courses of events of length n possible at t_0. By contrast, beforehand, at t_0, none of those courses of events has metaphysical priority over the others.[21] Evaluated at t_0, a proposition about a future contingent event affirms that in the yet-to-be-actualized future a certain state obtains. If the proposition indeed is true at t_0, a suitable state will pop up after t_0. If such a state does pop up at t_1, it makes the proposition true at the earlier moment t_0. By no means does the proposition *become* true-at-t_0 only at t_1. Due to the specificity of the proposition, what makes it true at t_0 is something that happens at a later moment. Its *being* true at t_0 means that the future turns out to actualize a state of a certain type. If the truth of certain propositions at a time could not be based on what happens at a later time, we could simply not make any sense of future-referring constructions (such as the grammatical future tense) in natural language. However, they appear to make perfect sense. We employ them quite successfully.

The concepts involved in the above-sketched analysis due to Boethius and Abelard are imprecise in many ways, and they are partly based on generalizations from an insufficient variety of data. I proceed to comment on the relevant problems and propose in each case a remedy. To keep the discussion clear, it must be explicitly noted that states of affairs viewed as *types* are universal and repeatable. They can get instantiated (realized, actualized) at different times, their instantiations being particular and unrepeatable momentary *occurrences* bound to a specific time. Types of states of affairs are atemporal, whereas their occurrences exist in time. I say that a type *obtains* at t_0 iff the type is instantiated at t_0 iff it has an occurrence that exists at t. That is, 'obtaining' is a possible qualifier of a *type* of a state of affairs, not of an occurrence. Such obtaining is, however, articulated in terms of momentary existence of occurrences.

The non-unicity of truth-makers. Consider the proposition *that Socrates was sitting*. What makes a proposition true is not a state of affairs (a type) as such, but the fact that it obtains at a given time (i.e., an occurrence of the type). Suppose t_0, t_1, and t_2 are moments such that $t_2 \prec t_1 \prec t_0$, and suppose that at t_1 and at t_2 alike, Socrates is sitting. Then the generic state of affairs

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[21] This is not to say that some courses of events could not be more probable than others. It just means that what has happened up to t_0 could be combined with suitable physically possible subsequently intervening factors so as to yield any of those courses of events; nothing at t_0 predetermines which of these courses of events will get realized.

Socrates's sitting obtains at t_1 and at t_2, and the proposition *that Socrates was sitting* has two distinct truth-makers at t_0—namely, the obtaining, at t_1, of the state of affairs *Socrates's sitting* and the obtaining, at t_2, of this state of affairs. It may be convenient to refer to such instantiations of a generic states of affairs as 'particular states of affairs'. Phrased in this way, the proposition *that Socrates was sitting* has at t_0 two truth-makers: the particular state of affairs *Socrates's sitting at t_1* and the particular state of affairs *Socrates's sitting at t_2*. Indeed, normally it makes no sense to speak of *the* truth-maker of a proposition.

Truth-makers need not come into being at a time. The proposition *that Socrates will be sitting* (call it ϕ) is true at t_0 if at a later time t_1, the generic state of affairs *Socrates's sitting* will obtain—i.e., if a particular state of affairs of this type comes into being after some finite duration counted from t_0. The truth-maker of the proposition ϕ at t_0 is the coming into being of a state of affairs at a specific moment; in this case it makes sense to speak of a time of the *eventus rei*, a time at which the relevant state of affairs is actualized. However, not all truth-makers behave like that—not all truth-makers can be said to come into being at a fixed time. Just consider the *negation* of the proposition ϕ, i.e., the proposition *that Socrates will not be sitting* (i.e., $\neg \phi$). This proposition is true at t_0 if at no later time does Socrates sit. We may still hold that the proposition has a global truth-maker, but in this case such a truth-maker is not of a kind that simply comes into being at a specific time. Such a truth-maker is a *process*, a potentially never-ending succession of obtainings of the momentary state of affairs *Socrates's not sitting*, one such state of affairs for each future moment.[22] Whereas we could say that the proposition ϕ has a *local truth-maker* (truth-maker whose obtaining is a local matter), the proposition $\neg \phi$ has a *totality truth-maker* (truth-maker whose obtaining concerns a totality of moments).[23]

Generally, propositions are not about events. Sometimes it is appropriate to say that a proposition concerns a past, present or future event. (I have said so myself above.) This is so especially if the proposition is expressed by a sentence of the form 'It was the case that p', 'it is the case that p' or 'it will be the case that p', where the clause 'p' uses no temporal

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[22] We need not think of such a 'process truth-maker' as itself being a (non-momentary) *state of affairs*. By contrast, it is *analyzable* in terms of momentary states of affairs.

[23] I opt for viewing *occurrences of states of affairs* systematically as momentary entities, but allow for *truth-makers* that are not themselves occurrences of states of affairs, as long as they are nevertheless analyzable in terms of such occurrences.

adverbs and contains no grammatical tenses save for the present. The propositions *that a sea battle took place*, *that a sea battle is taking place*, and *that a sea battle will take place* are of this kind, being respectively about an event's past, present, and future occurrence (the taking place of a sea battle). Tempting as it might be, these examples must not convince us to maintain that generally, propositions expressed by tensed sentences are about possible events—in the normal sense of 'event' according to which one cannot speak of an event unless it makes sense to ask when the event occurs. For instance, the propositions *that there has never been a sea battle* and *that Socrates will henceforth remain in Athens* are not about events, because if they have truth-makers, these are totality truth-makers which cannot be said to occur at a specific time. The fact that each past moment is associated with the obtaining of a state of affairs *a sea battle's not taking place* cannot be construed as a single event, and neither can the fact that each future moment is associated with the obtaining of a state of affairs *Socrates's remaining in Athens*.

Truth-makers are not tensed. The above three clarifications regarding the notions of truth-maker and propositional content result from a need to develop a general analysis of time-related propositions. The views of Boethius and Abelard, as sketched above, do not directly contradict the requisite generalizations; the examples they consider are simply somewhat limited and do not explicitly force these authors to adopt a greater generality in their exposition. There is, however, a further issue regarding truth-makers that Abelard himself may have raised and that at least emerges when interpreting what he says. This is the question of whether the states of affairs in terms of which the semantics of tensed sentences are articulated can themselves be tensed. Neil Lewis interprets Abelard as holding that the sentence 'A battle will take place' signifies a future-tensed state of affairs *that a battle will take place*, whereas the sentence 'A battle is taking place' signifies a present-tensed state of affairs *that a battle is taking place*.[24] If this is correct, the future-tensed sentence affirms, at a given time t_0, that a certain future-tensed state of affairs presently obtains—not that a certain (atemporal type of) state of affairs obtains at a later moment. Lewis proposes that we should distinguish things or events that sentences deal with from states of affairs signified by sentences, so that while 'A battle will take place' signifies a (future-tensed) state of affairs that obtains now, it is about a future event.

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[24] *Ibidem*, p. 91. Similarly, Gerhard Seel defends the idea that truth-makers of future contingent sentences are present facts about future events, and argues that Ammonius held this view. See Seel (2001c, pp. 239–246); cf. also Seel (2001a, p. 36; 2001b, p. 233).

No matter what the interpretive merits of Lewis's suggestion may be, the admission of tensed states of affairs into our ontology can only serve to muddle the semantic analysis of tensed sentences. Suppose we have just managed to convince the reader that the contingent future-tensed sentence 'Socrates will be sitting' can be indeterminately true at t_0, being made true by the obtaining of the state of affairs *Socrates's sitting* in the future of t_0. If we now modify the exposition and tell our interlocutor that actually, there is a future-tensed state of affairs *that Socrates is going to be sitting* that obtains already at t_0, then surely our interlocutor's doubts are newly awaken: if there really are such future-tensed states of affairs, then there is, after all, something present at t_0 that renders the future-tensed sentence true; why should not this go against the alleged non-necessity of the truth of our sentence? One may attempt a maneuver and say that what we mean by saying that the future-tensed state of affairs *that Socrates is going to be sitting* obtains at t_0 is that the corresponding event of Socrates's sitting materializes in the future. But the credibility of the very idea that present contingent truth may depend on the obtaining of a state of affairs in the future would suffer a serious blow if we introduced in our ontology such intermediary presently available ingredients as future-tensed states of affairs obtaining here and now.

We are, systematically speaking, much better off if we stay with the idea that *types* of states of affairs are atemporal, their *instantiations* being temporal but momentary. There just is no variant of the qualifier 'tensed' that would apply to a state of affairs, whether states of affairs are construed as types or as occurrences.[25] We have no reason to allow tensed states of affairs into our ontological inventory. They are not needed in the semantic account, and they are highly suspect metaphysically, especially if one is to defend the possibility of true future contingent propositions. The transition from the obtaining of a state of affairs in the future into the obtaining of a future-tensed state of affairs now is a conceptually illicit reification. It is not even evident that Abelard is committed to tensed states of affairs. He says that when a thing itself (an event) that a sentence deals with is still future, what the sentence says can nevertheless be (presently) the case. Lewis interprets this by postulating a presently obtaining future-tensed unit that the sentence signifies. Abelard clarifies his proposal by referring to the sentence 'A battle will take place', saying that the sentence is about a future battle, but as long as the battle is not yet taking place, things are as the sentence says. It says that a battle will take place. What it says is the case: it is the case that the

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[25] Sentences and, I take it, propositions may be *tensed*, states of affairs cannot.

state of affairs *a battle is taking place* will obtain.[26] What our sentence says or enunciates or signifies must be understood as expressing a relation that the moment of evaluation bears to the time at which the relevant event is supposed to occur or the relevant state of affairs is supposed to obtain. To put it employing a self-explanatory notation: at least on the face of it, there is no reason why such relating should take the form 'at t_0, *FUT(S)* obtains', instead of the form 'at t_0, *S* will obtain' or indeed the form 'at some t_1 with $t_0 \prec t_1$, *S* obtains'. Gerhard Seel identifies Carneades (214–129/8 BC) as the first philosopher to have held the view that future contingent propositions are made true by *future* facts (states of affairs obtaining at a later moment, being about an event occurring at that later moment), not by present facts about a future event.[27] It is essentially this view that I wish to develop in this article, though—as will be explained in Subsection 3.2—I prefer to conceptualize truth-makers of such propositions as *relational structures* comprising both the evaluation time and a later moment at which the truth-maker becomes actual, instead of conceptualizing them as self-standing momentary states of affairs which happen to occur sometime after the moment of evaluation.

3. Toward a purely semantic analysis of future contingent propositions

3.1 Remarks on 'pragmatic' approaches

In order to render understandable how my account differs from certain alternative accounts of future contingent sentences, I find it useful to briefly comment on those alternative approaches that were mentioned as examples in Section 1.

Belnap and Green (1994) maintain that the sentence 'A sea battle will take place' used now is *open* in the same way as the formula '*x* is red' is open. In the latter case, a context of use fails to provide a value assigned to the variable; in the former case, it fails to supply a unique future course of events allowing us to evaluate the sentence. The authors hold that an utterance of the tensed sentence (but not of the formula) nevertheless serves to express a content, and they account for this pragmatically. Time will tell— by gradually generating an ever longer future course of events—whether an utterer of the sentence deserves credit or discredit for his or her assertion.

MacFarlane (2004) is explicitly interested in the question of how to evaluate assertions and other speech acts. He wants a definition of truth of

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[26] Lewis (1987), pp. 90–92.
[27] Seel (2001a), p. 28.

utterances, though he takes it that this can only be accomplished via a definition of truth of sentences. He argues that the semantics of utterances of future contingent sentences must be based on a definition of sentence-truth that is doubly relativized contextually, being sensitive not only to a context of utterance but also to a 'context of assessment'. He is explicitly inspired by the work of Belnap and Green. Indeed, if 'A sea battle will take place' is uttered at t_0, and a later moment t_1 is taken as a context of assessment, then according to MacFarlane the sentence is true relative to the pair (t_0, t_1) iff the person who made the assertion at t_0 by uttering the sentence deserves credit at t_1 according to Belnap and Green. MacFarlane wishes to incorporate in his semantic clauses requirements that Belnap treats as pragmatic success conditions. However, MacFarlane's primary interest lies in speech acts (utterances).

Besson and Hattiangadi (2014), in turn, operate with 'intuitions' that people allegedly have regarding contingent statements about the future. Both the method and the object of study of these authors is utterly pragmatic. They maintain that pragmatic data shows that people sometimes judge that assertions of future contingent sentences are correct, while people simultaneously judge that the future is open. They take this to establish that in any event we are *not* intuitively committed to the view according to which future contingent sentences lack a truth-value.

The question I wish to address in the present paper is whether the plain semantic relation that a proposition bears to its circumstance of evaluation can be defined even for propositions expressed by sentences about future contingent events—and indeed for all contingent propositions regarding the future. 'Pragmatic' considerations involving language users, their speech acts, and their pre-theoretic opinions certainly have an interest in suitable settings. However, one should resist the temptation of jumping to the conclusion that the *Eigenart* of future contingent sentences *must* be explicated with reference to pragmatics, unless one has found a general argument to the effect that an explication cannot be provided at a more fundamental, purely semantic level. If my enterprise in this article is successful, the mentioned conclusion is unwarranted.

3.2 Truth-conditions and truth-makers

Boethius and Abelard employed—or can be interpreted as having employed—the obtaining of states of affairs to explicate conditions under which propositions are true. Their formulations are phrased by viewing the

time of evaluation of a proposition as a temporal perspective relative to which a state of affairs making the proposition true can possess such 'A-theoretic' characteristics as *being past*, *being present* or *being future*.[28] Local truth-makers themselves are naturally viewed as being momentary (anyway, rather short-lived) states of affairs; and totality truth-makers as being collections of such momentary states of affairs. I find it preferable to build the relation that an evaluation time bears to a time of actualization of the relevant momentary states of affairs into the notion of truth-maker itself. Thus construed, truth-makers become relational structures of a certain kind, involving the 'B-theoretic' causal ordering relation (the temporal *earlier than* relation), instead of the above-mentioned A-theoretic characteristics. As will be seen when we proceed, this does not mean that we can altogether rid ourselves of A-theoretic conceptualizations. We must appeal to the idea of temporal becoming or the passage of time.

Propositions are (or determine) functions that map circumstances of evaluation to truth-values. If p is a proposition and $\mathcal{K}$ is the relevant class of circumstances of evaluation, then the set $TC(p) = \{k \in \mathcal{K} : p(k) = \text{true}\}$ is the *truth-condition* of p. In a preliminary terminology, truth-makers of p are simply occasions in which p is true. They are elements of the truth-condition of p. As such, a truth-maker is a relational structure that singles out a specific moment as the time of evaluation, and relates this moment to further moments with specified properties. We could simply identify truth-makers with elements of the set $TC(p)$. However, in order to meet certain expectations about the 'minimality' of truth-makers (expectations that notably metaphysicians hold), I will opt to refer to elements of $TC(p)$ as *realizations* of p, and I will single out a certain proper subset $TM(p)$ of $TC(p)$ as consisting of the *truth-makers* of p. Any proposition that qualifies as true in some occasion or another has a realization in the above sense—any occasion in which the proposition is true *is* itself such a realization. Collecting together all such occasions gives rise to the truth-condition of the

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[28] In the terminology of McTaggart (1908), the 'A-series' is the order of positions in time as past, present and future, whereas the 'B-series' is the order of positions in time as earlier or later. As Broad (1976, pp. 289–291) and Geach (1979, p. 90) point out, it is also useful to make a distinction between A-characteristics and B-characteristics. *Being past*, *being present*, *being future*, *being yesterday* and *being ten years ago* are A-characteristics: they can only be ascribed to events from a fixed viewpoint which is taken to be the present. *Being earlier than* some event or *being later than* some event, *lasting an hour* and *being ten years apart in birthdays* are B-characteristics: possessing such characteristics is not relative to any fixed temporal perspective.

proposition. Truth-makers of p will be realizations of p subject to a certain 'minimality condition', to be explained as we proceed. If p is true in an occasion, either the occasion itself (which in any event is a realization of p) is a truth-maker of p, or else this occasion has a 'fragment' or 'substructure' that is a truth-maker of p.

Metaphysicians have developed involved theories of truth-making.[29] It is not my intention here to enter into a discussion about the relative merits or demerits of such theories. I take it that semantics is primarily concerned with the relation that a proposition (expressed by a sentence) bears to a circumstance in which the proposition is true. If any notion of truth-making is needed at all, it will be parasitic on the notion of being true, perhaps adding some metaphysical content to the formal features of the semantic notion of truth. For the present purposes, it will be enough to observe that 'k makes p true' is a sufficient condition of 'p is true in k'. This observation alone helps us to fix attention on the kind of entity that a truth-maker is: it is an entity of such kind that a proposition can be true in it. Now, already the notion of being true in a circumstance actually leads to rather complex considerations—considerations of a kind that call for some mastery of the branch of logic known as model theory. If a metaphysician sidesteps these complications and still hopes to gain insight into the notion of truth-making (which is parasitic on the notion of being true), I suspect that the result can be nothing but an utter confusion. A metaphysical construction built on a simplistic semantic ground is all too prone to collapse.[30]

In order to clarify the sense in which a realization must be 'minimal' to count as a truth-maker, we need to look rather closely into the semantics of the temporal language we choose to study. Roughly, the idea is that if p is true in k, then a certain 'fragment' of the circumstance k 'witnesses' the truth of p, while whatever lies beyond this fragment in k is superfluous insofar as we are merely interested in the truth of p in our circumstance of evaluation. Cut off the superfluous part, and you get a truth-maker! If p and q are both true in k, their resulting truth-makers may be distinct 'fragments' of k. Furthermore, we will see that even one and the same proposition p true in a given k can give rise to several truth-makers, since it can be 'witnessed' by

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[29] For a survey, see, e.g., Mulligan *et al.* (1984), MacBride (2019).

[30] To be sure, a metaphysician can insist that the notion of truth-making is basic and the notion of being true must be defined in terms of it. Even if this was correct, there is every reason to believe that the conceptual complications of a refined understanding of the notion of being true would have to be faced in a modified form when taking truth-making as a primitive notion.

several 'fragments' of the circumstance k. All these notions can be made entirely precise by using model-theoretic means. I undertake this clarification enterprise in the follow-up paper.

Restricting attention to those realizations that indeed count as truth-makers, it is useful to observe that the same circumstance may be a *totality truth-maker* for one proposition and a *local truth-maker* for another proposition.[31] If k is a local truth-maker for p, then we could embed k into a larger structure k', and the truth of p would be preserved when moving from k to k'. A circumstance k is a local truth-maker for p iff p is true in all extensions of k. By contrast, if k is a totality truth-maker for p, then p imposes a substantial universal condition on k, so that we could *not* take an arbitrary extension of k' and be sure that p is true even in k'. A circumstance k is a totality truth-maker for p iff p is not true in all extensions of k.

What interests me in this article is the following question concerning circumstances of evaluation of temporal propositions. Suppose p is true in a certain overall circumstance k which specifies t_0 as the time of evaluation. Suppose in particular that k is 'minimal' and so counts as a truth-maker of p. Now, does the truth-maker k *obtain* at t_0? Or does it have at t_0 a different temporal status: is it so that at t_0, the truth-maker k is merely *going to* obtain? Or is it not even going to obtain, being *modal*? I will show in the follow-up paper that there is a very reasonable way to define what it means that a truth-maker obtains, what it means that a non-obtaining truth-maker is going to obtain, and what it means that a truth-maker is modal. I will indicate that under these definitions, true future contingents about future events come out as propositions having no truth-maker that obtains, though they do have a truth-maker that will obtain.

4. Courses of events and semantic evaluation

In logically informed discussions about the semantics of temporal constructions under the assumption of objective indeterminism, it is taken to be an established fact that circumstances of evaluation of propositions about future must include not only a parameter for a moment of time t, but also a parameter h for a history—a maximal branch of the underlying branching

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[31] By no means do I assume that there is a one-one correspondence between (classes of pairwise logically equivalent) propositions and their truth-makers. Actually, the correspondence is many-many: normally there are several truth-makers for one and the same proposition (otherwise the proposition should admit only of pairwise isomorphic truth-makers, a feat highly uncommon for a proposition), and the same circumstance of evaluation can make true several propositions.

time structure, a branch that passes through t.[32] In particular, according to the so-called Ockhamist semantics, proposition Fp is true relative to moment-history pair (t, h) with $t \in h$ iff there is a moment t' such that t' lies on the history h, t' is later than t, and p is true relative to the moment-history pair (t', h). Here, the operator F does not quantify over all moments x with $t \prec x$, but merely over those moments x with $t \prec x$ that belong to the fixed history h. And the circumstance of evaluation must contain such a fixed history h as an explicit component, since it cannot be read off from the time t of evaluation alone—given objective indeterminacy.[33]

In my informal comments above, I have spoken of evaluating propositions about the future simply relative to a time, not relative to a time and a maximal course of events (history). Am I, then, trying to suggest that Prior, Thomason, Belnap, and others have been mistaken when insisting on the unavoidable relativization of evaluation to a history in connection with future contingents? Yes and no. Consider a moment t_0, with a unique past and several possible futures, some of which involve moments later than t_0 at which p is true, while others render p false at all moments later than t_0. I do maintain, indeed, that it makes sense to speak of truth or falsity of Fp simply relative to t_0, in any circumstance in which a proposition may ever be evaluated. Now, in any such circumstance, it makes sense to speak of the passage of time. In particular, it makes always sense to ask, for any duration n: Which course of events will get realized when n time units will have passed? And in all but extreme cases (due to time coming to an abrupt end) there is a unique right answer to such a question, an answer spontaneously determined by letting those n time units pass, and normally not determined at all before those n time units have indeed passed. If Fp is true at t_0, this is a contingent matter of fact—'contingent' because there are possible futures on which p fails everywhere and possible futures on which p holds somewhere, and a 'matter of fact' because its supposed truth concerns only what *actually will* happen, not what *could* happen. And saying so is fully compatible with objective indeterminacy: I do not assume that what has happened up to t_0 determines what will happen. In particular, I do not suppose that the history up to t_0 provides us with enough information to tell whether Fp is true at t_0. Something more is required, and this something more is: to wait! The relevant matter of fact *will* come into being.

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[32] See Prior (1967), Thomason (1984), and for a discussion, e.g., Belnap *et al.* (2001), ch. 6.

[33] Should time be linear in the direction of future, such a history would indeed be determined by the time t and the ordering relation of the underlying temporal structure.

Indeed, Fp is true at t_0 iff there is a finite duration n such that the increasing succession of moments that get actualized after t_0 in a time span of length n leads from t_0 to a moment t at which p is true.[34] At t_0, it is as yet entirely open *which* succession of moments will get actualized in a time span of length (at most) n.[35] But it is entirely unavoidable that one and only one succession will. Of course, objective indeterminacy of 'our world' at t_0 does not mean that for every duration n, all possible ways in which the history could develop from t_0 in fact become actual. It only means that at t_0, before anything more happens, all these options remain possible. For any duration n, a course of events gets actualized over a time span that begins at t_0 and endures the length n (or less, if an end of time is reached before that much time has passed). *Which* course of events will get thus actualized is something that is regulated by generally indeterministic physical laws and human actions carried out after t_0; the relevant course of events is *not* determined by t_0.

I do not deny, then, that more than the history up to t_0 is involved in the truth-condition of Fp. This proposition is true at t_0 iff a certain history passing through t_0 contains a time t at which p is true. And this history cannot be just an arbitrary history passing through t_0, but it must be a history having an initial segment that gets in its entirety actualized in a finite amount of time counted from t_0. However, this initial segment—itself a *partial* history—need not be already actualized in order for Fp to be true at t_0. What is required is merely that it so happens that such a partial history eventually gets actualized. (A *partial* history is a course of events leading to a specific moment x. It contains x and all moments preceding x, but contains no moments later than x.) It should not appear particularly striking that a proposition expressed by a future-tense sentence has a truth-maker whose actualization lies in the future! Because, then, a proposition about future is true at t_0 thanks to the fact that a truth-maker of this proposition comes to obtain at a time t later than t_0, truth can be ascribed to the proposition simply relative to a time. The truth-condition of the proposition mobilizes, by contrast, not only the time t_0, but also a (partial) history that stretches beyond t_0.

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[34] For simplifying the exposition, I will suppose that the causal order among moments is *discrete*, whence the *length* of a time span from t_0 to t_n equals the *number* of moments t_i satisfying $t_0 \prec t_i \preccurlyeq t_n$. (I use the symbol '$\preccurlyeq$' so that '$x \preccurlyeq y$' abbreviates '$x \prec y$ or $x = y$'.) A *time unit* is the length between a moment and any of its immediate successors. Generally, lengths of time spans could, of course, be measured by positive real numbers.

[35] 'At most', since the passage of time might come to an end in less than n time units.

A part of the problem in phrasing the semantics of future contingents derives from the nature of the tools we are forced to employ in modeling semantic phenomena: we are using 'static' models to describe semantic phenomena which are partly 'dynamic'. And we cannot really do better, insofar as our models are supposed to be general, and given that they are formulated without factual (fore)knowledge. If a tree structure $(T, \prec)$ represents time, it does not by itself represent any moment $t \in T$ as the 'present' moment, though it can be used to model the present evaluation of any tensed sentence: any moment t in the structure can be considered as the present moment. We can, if we so wish, even select once and for all an element t_0 from T and say that the slightly more complex structure $(T, \prec, t_0)$ with the designated element $t_0 \in T$ indeed represents a time structure 'from the perspective' of the moment t_0 viewed as the 'present moment'.

What about the way the future unfolds from t_0, then? If the time structure conforms to objective indeterminism, there are several branches in the structure $(T, \prec)$ passing through t_0. If h and h' are such branches, they involve moments $t \in h$ and $t' \in h'$ that are incomparable in terms of the causal ordering $\prec$. At t_0, no sequence of consecutive moments later than t_0 should be designated as representing any part of the future as it will in fact unfold from t_0, since on the assumption of objective indeterminism, there is at that point no such (partial) history to be represented! It would therefore be entirely incorrect to add to our model as a further component a designated history h_0—a 'thin red line'—passing through t_0.[36] Still, it remains a fact that a part of the phenomenon we would like to model is that no matter how much or how little time passes after a given moment t_0, certain histories that were possible at t_0 will no longer be possible at the actualized later moment, and a certain partial history indeed gets actualized. Imposing in the model a thin red line passing through t_0 amounts to positioning ourselves outside the time-structure, with a God's-eye view over the whole world-history, so that we can fix once and for all how the history as a matter of fact evolves. Assuming that we can adopt such a perspective is not only epistemically utterly unrealistic, but, more importantly, metaphysically wrong. The model would suggest that a certain history has from the beginning of time been fixed as the 'actual history'. Yet, according to objective indeterminism, at no point does any

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[36] Needless to say, the same criticism would apply to the generalized proposal according to which not only t_0, but each moment t is associated with its own thin red line h_t (being a maximal course of events passing through t). For a discussion of 'thin red lines' as added components of a temporal model, see Belnap & Green (1994), Belnap *et al.* (2001), ch. 6.

history have such a status (if not at an end of time). Ever new moments get actualized, but generally, at each moment many future developments remain equally possible, and only time will tell which possibilities remain open and which are excluded for ever. The way in which the 'passage of time' or 'temporal becoming' affects what counts as actualized is simply misrepresented by the postulation of a thin red line.

Are we obliged to give up modeling the semantics of future contingents because of the problems just described? No. We must just pay closer attention to the nature of the phenomenon to be modeled, and accept that this imposes certain limitations on what can be expected of the model. In order to facilitate discussion, let us fix some terminology. If $\prec$ is a causal ordering on a given set of moments T and $t \prec t'$, then t' is a *successor* of t and t is a *predecessor* of t'. If in particular there is no t'' such that $t \prec t'' \prec t'$, then t' is an *immediate successor* of t and t is an *immediate predecessor* of t'. By definition $succ^0(t) = \{t\}$. And we let $succ^{n+1}(t)$ be the set of those elements t' such that t' is an immediate successor of an element of $succ^n(t)$. Thus, the sets $succ^n(t)$ are defined for all natural numbers n and all $t \in T$. The elements of $succ^n(t)$ are referred to as *n-th successors* of t. The set $prec^n(t)$ of *n-th predecessors* of t can be defined similarly for all suitable n and t. Now, temporal becoming manifests itself in the context of objective indeterminism as follows. If t_0 is a moment in the structure $(T, \prec)$ and $\prec$ is a discrete relation,[37] let us say that a *temporal progression beginning at t_0* is any set $\{t_0, \ldots, t_n\}$ such that for all i with $0 \leq i < n$, we have that t_{i+1} is an immediate successor of t_i along the relation $\prec$. If $m \geq 0$, let us further say that a *temporal progression $\{t_0, \ldots, t_n\}$* is *m-maximal*, if either $n = m$, or else $n < m$ and the passage of time ends with t_n.[38] Let $H_m(t_0)$ be the set of all partial histories passing through t_0 that are composed of the unique past of t_0 followed by an *m-maximal* temporal progression beginning at t_0. By objective indeterminism, the set $H_m(t_0)$ contains normally many partial histories, none of which is actualized at t_0. By temporal becoming, again, over a time span of

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[37] Discreteness means that for any moments t and t', if t' is a successor of t, there is an *immediate* successor t'' of t such that $t \prec t'' \preccurlyeq t'$, and if t' is a predecessor of t, there is an *immediate* predecessor t'' of t such that $t' \preccurlyeq t'' \prec t$.

[38] As will be spelled out in detail in the follow-up paper, there are two reasons why the passage of time may end with a given moment t_n. Either t_n is $\prec$-maximal (it has no successor along the relation $\prec$), there being no causally possible later moments. Or else there are indeed such causally possible moments later than t_n, but the passage of time just will not actualize any of them.

length *m*, exactly one partial history in $H_m(t_0)$ becomes actual. A partial history in $H_m(t_0)$ can be classified as actualized only *a posteriori*. There is no way in which an element of this set could be classified as such already at t_0.

Here comes the only delicate point of my modeling enterprise. Since it is systematic that letting any *n* time units pass starting from a given time *t**, exactly one partial history in $H_n(t^*)$ is actualized, there is a function f_{t^*} that assigns to each natural number *n* an element of the set $H_n(t^*)$ such that the value $f_{t^*}(n)$ of this function for the argument *n* is the partial history that *will have actualized* when those *n* time units have passed starting from *t**. For each duration *n*, no matter how long, we know beforehand, in particular at *t**, that there is a value $f_{t^*}(n)$. Then again, we have no clue—and we can have no clue—of *which* particular history in the set $H_n(t^*)$ this history $f_{t^*}(n)$ is. We know that the function f_{t^*} will have such a value, but as to its identity, we have no idea whatsoever. This latter issue is even metaphysically entirely open at *t**, supposing objective indeterminism.

We may represent already at *t** the partial history that will have got actualized in *n* time units as $f_{t^*}(n)$—but this must absolutely not be taken to suggest that a certain partial history *g** has already at *t** been fixed as satisfying $g^* = f_{t^*}(n)$. Until *n* time units have elapsed, the expression '$f_{t^*}(n)$' remains so to say schematic, indicating merely a certain functional dependence. It acquires a value only once those *n* time units have passed. This is crucial for our model, and slightly delicate in the sense that it can be easily misconstrued. The proponents of the idea of thin red lines are indeed prone to such a misconstrual. Supposing that there is a thin red line passing through *t** amounts to pretending that the values $f_{t^*}(n)$ are, already at *t**, defined for all positive integers *n*, while according to the interpretation that respects the idea of temporal becoming, the function f_{t^*} is at that point not defined on any of those numbers *n*![39]

In the follow-up article, I proceed to present a formal semantic framework based on two background assumptions—the postulates of *objective indeterminism* and *temporal becoming*. The framework is meant to clarify how contingent propositions about the future can *be* true while being truth-maker indeterminate—while having a truth-maker that fails to obtain, but will obtain and whose identity is therefore presently undetermined. My proposal

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[39] Consequently, speaking of 'the function' f_{t^*} must be understood schematically, as well. If *t* is a moment actualized in *n* time units after *t**, then relative to *t*, the expression 'f_{t^*}' stands for a function of type $\{0,\ldots,n\} \rightarrow T$—whereas relative to *t**, the expression 'f_{t^*}' stands for a function of type $\{0\} \rightarrow T$.

shares with the accounts of Mario Mignucci and Gerhard Seel the idea that we can meaningfully speak of the *real* future development of the world without any commitment to 'thin red lines' and without calling into question objective indeterminism. My account is meant to be metaphysically rather minimalist; I reject tensed states of affairs, and operate only with momentary occurrences of states of affairs. My goal is to render explicit the kinds of conceptual tools that a precise formulation of the semantics of future contingent sentences requires.

Acknowledgments

References

Abelard, P. (1919–1927). *Peter Abaelards philosophische Schriften I. Die Logica 'Ingredientibus'*, ed. B. Geyer (Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters XXI, Hefte 1–3). Münster: Aschendorff.

Abelard, P. (1956). *Dialectica: First Complete Edition of the Parisian Manuscript*, ed. L.M. de Rijk (*Wijsgerige teksten en studies*, nr. 1). Assen: Van Gorcum.

Ammonius (1998). *On Aristotle's On Interpretation 9*, trans. D. Blank, with Boethius, *On Aristotle's On Interpretation 9*, trans. N. Kretzmann, with Essays by R. Sorabji, N. Kretzmann and M. Mignucci. Ithaca, NY: Cornell University Press.

Aristotle (1989). *Categoriae et Liber de Interpretatione*, ed. L. Minio-Paluello. Oxford: Clarendon Press.

Belnap, N. and Green, M. (1994). Indeterminism and the Thin Red Line. *Philosophical Perspectives* 8, pp. 365–388.

Belnap, N., Perloff, M., and Xu, M. (2001). *Facing the Future. Agents and Choices in Our Indeterminist World*. Oxford: Oxford University Press.

Besson, C. and Hattiangadi, A. (2014). The Open Future, Bivalence and Assertion. *Philosophical Studies* 167, pp. 251–271.

Boethius (1877–1880). *Commentarii in librum Aristotelis Peri hermeneias I–II*, ed. C. Meiser. Leipzig: Teubner.

Broad, C. D. (1976). *Examination of McTaggart's Philosophy, Vol. II, Part I*. New York: Octagon Books.

Crane, T. (2013). *The Objects of Thought*. Oxford: Oxford University Press.

Geach, P. (1979). *Truth, Love and Immortality. An Introduction to McTaggart's Philosophy*. London: Hutchinson.

Kaplan, D. (1989). Demonstratives. In J. Almog, H. Wettstein, and J. Perry (eds.). *Themes From Kaplan*. Oxford: Oxford University Press, pp. 481–563.

Knuuttila, S. (2010). Medieval Commentators on Future Contingents in De interpretatione 9. *Vivarium* 48, pp. 75–95.

Lewis, N. (1987). Determinate Truth in Abelard. *Vivarium* 25, pp. 81–109.

MacBride, F. (2019). Truthmakers. In E. N. Zalta (ed.) *The Stanford Encyclopedia of Philosophy (Spring 2019 Edition),* URL = <https://plato.stanford.edu/archives/spr2019/entries/truthmakers>.

MacFarlane, J. (2003). Future Contingents and Relative Truth. *Philosophical Quarterly* 53, pp. 322–336.

McTaggart, J. (1908). The Unreality of Time. *Mind* 17, pp. 457–474.

Mignucci, M. (1998). Ammonius' Sea Battle. In *Ammonius* (1998), pp. 53–86.

Mulligan, K., Simons, P., and Smith, B. (1984). Truth-Makers. *Philosophy and Phenomenological Research* 44, pp. 287–321.

Prior, A. (1967). *Past, Present and Future*. Oxford: Clarendon Press.

Seel, G. (ed.). (2001). *Ammonius and the Seabattle: Texts, Commentary, and Essays*. Berlin: de Gruyter.

Seel, G. (2001a). Introduction—Future Contingencies: The Problem and its Possible Solutions. In G. Seel (ed.). (2001), pp. 15–38.

Seel, G. (2001b). Ammonius' Semantics of the Assertoric Sentence. In G. Seel (ed.). (2001), pp. 213–233.

Seel, G. (2001c). 'In a Definite Way True': Truth-Values and their Modalization in Ammonius. In G. Seel (ed.). (2001), pp. 234–246.

Thomason, R. (1984). Combinations of Tense and Modality. In D. Gabbay and F. Guenthner F. (eds.). *Handbook of Philosophical Logic, vol 2*. Dordrecht: Springer, pp. 135–165.

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