

# The Open Future: Bivalence, Determinism and Ontology<sup>1</sup>

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## Abstract

In this paper we aim to disentangle the thesis that the future is open from theses that often get associated or even conflated with it. In particular, we argue that the open future thesis is compatible with both the unrestricted principle of bivalence and determinism with respect to the laws of nature. We also argue that whether or not the future (and indeed the past) is open has no consequences as to the existence of (past and) future ontology.

## 0: Introduction

The open future thesis – the claim that contingent facts about how things will be are presently unsettled – has often been thought to have a bearing on logic and semantics, natural science, and ontology. Here are three theses that have been cited as consequences of the open future thesis:

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Non-bivalence: The principle of bivalence does not hold unrestrictedly. In particular, future contingents (claims concerning how things will be such that neither it nor its negation is metaphysically necessary) are neither true nor false.<sup>2</sup>

Indeterminism: The laws of nature are indeterministic, in that a world's being in a certain state at time  $t$  does not nomically necessitate the way it is at any future time  $t^*$ .<sup>3</sup>

Anti-Eternalism: The future does not exist; there are no future entities.<sup>4</sup>

None of these, we will argue, are implications of the open future thesis, properly understood. Any or all of them may be false, and yet the future be open in a substantial way. We will go through the theses in turn and show how an open future advocate need not accept them, and that the basic commitments of the open future thesis do not, on their own, support them.

## 1: Bivalence

### a. The argument against bivalence

Here's a familiar puzzle.

- 1) Either it's true that there will be a sea battle tomorrow or it's true that there won't be a sea battle tomorrow.

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<sup>2</sup> See, *inter alia*, Markosian (1995), Tooley (1997), MacFarlane (2003), Bourne (2004) and Brogaard (2008).

<sup>3</sup> See Prior (1967), Honderich (1988), Van Inwagen (1989), and Markosian (1995). The fact that there exists an ongoing debate as to whether or not determinism entails the permissibility of 'pre-punishment' (as in Smilansky (2007)) shows just how endemic the idea is: if, as we will argue, determinism and the open future are entirely independent, the truth or falsity of determinism is an issue totally orthogonal to the permissibility of pre-punishment, where what matters is whether it was *settled* that the crime would occur.

<sup>4</sup> See Diekemper (2005), (2007).

- 2) If it's true that there will be a sea battle tomorrow then it's true *now* that there will be a sea battle tomorrow, and likewise, *mutatis mutandis*, if it's true that there won't be a sea battle tomorrow.
- 3) If it's true *now* that there will be a sea battle tomorrow, or true *now* that there won't be, then how tomorrow is (at least with respect to sea battles) is settled by how the present is.
- 4) Therefore, how tomorrow is (at least with respect to sea battles) is settled by how the present is.
- 5) Since we were dealing with an arbitrary event at an arbitrary future time, how the future is in all respects is settled by how the present is.

(5) is the denial of the claim that the future is open in any respect whatsoever. If the above argument is good, then the open future is ruled out by the principle of bivalence. Indeed, some writers even *define* the open future thesis as the failure of bivalence when applied to future contingent truths. Here, for example, is Markosian (1995, p96) on the open future:

Let us agree on some terminology. To say, with regard to some time, *t*, that the future is *open* at *t* is to say that there are some propositions about the future relative to *t* that are, at *t*, neither true nor false. To say that the future is *closed* at *t* is to deny this, i.e., to say that every proposition about the future relative to *t* is, at *t*, either true or else false.

We can define terms how we want, of course. Someone can choose to use the term 'open future' in such a way that it is analytic, in their mouth, that the future is only

open if future contingents are neither true nor false. The principle of bivalence is obviously incompatible with the open future in *this* sense. That claim, though, is dialectically uninteresting. The open future thesis is meant to capture some pre-theoretic thought we have about the nature of time, and if we *define* it as the thesis that future contingents lack a truth value then we risk simply changing the subject. The question we should be asking is how best to understand the pre-theoretic thought about time, and whether our best understanding of this thought commits us to a rejection of bivalence.

#### b. Truth-values vs. settled truth-values

The pre-theoretic thought is that the future is as yet *unsettled*. It is helpful, we think, to think of this ‘unsettledness’ with respect to future states of the world as a type of *indeterminacy*. For all times  $t_1$  and  $t_2$  such that  $t_2$  is later than  $t_1$ , it is indeterminate at  $t_1$  what the state of the world is at  $t_2$ . (Scope distinctions are important here, as will be evident later. To emphasize, the claim is not: at  $t_1$  the state of the world at  $t_2$  is indeterminate; but rather: it is indeterminate at  $t_1$  what the state of the world is at  $t_2$ . So, with ‘ $[p]_t$ ’ read as ‘ $p$  is true at time  $t$ ’, ‘ $Dp$ ’ read as ‘ $p$  is determinately true’, ‘ $Sct$ ’ read as ‘ $c$  is the state of the world at  $t$ ’ and ‘ $Ic$ ’ read as ‘the state  $c$  is an indeterminate state of the world’<sup>5</sup>, the claim that it is open at  $t_1$  how the future at  $t_2$  will be is  $[\neg\exists xD(Sxt_2)]_{t_1}$  (at  $t_1$ , there’s nothing that is determinately the state of the world at  $t_2$ ), and not  $[\exists x(Sxt_2 \ \& \ Ix)]_{t_1}$  (at  $t_1$ , there’s some state that is the state of the world at  $t_2$  and that state is indeterminate).)

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<sup>5</sup> The notion of indeterminacy that applies to states of the world can be defined in terms of the sentential determinacy operator as follows:  $Ic$  iff<sub>df</sub>  $\Box\forall t(Sct \rightarrow \exists p([\neg Dp]_t \ \& \ [\neg D\neg p]_t))$  – that is,  $c$  is an indeterminate state of the world iff<sub>df</sub>, necessarily, and for all times  $t$ , if  $c$  is the state of the world at time  $t$ , then there is at least one proposition that is indeterminate at  $t$ : i.e. that is neither determinately true at  $t$  nor determinately not true at  $t$ .

So understood, the principle of bivalence really has nothing to do with the open future thesis. One can accept bivalence without restriction and accept that the future is open. If you find such a combination attractive – and there’s good reason to, if you are at all attracted to the open future thesis (since not giving up on classical semantics is, other things being equal, preferable to revising it) – then you should deny step (3) in the above argument.

Step (3) relies on the thought that if a proposition has a truth-value then it is settled that it has that truth-value. What else could justify the move from ‘it’s now true that p’ to ‘it’s now settled that p’? But that thought is going to be rejected by anybody who wants to retain bivalence and who thinks that there is unsettledness that is not simply a result of our ignorance of the extensions of our terms; that is, anyone who is not an epistemicist about unsettledness but who nevertheless agrees with the epistemicist that every proposition is either true or false.<sup>6</sup>

Such positions are in the minority, perhaps, but they are becoming increasingly popular.<sup>7</sup> The idea, after all, is a very simple yet seductive one: that every proposition is either true or false, but that for some propositions it is unsettled *which* truth-value they have. Determinately, it’s true that p or it’s true that not-p; but it’s neither determinate that p is true nor is it determinate that not-p is true. The world settles the matter that one or other of a proposition or its negation is the case, but it fails to settle *which* is the case.

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<sup>6</sup> Examples include the account of semantic indeterminacy defended by McGee and McLaughlin (1994), and the account of metaphysical indeterminacy defended by Barnes and Williams (ms).

<sup>7</sup> In part due to the growing uneasiness about the consequences of adopting more familiar supervaluationist theories, which retain classical logic but deny bivalence (allowing for ‘truth value gaps’). See e.g. Fara (forthcoming).

So take a borderline case of being bald; it is unsettled whether this person is bald or not; but it is settled that *either* he is bald or he isn't – those are the only options. So, likewise, it's settled that it's either true that he's bald or false that he's bald – those are the only two options. It's just unsettled which of the two (exhaustive and exclusive) options is in fact the case. For another familiar case: it is settled that the colour patch is either red or not red (and settled that it's either true that it's red or false that it's red, and true that it's not red or false that it's not red) – it's just unsettled which.<sup>8</sup> And similarly for the paradigm examples of the open future: it's settled that there either will be a sea battle tomorrow or there won't be; it's settled that it's either true that there will be a sea battle or false that there will be a sea battle – it's just unsettled which. The thought that the open future thesis requires a rejection of bivalence is motivated by the thought that indeterminacy in general motivates a rejection of bivalence, with statements that are indeterminate being neither true nor false. But this general account of indeterminacy is not forced upon us; a fortiori, it is not a consequence of the open future thesis.

In the following section, we present a model for the open future which allows us to uphold bivalence (and, we will subsequently argue, determinism and an eternalist ontology). We're not arguing that this is the best interpretation of the open future – e.g., we won't be comparing it to its rivals. Our claim is simply that if this model is a coherent picture of the open future (which we think it clearly is) then many of the claims meant to fall out of a commitment to the open future thesis are no longer

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<sup>8</sup> NB: These examples are paradigm cases of *semantic* indeterminacy. Williamson (1994, Ch.5 & 2004) has strongly criticized McGee and McLaughlin's bivalent theory of semantic indeterminacy on the grounds that its central notion (indeterminacy in which interpretation is intended) is primitive rather than semantic, and thus that the theory does not succeed as a semantic theory of indeterminacy (and must collapse into epistemicism). This criticism, regardless of how potent it is against McGee and McLaughlin's view, is obviously no argument against an analogous model applied to the *metaphysical* sort of indeterminacy we find in the open future.

entailed. Moreover, if what follows represents a *good* model for thinking about the open future, then those claims, in addition to not being *consequences* of the open future thesis, do not even seem to be *supported* by the open future thesis.

c. A model for the open future

Think about the open future as follows: for every time at our world *w*, there is a set of possible worlds that represents the potential ways *w* could be atemporally given its history and current state. That is, for any arbitrary time *t* at *w*, there are a set of worlds that are duplicates of *w* up to *t* and represent the ways *w* could possibly be atemporally, given its history up until *t*. Call this set {Futures}.<sup>9</sup> At the beginning of *w*'s history, {Futures} is very large; it<sup>10</sup> gets smaller as *w* moves through time. Each change in *w* has the effect of removing worlds from {Futures} – making certain ways a world could be (atemporally) no longer compatible with the way *w* is now. At the last instant of *w*'s life, perhaps<sup>11</sup>, {Futures} will have been whittled down to a single possible world: the possible atemporal state of *w* which is *actualized*.<sup>12</sup>

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<sup>9</sup> We are representing the strongest sense of openness here: *all* futures which are *possible* given the state of the world up to *t* are metaphysically open at *t*. The open future theorist might well want to restrict this, and there are various principled ways she could go about doing so. She might say, e.g., that {Futures} contains only the law-like worlds compatible with how things have been up to *t*, or that the worlds in {Futures} differ only with respect to the results of the free actions of agents. This would allow her to say that while it's open that you wear a red shirt tomorrow and open that you wear a green shirt, it's not open, for example, that tomorrow everything will be fish. The open future theorist doesn't, however, *need* to place such restrictions on {Futures} in order to maintain the truth of future-directed conditionals like: 'if the world continues tomorrow, there will be things other than fish'. We can define a closeness metric for the worlds in {Futures} that can allow for the truth of such plausible future-directed conditionals while allowing for the inclusion of fishy worlds in {Futures}. In that case, 'if the world continues tomorrow, there will be things other than fish' could be true and it still be metaphysically open that everything will be a fish tomorrow.

<sup>10</sup> For simplicity, we'll speak of {Futures} getting smaller. Of course, sets don't undergo change in their members: what's really going on is that the referent of the term '{Futures}' is changing – at each moment in time it refers to a proper sub-set of the set that it referred to before.

<sup>11</sup> We say 'perhaps' because nothing we say forces us to say that at the final moment of time {Futures} is a singleton set. That will only be true if the *only* source of indeterminacy is from the openness of the future; we simply remain silent on whether that's the case.

<sup>12</sup> The terminology should be familiar from ersatz theories of modality – there are many abstract representations of how reality could be, but only one (the one which matches the way the concrete actual world in fact is) is actualized.

The future of  $w$  is open at  $t$  insofar as it is unsettled at  $t$  which of the worlds in  $\{\text{Futures}\}$  is the actualized world. Given that we are thinking about such unsettledness as a form of indeterminacy, it's both natural and helpful to incorporate some of the tools from another facet of indeterminacy – namely, vagueness.<sup>13</sup> We can treat the possible worlds in  $\{\text{Futures}\}$  as *precisifications* of the present state of the actual world and then *supervalue* across them – with the determinate truths taken to be those that are true at every precisification and the propositions which are indeterminate between truth and falsity taken to be those that are true at some but not all precisifications – for some notable results.<sup>14</sup> Firstly, for any proposition  $p$  (including ones about the future), it's determinately the case that  $(p \vee \sim p)$ . All the worlds in  $\{\text{Futures}\}$  are fully classical, fully precise, and represent the state of the world for each time it exists. So no matter what  $p$  we choose, each world will either say that  $p$  or say that not- $p$ . But if  $p$  is a future-directed proposition there may well be disagreement between the worlds as to whether or not  $p$  holds. Thus it's determinately the case that  $(p \vee \sim p)$ , yet indeterminate that  $p$  and indeterminate that  $\sim p$ . Either  $p$  holds or not- $p$  holds – those are the only two options; but for facts about the future it can be unsettled which.

Secondly,  $p$  is determinately either true or false. That is, for all  $p$ , determinately  $(Tp \vee Fp)$ . Again, since all worlds in  $\{\text{Futures}\}$  are maximal and classical they all represent either the truth or the falsity of  $p$ . Those are the only two options. But in some cases there is disagreement between the worlds as to the truth-value of  $p$  (some representing

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<sup>13</sup> In what follows we make use of the apparatus for thinking about indeterminacy developed in Barnes (ms. a).

<sup>14</sup> Supervaluational accounts of the open future are quite common – see Thomason (1970) for the basic version. The supervaluationist model outlined here is somewhat non-standard, though, (as we shall note later) in a way that helps to avoid various problems with the basic supervaluational framework.

p as true, others as false), and so although it is determinate that p is either true or false, it can simultaneously be indeterminate *which* of the two truth values is had by p.

Finally, it's determinately the case that exactly one of the worlds in {Futures} is actualized.<sup>15</sup> One and only one world matches the complete atemporal state of the actual (concrete) world. It's just that it's indeterminate which of the worlds in {Futures} is in fact actualized. So at t it's still the case that determinately, there's a single, unique way the world atemporally is; it's just that it's indeterminate which (among a list of options) way is the way that the world atemporally is. That is, it's always determinately the case that the world is some particular way atemporally; it's just that (at least prior to the last moment in time) there's no single atemporal way that the world determinately is.

The narrow scope claim – that there's no atemporal way that the world determinately is – allows us to capture the 'unsettledness' content of the open future thesis while still endorsing the wide-scope claim – that determinately there is a single, unique way the world is atemporally.

So the above argument from bivalence to the denial of the open future is not compelling. The open future thought is the thought that it is not at the present time settled whether or not there will be a sea battle tomorrow. Bivalence is only going to threaten this thought if we hold that a proposition's being unsettled in truth value is incompatible with it being settled that it has one truth-value or another. We take it to

<sup>15</sup> This is a departure from the traditional supervaluationist apparatus, in which no single precisification is privileged. The model here is thus more formally analogous to the so-called 'non-standard' supervaluationism of, e.g., McGee and McLaughlin (1994) (where there is a single intended interpretation, but indeterminacy in which interpretation is the intended one). This departure from standard supervaluationism allows for the endorsement of bivalence, as well as for a disquotational treatment of truth. For further elaboration see Barnes (ms) and Barnes and Williams (ms).

be uncontroversial that it's *coherent* to deny this claim (i.e. that it's coherent to hold the *compatibility* of a proposition's being unsettled in truth value and its being settled that it has one or other truth value), and so we conclude that one shouldn't accept any account of the open future thesis that simply builds into the thesis that the future is open that future contingents lack a truth-value.

We would further argue<sup>16</sup> that the claim *should* be denied: that the *best way* of treating indeterminacy upholds bivalence, and so the principle of bivalence should *not* be rejected by those attracted to the openness of the future. It is presently settled that either there will be a sea battle tomorrow or there won't be; it's just unsettled which. Which truth-value the proposition gets will only be settled tomorrow.

John MacFarlane says that there are two intuitions that need to be captured by any successful account of the open future, and he criticises rival accounts on the grounds that they must secure one at the expense of the other. The intuitions he identifies are:

The indeterminacy intuition: “The assertion<sup>17</sup> [‘there will be a sea battle tomorrow’] is neither true nor false. After all, there are possible future histories witnessing its truth, and others witnessing its falsity, with nothing to break the symmetry.”<sup>18</sup>

The determinacy intuition: “The assertion [‘there will be a sea battle tomorrow’] does have a definite truth-value, albeit one that must remain unknown until the future

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<sup>16</sup> Citing the many counter-intuitive results that non-bivalent precisificational theories lead to. See Fara (forthcoming and 2004).

<sup>17</sup> MacFarlane speaks in terms of the assertions being true or false; we'll leave his words unaltered, but when we come to discuss the intuitions we'll speak in terms of the truth-value of the proposition *expressed by* the utterances.

<sup>18</sup> MacFarlane (2003), p321.

‘unfolds’. After all, once the sea battle has happened (or not), it seems quite strange to deny that the assertion was true (or false).”<sup>19</sup>

MacFarlane aims to save both intuitions. “But how?” he asks, “Are they not incompatible?” And he answers: “Only in the presence of the orthodox assumption that truth for utterances is non-relative.”<sup>20</sup> MacFarlane rejects this assumption, and proposes a semantics whereby the truth-value of utterances is relative both to the context of utterance and the context of assessment and on which both the above intuitions are secured.

We think that the move to a relativist semantics is unmotivated. MacFarlane has identified the wrong intuitions, and he has done so precisely because he is assuming a non-bivalent treatment of indeterminacy. The motivation for the indeterminacy intuition is good, but one would only take that to be motivation for denying that the proposition expressed by the utterance has a truth-value if one thinks that *what it is* to be indeterminate is to lack a truth value. If you want to hold a bivalent account of indeterminacy you will deny this; and so unless one wants to beg the question against such a theorist the indeterminacy intuition should be stated not as MacFarlane states but as follows:

The real indeterminacy intuition: The proposition expressed by the assertion ‘there will be a sea battle tomorrow’ is neither determinately true nor determinately false.

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<sup>19</sup> *ibid.*

<sup>20</sup> *ibid.* p322

What of the determinacy intuition? We agree that we can today look back on *yesterday's* utterance of 'there will be a sea battle tomorrow' and say whether the proposition expressed was true or false. That is, on seeing that there is no sea battle around us today (let us suppose), we can truly say 'When I said yesterday "there will be a sea battle tomorrow", I said something false'; if I had placed a bet on what I said being true, I would now owe someone some money. There is even more pressure on us to agree with this than there is on MacFarlane; he has the option of saying that it was neither true nor false, but by upholding bivalence we say that every proposition is either true or false; and so since it certainly wasn't true (given the current lack of sea battles), it must have been false. But if we can today say that the proposition expressed by yesterday's utterance of 'there will be a sea battle tomorrow' was false, we should also say of the proposition expressed by today's utterance of that string of words that it is either true or false, even if it's presently unsettled *which* it is until the future unfolds.

So should we agree with MacFarlane's determinacy intuition? No, due to the inclusion of the term 'definite'. (We're assuming 'definite' means 'determinate' here; if it doesn't, we don't know what it means.) What we said above gives us reason only to attribute a truth value to the proposition expressed by our current utterance of 'there will be a sea battle tomorrow'; but of course, that only gives us reason to think it has a *determinate* (or definite) truth value if we think that indeterminacy entails a truth value gap, which is exactly what we, in accepting a bivalent account, deny. So again, if we are to avoid begging questions against the bivalent indeterminacy theorist, the intuition we should accept as a constraint on any account of the open future is not MacFarlane's determinacy intuition but rather simply:

The truth intuition: The proposition expressed by the present assertion ‘there will be a sea battle tomorrow’ does have a truth-value, albeit one that must remain unknown until the future ‘unfolds’.

And of course, the unknowability on our account is not *constitutive* of the indeterminacy, but rather a consequence of it. Because the truth-value of the propositions expressed by presently uttered future-directed sentences are metaphysically unsettled, such propositions cannot be known – such propositions have a truth-value, but their truth-value must remain epistemically inaccessible until the unfolding of the future settles which truth-value they in fact have.

It is the truth intuition and the real indeterminacy intuition satisfaction of which are constraints on any acceptable theory of the open future. Now, we beg no questions against the non-bivalent theorists in laying down these constraints, since *one way* of accepting these two intuitions is to hold that indeterminacy entails a truth value gap and to adopt a relativistic semantics like MacFarlane’s. But, we contend, a simpler (and, in our opinion, more natural) way of securing both intuitions is simply to claim that truth is one thing and determinate truth another: the proposition expressed by our current utterance of ‘there will be a sea battle tomorrow’ has a truth value (thus securing the truth intuition), but it is indeterminate *which* one it has (thus securing the real indeterminacy intuition). Indeterminacy leads to ignorance, so we cannot know what truth value it has; tomorrow, however, we will know what truth value it had today, and we will be able to truly say ‘Yesterday we said something true (or false), although it was indeterminate’. And that’s perfectly consistent, precisely because we

adopt a bivalent account of indeterminacy, where ‘p is indeterminate’ is compatible both with the truth and the falsity of p.<sup>21</sup>

## 2: Determinism

### a. The contrast of determinism and the open future

As well as bivalence, there is another claim that the open future thesis is often contrasted to – in our opinion, mistakenly. That is the claim that the world is deterministic.

Determinism is the thesis that the future history of the world is nomically necessitated by its past history. If a world is deterministic, then once you’ve fixed the history of a world up until a time t and fixed the laws of nature at that world, you’ve fixed everything about that world. So for any two worlds, if there is a difference in what’s true according to those two worlds, then either there is a difference in the initial state of those two worlds, or it’s not the case that the same deterministic laws hold at both worlds. In other words, any two worlds that are indiscernible with respect to initial conditions and their deterministic laws of nature are indiscernible simpliciter.

It’s easy to see why determinism might be thought to entail the denial of the open future thesis.<sup>22</sup> The argument goes simply: if determinism is true then there’s only one way the future could be, given how the world is now and what laws obtain. But if

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<sup>21</sup> We grant that ‘p and it is indeterminate that p’ sounds a bit strange. But we have a diagnosis of *why* it sounds strange: it’s that it can never be *determinately* true. And we need not commit to the assertability of ‘p and it is indeterminate that p’. Our claim is just that ‘p and it is indeterminate that p’ is perfectly consistent and that ‘it *was* the case that (p and it is indeterminate that p)’ can be determinately true (and assertable). For discussion of the consistency of ‘p and it is indeterminate that p’ see Barnes and Williams (ms.) and Greenough (2008).

<sup>22</sup> The terminology itself suggests (falsely) an incompatibility – it’s somewhat natural to think that *determinism* about the future entails *determinacy* about the future. But really these are just two separate concepts, and any connection would need to be argued for.

anything's a constraint on the notion of 'unsettledness', it's that what's metaphysically necessary is settled.<sup>23</sup> So since it's metaphysically necessary, given the facts about how things are now and what laws obtain, that the future will be a certain way, the fact that the world is that way now together with the fact that those laws obtain settle it that the future is that way; which is just to say that the future is now settled, which is just to deny the open future thesis.

But of course, it's not that the future state of the world is metaphysically necessary (given determinism): it is the conditional that *if* the world has been a certain way up until time *t* and has certain laws *L* *then* it will be a certain way after *t* that determinism says is a metaphysically necessary truth; both the antecedent and the consequent of this conditional, on the other hand, are contingent. It seems, then, that the most we are entitled to say is that the consequent of the conditional is settled *if* the antecedent

<sup>23</sup> You might not agree with this. But the hardest case for us is if this assumption is true (as well as it being used in this argument that determinism entails the closed future it will also be used in a potential objection to us in section 2c below), and so we will show that we can make our case even if it is true. In fact, we feel some pull to this claim. For us, what is determinately true is what is true at every precisification, where these precisifications are certain ersatz worlds: namely, those ersatz worlds that don't determinately misrepresent the way the actual world is. Whether or not necessity entails determinacy depends on whether the precisifications are all *possible* worlds or whether impossible worlds may number amongst the precisifications. If the former then, since a necessary truth is true at every possible world it is also true at every precisification, and hence is also a determinate truth. If the latter then there might be an impossible world that is nevertheless a precisification, in which case there will be some necessary truth that is false at it, and hence not determinately true. We are attracted to the idea that every precisification is a possible world because it then falls out of the semantics that the law of excluded middle and bivalence are determinately true, whereas if there can be impossible precisifications the semantics might *allow* that they are both determinately true but it won't guarantee it.

Note that the constraint is just that what is metaphysically necessary is determinately true, and that this is compatible with the claim that it can be indeterminate whether or not a proposition in fact *is* metaphysically necessary. We are silent on whether there are any of the latter cases. If there are, though, it will require a rejection of S4. For on our account, which eschews a third-value or gappy treatment of indeterminacy, indeterminacy with respect to *p* is compatible both with the truth and the falsity of *p*. (See Barnes and Williams ms.) So it being indeterminate whether or not a proposition is necessary should be compatible with it being necessary. But if *p*'s being necessary entails it being necessary necessarily (as in S4) then, given the assumption that necessity entails determinacy and the transitivity of entailment, *p*'s being necessary entails *p*'s being determinately necessary, in which case it being indeterminate whether *p* is necessary entails that *p* is not necessary, and so indeterminacy as to whether a proposition is necessary is not compatible with it being necessary after all. *Reductio*. This shouldn't be thought to be a problem though; semantic considerations like this are exactly the kind of reasons that one should appeal to when deciding whether or not to accept such and such a modal system.

is; if there is any unsettledness in the antecedent, this may bleed over into the consequent.

This is exactly what falls out of the method of dealing with indeterminacy given in 1.C. Since the precisifications are possible worlds, and since the determinate truths are those that are true at every precisification, it follows immediately that the metaphysically necessary truths are determinately true. If the conditional ‘if p then q’ is metaphysically necessary, then, it is true at every precisification: it is determinately true. It follows that if p is determinately true then q is determinately true; for if p is true at all precisifications and the conditional ‘if p then q’ is true at all precisifications then, since each of these precisifications is a possible world (and hence obeys classical logic), q is also true at all precisifications. But if it is indeterminate whether or not p is true, this leaves it open (although it does not entail) that q is itself indeterminate. The truth value of both p and q can vary across precisifications (and hence each be indeterminate) and yet it be determinately the case that if p is true then q is true provided that each of the precisifications at which q is false is also one at which p is false.

And so we can see that the commitment of determinism is not that the future is not open, but that the future is only open if there is unsettledness in the antecedent of the conditional: i.e. only if there is unsettledness either in the state of the world up until the present time or in what laws of nature obtain. (Since the antecedent is a conjunction, indeterminacy in either conjunct will be enough to allow for indeterminacy in the consequent.) Neither of these disjuncts is implausible, as we shall soon see.

### b. Indeterminacy in laws

Consider firstly unsettledness in what laws of nature obtain. This is exactly what the believer in the open future should accept if she accepts any picture of the laws of nature – such as regularity theory<sup>24</sup> – whereby what laws hold is determined by what happens in the world. Consider the set of worlds in {Futures} at time *t*. Different regularities will hold in different worlds. Thus, if what laws obtain is determined by what regularities hold, which world is in fact actualized will determine what the laws of nature are. It may be the case, then, that no matter which laws obtain, those laws are deterministic – this just means that at each world in {Futures}, the laws at that world permit only one possible future given any particular possible past – but it still be the case that there is variation across the worlds in {Futures} concerning how things will be. This variation is perfectly compatible with there being no variation in the conditional entailed by determinism, precisely because the variation in how things will be entails a corresponding variation in what laws hold.

Of course, someone who denies the open future thesis on the grounds that the laws of nature are deterministic probably has a stronger account of the laws of nature in mind than the regularity theory. But it should be easy to see that similar points can be made to show that the open future thesis is compatible with determinism even on more substantial views of laws, such as Armstrong-style realism.<sup>25</sup>

Even on an Armstrong-style realist picture of laws, determinism and the open future thesis could both be true. Suppose that laws are reified entities – e.g., the Armstrong

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<sup>24</sup> For formulations of regularity theory see, *inter alia*, Lewis (1994) and Loewer (1997)

<sup>25</sup> See especially Armstrong (1983) for details.

picture of them as the state of affairs of a necessitation relation holding between two universals. Even given such a strong account of laws, determinism only rules out the open future thesis if we can assume that it's fully determinate what laws there are. Even if you are substantially opposed to metaphysical indeterminacy elsewhere, you might think (precisely because you are inclined to endorse the open future thesis), that it can be indeterminate which law-like states of affairs obtain. So at some time  $t$  in the middle of our world's temporal existence, it could be indeterminate whether some law-like state of affairs  $F$  obtains. This indeterminacy would be precisely due to the fact that it is as yet unsettled what will happen, and thus unsettled whether the particular universals involved in  $F$  are related in a law-like way.

Once things are settled – once the world has made its full progression through time – then that state of affairs will exist, and exist atemporally. But that's precisely because the possible world which is in fact actualized – the world which ends up being the best candidate to represent the atemporal state of our actual world – is determined by what in fact happens.<sup>26</sup> There are many candidates in {Futures} for being the actualized world, many of which represent law-like states of affairs other than  $F$ ; but they don't get selected (and the world which in fact ends up actualized does get selected) in virtue of what happens.

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<sup>26</sup> The realist about laws might object that laws are meant to 'govern' what happens, and hence that letting what laws obtain get settled by what happens gets things the wrong way round. It's not overly clear how the law-governing conception is meant to be understood, however. If what it is for laws to 'govern' the future is simply: for any world  $w$ , for all times  $t$  and  $t^*$  such that  $t^*$  is later than  $t$ , the laws at  $w$  settle at  $t$  (given the way  $w$  is at  $t$ ) what happens at  $t^*$ , then the law-governing conception is perfectly compatible with what we've said, and thus perfectly compatible with the open future. If, however, the metaphor of 'governing' is cashed out in some stronger way, such that the determinacy of the future falls out of it, then obviously the open future isn't compatible with the existence of deterministic governing laws. However, it's not clear (due to exactly the kinds of reasons we've been pressing) that such a stronger understanding of the 'governing' metaphor is warranted; it certainly no longer seems like an empirical scientific claim that such laws obtain, and so we maintain our claim that the open future theorist shouldn't be worried about the possibility that empirical science will conflict with her view.

If this is the case, then at certain times it could simply be indeterminate which Armstrong-style laws in fact hold: some worlds in {Futures} represent F laws and others represent G laws.<sup>27</sup> This renders the open future thesis again compatible with determinism. The laws of nature plus the state of the world up until now strictly imply the future state of the world. But at the present it could simply be indeterminate what the laws in fact are, thus leaving the future unsettled.

c. Indeterminacy in the present state of the world

Some are not going to be happy with the suggestion that it is indeterminate which laws of nature hold, of course. In particular, some think that nomic necessity is the strongest form of necessity, and hence that the laws of nature that hold do so as a matter of necessity.<sup>28</sup> Since every precisification, on our framework, is a possible world, it follows that there cannot be variation across precisifications as to which laws hold, and hence it cannot be indeterminate what the laws are. But of course, even if it is perfectly determinate what laws of nature obtain, a believer in deterministic laws can still accept the open future thesis provided she is prepared to accept some amount of indeterminacy in the state of the world.

How much indeterminacy depends on what form of determinism she accepts. It hasn't thus far been important, but we should now distinguish between two forms of determinism.

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<sup>27</sup> This might be considered a tension for the person who wants to restrict the worlds in {Futures} – how can you make a principled selection of which worlds can be included in {Futures} without reference to laws? The tension here is only a surface one, however. It's plausible that the person who wants to restrict {Futures} needs to make reference to laws (or law-like relations, regularities, etc) – but she doesn't need to make reference to *specific* laws. So, e.g., she can stipulate that determinately all the worlds in {Futures} are law-like while still maintaining that there's no particular law-like way which all the worlds in {Futures} determinately are.

<sup>28</sup> See, inter alia, Bird (2004).

Strong determinism: The state of the world at a time  $t$ , together with the laws of nature, necessitate the state of the world at every time later than  $t$ .

Weak determinism: The state of the world up until time  $t$ , together with the laws of nature, necessitate the state of the world at every time later than  $t$ .

Strong determinism says that for any world  $w$  with the same laws as our world, if there is a time at which  $w$  is in a state that our world is in at some time, then how the two worlds are after those times must be the same. Weak determinism adds a disjunct to the consequent: it says that for any world  $w$  with the same laws as our world, if there is a time at which  $w$  is in a state that our world is in at some time, then *either* how the two worlds are after those times is the same *or* the two worlds differ in how they are up until those times. Weak determinism is what we mean if we say that the laws plus the *initial* state of the world determine the future. It says just that if two worlds match in their initial histories *from their start* and up until a certain point then they must match in their future histories or else differ in their laws; but it allows what is ruled out by strong determinism: namely that two worlds with the same laws start differently but converge and then diverge again.

No one should have pre-theoretic or a priori reasons either for or against either deterministic thesis; the question as to which, if either, is true should be decided by philosophical reflection on best empirical science. But both theses are compatible with the open future thesis even if it is fully determinate what laws obtain.

If one holds strong determinism together with the open future thesis then one can only hold that it is determinate what laws obtain if one holds that there is indeterminacy in what the present state of the world is.<sup>29</sup>

Suppose that P is a present-directed proposition and it is metaphysically indeterminate whether P. There are two possible ways of representing the present state of the world – a P way and a not-P way. Unsettledness with respect to P would just amount to the claim that determinately one of these ways of representing actuality is correct (as they are the only two options), but neither of them is determinately correct. The present state of the world is either such that P or such that not-P, but it is simply unsettled which is the case.<sup>30</sup>

If this is coherent – and we think it is – then strong determinism does not rule out the open future thesis even given a strongly realist theory of laws that are supposed to determinately obtain. The laws determine the future state of the world given the present state of the world. But if there is genuine metaphysical indeterminacy then there is nothing such that it is *determinately* the present state of the world. If it's indeterminate what the present state of the world is then there is more than one way such that it's indeterminate which of those ways is the way the world presently is.

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<sup>29</sup> Objection: That would be to accept an open present – but the open future thesis is only interesting if the future is open in some way that is *in contrast* to how the present is. In accepting indeterminacy in the present your theorist isn't seeing anything distinctive about the *future* being unsettled: she just sees unsettledness everywhere.

Reply: The difference between the present and the future is the *extent* of the unsettledness. To make the open future thesis consistent with strong determinism we need only say that *some* claim about how things presently are is currently unsettled. That's consistent with plenty – indeed, most – of the contingent claims concerning how things presently are being currently settled; whereas the open future theorist may (see fn.8) hold that *no* contingent claim about how things will be is currently settled, or that no contingent claim concerning how free agents will act is currently settled. Either way, the future is filled with unsettledness, whereas the present is settled in many, perhaps most, respects. That's exactly as it should be: one shouldn't be discounted as an open future theorist just by believing in *some* present unsettledness.

<sup>30</sup> See, e.g., Barnes (ms) and Barnes and Williams (ms).

For each of those ways, there may be only one possible future given that the world is presently that way, and that it has the laws it does, (that is what strong determinism says); but since it's indeterminate which of those ways is the present way the actual world is, it remains indeterminate which one of those possible futures is the future of the actual world. And so the future state of the world can be left open, even given the robust account of determinately obtaining strongly deterministic laws.

If one holds weak determinism then one can believe both that the future is open and that the weak deterministic laws determinately obtain provided one accepts some indeterminacy either in how the world presently is or in how it *was*.

Weak determinism says that the future is settled by the history of the world up until now and the laws of nature. So if you settle the laws and the history, you've settled the future. But if all you settle are the laws and the *present* state of the world, weak determinism just settles a bunch of conditionals of the form 'if the past was such and such a way, the future will be so and so a way'. And so any indeterminacy in the antecedent can again bleed into the consequent: unsettledness in how things were *before* now may lead to unsettledness in how things will be *after* now.

This means that if all we have warrant for is the weaker form of determinism then the case against the open future is really quite weak indeed. For as has been remarked<sup>31</sup>, at least some of the motivations for the open future thesis also provide motivations for the thesis that the *past* is open. In that case, the believer (or some believers at least) in the open future *already* has reason to accept an unsettledness in how the past was. *Of course* weak indeterminism isn't going to pose a challenge to her position, then, given

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<sup>31</sup> Markosian (1995).

that it only motivates against the open future thesis insofar as the history of the world up until the present is settled, and if the past is unsettled then the history of the world up until the present is not settled.

#### d. Metaphysical indeterminacy and future indeterminacy

Now, the methods of reconciling the open future thesis with determinism – other than the method that says that what laws hold depends on what happens, and a fortiori that it depends on what happens in the (as yet unsettled) future – all require us to admit some metaphysical indeterminacy into the world. There is, on these views, indeterminacy either in what laws obtain, in what the present state of the world is, or in what was the case; and such indeterminacy is not plausibly the result of semantic indecision or our epistemic limitations: they must be cases of ontic indeterminacy. Many would find this objectionable.<sup>32</sup> But remember: this paper is concerned with someone who has already accepted the open future thesis. She is therefore *already* committed to making sense of robust, non-representational indeterminacy (indeterminacy in how things are, rather than how they are described). In her case, she is committed to worldly indeterminacy concerning the future. (Her claim is not simply to do with our lack of epistemic access to future truths or our inability to precisely describe future states of affairs: her claim is that *it is metaphysically unsettled* what will be the case tomorrow.) Is it then such a radical departure to posit indeterminacy in the past or present state of the world, or the exact value of the constants in the laws of nature? She already has the resources at her disposal to make sense of these ideas, since she already has to make sense of a robust (ontological, metaphysical) sense of ‘unsettledness’. If metaphysical indeterminacy were

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<sup>32</sup> Though we don’t. For a survey of arguments against ontic indeterminacy, together with the reasons why they are unconvincing, see Barnes (ms. b).

incoherent, then the defender of the open future is in trouble independently of any issue over determinism. But if metaphysical indeterminacy is coherent, then it's hard to see a principled reason for confining it to future-directed facts. (It does not seem that our evidence for determinism is ipso facto evidence that the laws and present state of the world are fully determinate.) So believing in metaphysical indeterminacy as to how the world is now, or how it was, or in what laws obtain, shouldn't be of any *additional* cost to someone who already endorses the open future.<sup>33</sup>

The idea of a metaphysically open future is fully compatible with the truth of determinism (as the interpretation of the open future given in 1.C clearly shows).

Thus those that want to explore the concept of the open future more fully should do so without recourse to a contrast with determinism.

### 3: Ontology

#### a. The non-existence of the future

The open future thesis is also sometimes taken to have consequences for ontology.

Thus we have Joseph Diekemper<sup>34</sup> arguing for the growing block theory – that there are past and present entities but not future entities – precisely to secure the intuition that the future is open in contrast to the fixed past. “[I]f the event of the Third World War exists eternally” he asks (2007), “then in what sense is that event – prior to its occurrence – *not* inexorable?” The thought, and it is a seductive one, is that if it is *now* the case that these future events exist, then it is surely *now* settled that they occur in our future, which is just to say that it's now settled that they will occur.

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<sup>33</sup> And besides, the first example – appealing to regularity theory – is neutral on these concerns, and thus the main point endorsed in this section – that determinism does not rule out the open future – stands regardless of worries about metaphysical indeterminacy.

<sup>34</sup> Diekemper (2005), (2007).

But it should be clear from the above that really the denial of future ontology is no *implication* of the open future thesis. The eternalist can be an open future theorist. It's only now settled that World War III will occur in our future if it is now *settled* that this future event exists: and that claim is not forced upon us by eternalism. The eternalist believes, simply, that what exists includes what did exist, what presently exists, and what will exist. The reasoning from eternalism to the denial of the open future thesis, we take it, goes something like as follows. Truth is supervenient on being; so what will be true supervenes on what will exist; so if the future ontology already exists (i.e. exists now) then the future truths are already settled, in which case the future is not open.

But it is only if it is now *settled* what future ontology exists that the future truths are settled; one can think that past, present and future entities all exist without thinking that it is determinate *which* future entities exist, in which case one can be an eternalist and still believe in the open future.

The existence or otherwise of the future is simply not the issue. What matters to the open future is solely that it is presently unsettled what entities will exist. *One way* to argue for this unsettledness is to deny that there are any future entities (whilst also providing some argument that nothing *else* could settle what entities will exist other than the future ontology itself); but our point is simply that this is not necessary. It is perfectly consistent to claim that there *are* future entities, but that it is as yet unsettled *which* future entities there are: that's exactly analogous to claiming that it's perfectly

settled that there is a colour that this borderline colour patch has, but that it's unsettled *which* colour it has.

The rival to the growing block theory is the 'growing cloud of determinacy' theory. The growing block theorist says that as the world moves through time, more and more things come into existence – and once they're there, they stay there. The growing cloud of determinacy theorist says that nothing comes into or goes out of existence: at all times, what there is, unrestrictedly, encompasses what there was, what there is presently, and what there will be. But at least at all times prior to the last one<sup>35</sup>, it is indeterminate what the domain of this unrestricted quantifier is.<sup>36</sup> As the world progresses through time, the options for what there (atemporally) is narrow down, and it becomes determinate (assuming that the *past* isn't open) that some things (namely, the things that *did* exist) atemporally exist – and once it's determinate that something (atemporally) exists, it remains determinate; but right up until the last moment of time (at least) there remains some indeterminacy in what there (atemporally) is, because it is always unsettled what *will* exist.

You might think we're drawing a distinction without a difference here: that our 'growing cloud of determinacy' view is really no different from the growing block view. But they are different: there are objections that, if sound, disprove the growing block theory but don't touch the growing cloud of determinacy theory. Consider the

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<sup>35</sup> Again: we make no commitment to the claim that at the last moment, everything is determinate. Our commitment is only that *prior* to this moment, some things are not determinate.

<sup>36</sup> You might be worried about the claim that the domain of the unrestricted quantifier can be indeterminate, as a result of Sider's argument (Sider 2001, p128-9) that the unrestricted quantifier doesn't admit of multiple precisifications. But remember that the view in question is that it is *metaphysically* indeterminate what the domain of the unrestricted quantifier is. Sider's argument simply does not have such a view as its target: he is quite explicit (p129) that his argument is directed against only those who share his assumption of the linguistic theory of vagueness. For discussion of Sider's argument and metaphysical indeterminacy in what there (unrestrictedly) is, see Woodward (ms.).

familiar objection that there's really no metaphysical question as to the ontological status of non-present times.<sup>37</sup> 'Exists', according to this objection, can mean either 'exists now' or 'exists now or did exist or will exist'. On the former reading, presentism is trivially true; on the latter, eternalism is trivially true. On either reading, the growing block theory is trivially false. But such an objection wouldn't touch the growing cloud of indeterminacy theory: that view is not trivially false on the second reading of 'exists'. Now, we in fact don't have any sympathy for that objection; we think we can meaningfully talk of what unrestrictedly exists *simpliciter*, and that it is an open question whether non-present (and indeed, present) ontology falls under the domain of the unrestricted quantifier. But our purpose here, remember, is just to disentangle what are and are not commitments of the open future thesis; and we maintain that the open future theorist is not *committed* to the non-existence of future ontology, and so even if she has no sympathy for the above objection to the growing block theory, she shouldn't think that she has to resist it *qua* open future theorist. If the objection turns out to be correct, the thesis that the future is open and the past fixed is simply unaffected.

#### b. The openness of the past

Just as the non-existence of the future is no commitment of the open future thesis, neither, we maintain, is the open past a consequence of presentism. We saw above that Diekemper argues for the non-existence of future ontology on the basis that the future is open; but the reason he is a growing block theorist and not a presentist is that he also wants to secure the fixity of the past, and he thinks that you need an ontological asymmetry between the existence of the past and the future to secure this

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<sup>37</sup> For discussion see the symposium on 'Defining Presentism' between Thomas Crisp and Peter Ludlow in Zimmerman (2004), p15-46.

asymmetry in openness. Our complaint by this point should be obvious. Whether or not the past *exists* is not the issue: the issue is whether or not it is presently *settled* what things existed in the past. It's perfectly consistent that there are past entities but that it is indeterminate *which* past entities there are – and so the existence of the past doesn't entail the fixity of the past; and it's perfectly consistent that there are no past entities but that it's settled what past entities there *were* – and so the non-existence of the past doesn't entail the openness of the past. Our attention, insofar as our concern is solely with the openness or otherwise of the past and future, should not be on what there (unrestrictedly) is, but on what's *settled*.

Consistency, of course, is one thing, and plausibility quite another. But we also think that the plausibility of both the open future and the open past is not affected by the existence or otherwise of past and future ontology. To demonstrate the point, let us describe what we think is an attractive position whereby the presentist can secure the fixity of the past and the openness of the future. In order to ground truths concerning how things were, the presentist should admit into her ontology *world histories*: properties that are (presently) instantiated by the (presently existing) world that determine the course of that world's history.<sup>38</sup> What world history is instantiated by the world determines what happened in that world as well as what will happen. Now we make the following conjecture: it is indeterminate what world history is presently instantiated by the world; there are a range of world histories which are the candidates for being the *actual* world history, and while it is determinate that exactly one of these world histories is instantiated, it is indeterminate *which* of them is instantiated. So far, that entails that it is indeterminate what happens in the course of our world's history, but now we make the following conjecture: each of these world histories

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<sup>38</sup> See Cameron (ms.); cf. Bigelow (1996).

agree as to how the world is up until (and including) now, but they each disagree with each other as to how the world will be after now. If those conjectures are correct then, even though this is a presentist theory (since these world histories are instantiated by presently existing ontology), the past is fixed and the future open. The past and present are fixed – it is determinate what has happened and what is now happening – because at every precisification one of the candidate world histories is instantiated, and no matter which of them is instantiated, how things were before now, and how they are now, is the same. The future is open – it is indeterminate what will happen – because the precisifications vary as to what particular world history is instantiated, and what will happen is dependent on which of these world histories is instantiated.

The natural question to ask, of course, is: what right do we have to make those conjectures? What right do we have to assume that all the candidate world histories agree on what *did* happen when they don't agree on what *will* happen? That's a good question. But we don't think we have any harder a time answering it than the question we should ask the growing block theorist: what right do you have to assume that the past exists and the future doesn't? The growing block theorist doesn't offer us an argument that the past has to exist and that the future can't exist; rather, they are guided to *postulate* this ontological asymmetry as a way of securing their *intuition* that the past is fixed and the future open. Well if that's an allowable move, it's no less acceptable for us simply to postulate that the candidate world histories agree on the past and disagree on the future on the basis of our intuition that the past is fixed and the future open. It's either okay to let this intuition drive ontology or it's not, and

our presentist is not doing anything objectionable that the growing block theorist is not doing.

In any case, our intention is certainly not to argue for either this form of presentism or for the eternalism with the growing cloud of indeterminacy theory introduced above. We're not defending a particular ontology but rather pulling apart the ontological question concerning other times from the metaphysical question as to the openness or otherwise of the past and future. It is a mistake to deny the existence of the future to secure the open future thesis, and a mistake to accept the existence of the past to secure the fixity of the past. The central question of the open future debate is simply whether what there was and will be is presently settled. This question, however, is simply orthogonal to the question of whether the unrestricted quantifier ranges over past and future ontology.

#### 4: Conclusion

We have argued that the thesis that the future is open does not entail either the denial of bivalence, the denial of (either strong or weak) determinism or the non-existence of future ontology. Whether or not one should accept any of these three theses is just a separate question. This means that someone who defends the open future thesis is not committed to non-classical semantics, indeterministic laws of nature, or particular views on temporal ontology, and hence that any attempt to characterize or define the doctrine of the open future must be developed independently of these issues.

*Perhaps* it is the case that although the open future thesis is *compatible* with bivalence, determinism and eternalism, the *best theory* of the open future leads to

their denial. But that is a substantial claim that would need to be argued for: it is not *definitional* of the open future that any of them are false. And we have provided what we think is an attractive theory of the open future which upholds bivalence and is simply silent on the question of determinism or future ontology; and so should this theory be an improvement on its rivals (which we think it stands a good chance of being), we think that the open future theorist (at least *qua open future theorist*) should uphold bivalence and simply be agnostic as to the truth of determinism or the existence of future ontology.

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