

FOUR DIMENSIONALISM[†]

MICHAEL C. REA

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Four dimensionalism, as it will be understood in this article, is a view about the ontological status of non-present objects. *Presentists* say that only present objects exist. There are no dinosaurs, though there were such things; there are no cities on Mars, though perhaps there will be such things.¹ *Four-dimensionalists*, on the other hand, say that there are past or future objects (or both); and in saying this, they mean to put such things ontologically on a par with present objects. According to the four-dimensionalist, non-present objects are like spatially distant objects: they exist, just not here, where we are.

The term ‘four-dimensionalism’ is sometimes applied to a very different sort of view.² Consider a man, Fred, who was born in 1975, went to kindergarten in 1980, and graduated from high school in 1993. One very natural way to think about this progression is to think that Fred *moves*, whole and complete, through each of these times in his career. Admittedly, he is different at each time: he grows taller, more independent, more knowledgeable, and so on as time passes. But one and the same man exists in his entirety at each of these different times. This view is sometimes called ‘three dimensionalism’ because it holds that ordinary objects are three-dimensional, temporally non-extended entities. It is also called ‘endurantism’, because objects are said to *endure* if and only if they last over time by being wholly present at every moment at which they exist.³ Some philosophers, however, believe that objects *perdure*—that they last over time without being wholly present at every moment at which they exist. So, for example, in the case of Fred such philosophers would say that the infant, the kindergartner, and the graduate are distinct *temporal parts* of a four-dimensionally extended whole. This view is variously called

‘four-dimensionalism’, ‘perdurantism’, or ‘the doctrine of temporal parts’.⁴ Some think that four-dimensionalism understood as the denial of presentism implies four-dimensionalism understood as perdurantism.⁵ But whether or not that is true, the important thing to recognize is that these are two very different views. To avoid confusion, I will in this paper reserve the term ‘four-dimensionalism’ exclusively for the view that presentism is false, and I will use the term ‘perdurantism’ to refer to the view that objects last over time without being wholly present at every time at which they exist.

Four-dimensionalism comes in several varieties. The two main varieties are *eternalism* and the *growing block theory*. Eternalists believe that all past and future objects exist (i.e., there are some past objects, there are some future objects, and there neither were nor will be objects that do not exist).⁶ Growing block theorists believe that all past objects exist, but future objects do not.⁷ There are also further options. For example, Storrs McCall (1976, 1994) endorses a *shrinking tree* theory. On his view, at the beginning of the universe every physically possible future exists, so that from every time not just one but many physically possible futures branch off. But, as the universe ages, branches disappear, thus producing a successively shrinking tree whose trunk represents the fixed past and whose branches represent remaining physically possible futures. Alternatively, one might endorse a *shrinking block* theory, according to which all future objects but no past objects and no objects belonging to “merely possible” futures exist. Or one might believe that only some but not all past objects, only some but not all future objects, or some but not all of both, exist. All of these varieties except eternalism entail that time is in some sense dynamic. Eternalism is compatible with the idea that the structure of spacetime is ever changing if we are willing to understand change as simply a matter of exemplifying different properties at different locations in spacetime. It is also at least *prima facie* compatible

with the idea that time *passes*, if we are prepared to view the property of presentness as a sort of “spotlight” moving along an eternally existing series of events.⁸ But the four-dimensionalist alternatives to eternalism seem, at least initially, to allow for more robust changes in the structure of spacetime. Most notably, these views, like presentism, hold that events, times, and objects may come into or pass out of existence.

I said above that presentists deny the existence of past and future objects whereas four-dimensionalists accept the existence of non-present objects. This way of drawing the distinction will do for rough and ready purposes, but attention to the different varieties of four-dimensionalism makes it clear that official formulations will need to be more careful. For example, if the growing block theory is true, and if there was a *first* time in the block, then that first time would have been one at which it was true that there exist no past or future objects. The same goes for the last time in a shrinking block. But it seems implausible to say that these two theories imply, respectively, that presentism was or will be true, but only for a moment. Furthermore, we must also keep in mind that presentism and four-dimensionalism are views about the ontological status of past and future objects in the *actual* world, and, properly speaking, have no implications for the ontological status of objects in other *possible worlds* if such there be.⁹ So, in light of these considerations, we should officially characterize presentism as follows. Presentism is the view that it always has been and always will be the case that there are no actual but non-present objects. Four-dimensionalism will be officially characterized as the view that presentism is false. As with our rough and ready characterization, this one leaves open the question whether presentism and its denial are *necessarily* true if true at all; but it rules out the unwelcome possibility that presentism might only be temporarily true.¹⁰

At this point, some assumptions should be made explicit. First, I assume, for ease of exposition, that the word ‘object’ applies to *events* as well as to familiar particulars like horses and trees. Second, as indicated by the parenthetical qualifier in the official formulation of presentism, I assume that in denying the existence of non-present objects, the presentist does not thereby commit herself to the repudiation of objects like numbers, properties, or other non-spatiotemporal items. Third, I assume that times are concrete sums of events. Thus, on my view, presentists and four-dimensionalists also differ about the existence of past and future times. All three assumptions are harmless. The first two are merely terminological; dropping them would just add awkwardness to our formulations. The third is more substantial; but it too could be dropped at the expense of complicating our discussion a bit. Those who deny that times are events or sums thereof typically take them to be abstract states of affairs. A presentist who endorses this sort of view will admit that past and future times *exist*, but she will deny that they *obtain*. Thus, our formulations would need to take account of this difference. But, again, nothing hinges on the issue; so, except where the view that times are abstract is explicitly under consideration, I’ll proceed on the assumption that times are concrete. One might worry that talk of times is unacceptable altogether from the point of view of contemporary physics. The reason is that such talk might seem to presuppose that time as we know it is an absolute, observer-independent feature of reality, whereas the Special Theory of Relativity seems to imply that space and time are both mere appearances of a more fundamental reality—namely, spacetime. However, there are ways of understanding talk of times that get around this concern. For example, we may say that a concrete time is a plane of simultaneity in a frame of reference or the sum of all of the events that share such a plane, and we may take an abstract time to be the total state of the universe on such a plane.¹¹

This article will provide a critical overview of the main arguments in favor of four-dimensionalism. I will begin in Section 1 by discussing several issues that will help us better to understand the nature of the debate between presentists and four-dimensionalists. Sections 2 – 4 will then discuss in detail the three main arguments in support of four-dimensionalism: the argument from the impossibility of temporal passage, the truthmaker argument, and the argument from Special Relativity. We'll see that the first two arguments on their own pose no serious threat to presentism. However, we'll also see that the options available to presentists for replying to the third argument are extremely implausible, and that the considerations commonly cited in favor of presentism are generally outweighed by those arising out of the first and third arguments taken together. Thus, I'll conclude that, as the debate currently stands in the literature, four-dimensionalism has the upper hand.

1. Understanding the Debate

Before turning to arguments in support of four-dimensionalism, it is important first to be sure that we understand the terms of the debate. There are two ways in which the current literature threatens to obscure our understanding. One is by tempting us to conflate the presentism/four-dimensionalism debate with “A-theory/B-theory” debate or with the “tenser/detenser” debate. The other is by tempting us to think that there really is no meaningful debate in the neighborhood at all—that four-dimensionalism is either trivially true or trivially false. I'll discuss each of these issues in turn.

Let us begin with the temptation to conflate the presentism/four-dimensionalism debate with the A-theory/B-theory controversy.¹² In presenting his famous argument for the conclusion that time is unreal, J. M. E. McTaggart (1908, 1921) introduces a distinction between three kinds

of ordered series of events. Working backward alphabetically, a ‘C-series’ is one whose members are ordered, but not necessarily in a temporal manner; a ‘B-series’ is one whose members are ordered by earlier-than and later-than relations; and an ‘A-series’ is one whose members each may be characterized as past, present, or future, but not all three at once. In rejecting the idea that an event may be characterized as past, present, and future all at once, McTaggart assumes that A-determinations are not reducible to B-relations. McTaggart also explicitly assumes that A-determinations are transitory.¹³ In the literature, these two assumptions have been preserved, so that it is generally held that an A-series exists only if pastness, presentness, and futurity are transitory and not reducible to B-relations. However, there are two further assumptions lurking in McTaggart’s characterization of an A-series, both of which may be dispensed with. One is that A-determinations are either properties or relations; the other is that there are three of them. The latter assumption would be rejected by a presentist who believes that times are concrete sums of events (for, on her view, there would be no past and future times to have the properties of pastness and futurity). The former assumption would be rejected by one who thinks that presentness is reducible to existence, and that existence is neither a property nor a relation.¹⁴ Nevertheless, most participants in the A-theory/B-theory debate would agree that one who rejects these two assumptions may nonetheless count as an A-theorist so long as she holds (a) that some things were or will be present which are not in fact present, and (b) that facts about what was or will be the case cannot be reduced to B-relations holding between existing things. Every version of presentism entails (b), and (a) is trivially entailed by what we might call *commonsense presentism* (the view that presentism is true and that there were or will be objects other than those present). So, as an official characterization we will say that an A-series exists just in case both (a) and (b) are true. In what follows, I will speak as if this is equivalent to the

claim that an A-series exists just in case presentness is an *irreducible transitory property*. In doing this, I ignore the fact that presentness might be reducible to something like existence, and I also ignore the possibility that presentness and existence might not be properties. We could do away with these assumptions without substantially affecting the arguments below, but only at the price of severely complicating the discussion.

In the literature on McTaggart's argument, the C-series is often ignored. Furthermore, it is generally taken for granted that the series of events that constitutes our world's history is at least a B-series.¹⁵ Thus, the three main questions in the A-theory/B-theory debate are (i) whether an A-series is possible, (ii) whether our world's history constitutes an A-series, and (iii) whether a mere B-series can count as a temporal series. As far as I know, everyone who believes that an A-series is possible also believes that our world's history *is* an A-series. Hence, the term 'A-theory' is used in the literature mainly to refer either to the view that our world's history is an A-series or to the view that no series counts as a temporal series unless it is an A-series. On the former way of using the term, McTaggart does not qualify as an A-theorist; on the latter way of using the term, he does. For purposes here, I will use the term in the former way.

People often speak as if the question whether an A-theory is true is just equivalent to the question whether presentism is true. But from what has just been said, it should be clear that it is not. McTaggart characterized the A-theory under the presupposition that eternalism is true. Furthermore, growing block theorists like Broad and Tooley, as well as shrinking tree theorists like McCall, explicitly reject presentism while at the same time endorsing the claim that presentness is irreducible and transitory.¹⁶ So one should not simply assume that accepting an A-theory commits one to presentism. Furthermore, accepting presentism does not commit one to an A-theory. For example, one might believe that only the present exists *and* that there neither have

been nor will be times other than the present. On this view, presentness might be irreducible, but it would not be transitory; hence there would be no A-series.

So the presentism/four-dimensionalism debate is not equivalent to the A-theory/B-theory debate. Nevertheless, there is at least this connection between the two: *Commonsense presentism*, as we observed above, does imply that an A-theory is true. Furthermore, some think that the implication goes in the reverse direction as well.¹⁷ Thus, the success of various arguments in the A-theory/B-theory debate will have direct bearing on the presentism/four-dimensionalism debate, even if the two debates are not to be identified with one another.

Related to the A-theory/B-theory debate is the controversy between *tensers* and *detensers*. Detensers are those who think that tensed language is somehow reducible to tenseless language; tensors are those who think that it is not. At the heart of the debate is the question whether tensed sentences can be true even if events in the world fail to constitute an A-series. For example: Suppose Jones was tall but is now short due to an unfortunate error during knee surgery. Tensors want to say that part of what makes the sentence ‘Jones was tall but is now short’ true is the fact that Jones’s being short occurs at a time which has the irreducible transitory property of being present. On their view, the meanings of words like ‘now’, ‘was’, ‘will be’, and so on can’t be cashed out in terms of earlier-than, later-than, and simultaneity relations; and the truth of sentences containing such words is not guaranteed by the mere holding of B-relations among various times. On this way of looking at things, the tensor/detenser debate is closely related to the A-theory/B-theory controversy. Indeed, the B-theory is generally taken to be a *tenseless* theory of time, and the A-theory is generally taken to be a *tensed* theory of time. Thus, insofar as we can see how one might conflate the presentism/four-dimensionalism debate with the A-theory/B-theory debate, so too we can see how one might conflate it with the

tenser/detenser debate. But, as before, it is possible to accept presentism without taking tense seriously; and it at least appears to be possible to take tense seriously without accepting presentism.¹⁸

So much, then, for the temptation to conflate our debate with others in the philosophy of time. What, now, of the temptation see our debate as empty? The worry arises as follows: Consider the four-dimensionalist claim that some time other than the present exists. In this claim, the predicate ‘exists’ is either tensed or tenseless. If it is tensed, then to affirm that some time other than the present exists is to say that some such time exists *now*, which is false. Thus, four-dimensionalism appears absurd. On the other hand, if ‘exists’ is tenseless, then it would appear to be equivalent to the predicate ‘did, does, or will exist’. But no one denies that non-present times did or will exist. Hence, four-dimensionalism appears trivial.¹⁹

A common response is to compare the presentism/four-dimensionalism debate with the actualism/possibilism debate.²⁰ Most of us believe that there are other ways the world could have been. Taking this belief seriously has led many to think that, in addition to the actual world and its concrete inhabitants, there are also countless *possible* worlds. But if there are such things, *where* are they? Two alternatives suggest themselves: they are right here in the actual world, or they are somewhere else. *Actualists* believe that everything there is exists in the actual world; so, since there aren’t any concrete things in the actual world that are plausibly taken to be possible worlds (total ways the universe might have been), actualists tend to believe that possible worlds are abstract items like propositions or states of affairs.²¹ *Possibilists*, on the other hand, believe that some things exist that do not exist in the actual world; thus, they are free to say that other possible worlds are concrete things just like ours.²² At first blush, however, their thesis is puzzling. Plausibly, the actual world is just the total way things are; and, plausibly, anything that

exists would have to be included in the total way things are. But then anything that exists must exist in the actual world, which is what the possibilist denies. Still, we can understand the debate. One way to understand it is to see it as a debate precisely over the question whether *existence* trivially entails *existence in the actual world*. Actualists say yes; possibilists say no. Another way to understand it (or perhaps the same way in different guise) is to see it as a debate over whether our *unrestricted* quantifiers range over non-actual things. That quantifiers can be restricted is evident in ordinary discourse. Are all the students in the room? Yes, for most contexts, just in case all the students enrolled in the course are present; no, however, for someone who happens to be wondering whether every student that exists has somehow managed to squeeze into her lecture hall. In most contexts, then, the quantifier in the question ‘Are all the students in the room’ is restricted; but it is also possible to drop the restrictions. Thus, the debate between actualists and possibilists might be seen as a debate over the question whether, all restrictions dropped, there exist any objects that don’t exist in the actual world. Actualists say no; possibilists say yes.

The analogy is obvious. Other times are like other worlds; they are just ways things were or will be rather than ways things might have been. Presentists hold that *existence* trivially implies *present existence*; four-dimensionalists disagree.²³ Four-dimensionalists believe that the unrestricted quantifier ranges over past and future things as well as present things; presentists disagree. Four dimensionalists will affirm claims like ‘there are dinosaurs and computers’; presentists will not. Assuming that sets exist only when their members do, a four-dimensionalist can believe that there is a set containing a dinosaur and a computer; a presentist cannot. Thus, the debate is not empty.

2. Temporal Passage

In the last section, I said that commonsense presentism implies that presentness is irreducible and transitory. But if presentness is transitory, then time passes. Virtually no one is willing to deny that there were or will be times other than the present. Thus, debate about whether temporal passage is possible has direct bearing on the question whether presentism is true.

The most well-known arguments against the possibility of temporal passage are those given by J. M. E. McTaggart (1908, 1927) and D. C. Williams (1951). Interestingly enough, however, both start with the assumption that four-dimensionalism is true. In the case of Williams, this assumption renders his argument completely sterile with respect to the presentism/four-dimensionalism debate. The crucial premise is that there is no distinction to be drawn between an event's *existing* and its *happening*. Thus, he argues, since past and future events exist, they are (in a tenseless sense) also happening; so there is no ontologically relevant difference between those events and present events that could give sense to the claim that presentness is a temporary property. But presentists needn't be concerned about whether four-dimensionalism is incompatible with temporal passage. What the presentist needs to worry about is whether temporal passage is compatible with presentism. If it isn't, then her view is in deep trouble. Williams does not speak to this question. Ultimately, neither does McTaggart; but this fact is not immediately obvious. Thus, McTaggart's argument merits closer consideration.²⁴ As I have already mentioned, McTaggart's goal was to defend the striking thesis that time is unreal. His argument for this conclusion has two main premises. The first is that a series of events counts as a temporal series only if it is an A-series; the second is that an A-series is impossible. I

will not discuss the first premise since only the second has direct bearing on the main topic of this article.

There is some dispute about the structure of McTaggart's defense of the second premise. Everyone agrees that McTaggart thinks that a contradiction can be derived from the supposition that an A-series exists (because he says so explicitly). What people disagree about is the question of *how* he thinks it can be derived. The interpretation I prefer is the one that sees McTaggart's argument as parallel to the so-called "problem of temporary intrinsics".²⁵ Since the purpose of this essay is not to settle exegetical debates but only to provide an overview of the main arguments in support of four-dimensionalism, and since I think that the interpretation of McTaggart that I favor is the one that sets his argument on strongest ground, I will not take the time to discuss other interpretations here.

The problem of temporary intrinsics is an alleged problem about the possibility of intrinsic change.²⁶ To illustrate, let us consider a putative example of intrinsic change: Philip is drunk in the evening, sober the next morning.²⁷ In order to understand this scenario as a case involving genuine change, we need somehow to be able to say that one and the same person is drunk in the evening and sober in the morning. But there is *prima facie* reason for thinking that we can't say this. Let the name 'Philip-drunk' refer to Philip when he is drunk; let the name 'Philip-sober' refer to Philip when he is sober. We then have:

(1) Philip-drunk is drunk.

(2) Philip-sober is sober.

But 'Philip-drunk' and 'Philip-sober' are supposed to be just alternative names for Philip; and, indeed, it appears that, in order for Philip to have *changed*, it would have to be the case that Philip-drunk = Philip-sober = Philip. Thus, it apparently follows that:

(3) Philip is both drunk and sober.

But (obviously) being drunk and being sober are mutually incompatible properties. Thus, it appears that the supposition that intrinsic change occurs involves a contradiction: it implies that one and the same thing can be both ϕ and not- ϕ , for some property ϕ .

The problem of temporary intrinsics is generated by the following tacit assumption:

(A) For any x and ϕ , if x is, was, or will be ϕ , then x is ϕ .

Once this is clear, there is no need to resort to using funny names for Philip in order to raise the problem. We may simply reason directly from the assumption: If Philip is drunk at one time and sober at another, then Philip is drunk and sober; but being drunk and being sober are mutually incompatible; thus, intrinsic change involves a contradiction. But once matters are put thus baldly, we can see that intrinsic change is not the culprit. The culprit is the assumption, which raises problems not only for intrinsic change, but for other sorts of change as well. If Philip is at one time the tallest man in Boston and at another time not, then Philip both is and is not the tallest man in Boston, which is contradictory; if Philip exists at one time but not at another, then Philip both does and does not exist, which is contradictory; and so on. The problem is very general, and is therefore more aptly described not as a problem about temporary intrinsics but simply as a problem about change.

Like the problem of temporary intrinsics, McTaggart's argument is just a special case of this very general problem about change. According to McTaggart, an A-series is incoherent because, on the one hand, A-determinations are mutually incompatible but, on the other hand, every event in an A-series must have every A-determination. The reason every event must have every A-determination is as follows. There exists an A-series only if A-determinations are transitory. But if they are transitory, then it must be possible for one and the same event to have

one A-determination and then another in succession. So suppose this happens: event E is present, was future, and will be past. From (A), it follows directly that E *is* past, present, and future, which is contradictory. Note that in formulating this puzzle we needn't assume that pastness and futurity are properties. Presentists will deny that anything has the *property* of being past or future since past and future events do not exist. But they will admit that present events now exemplify the property of being present and will later fail to exemplify it by failing to exist; and this is all that is needed, in conjunction with (A), to generate a contradiction.²⁸

It is possible to solve the problem of temporary intrinsics without rejecting (A). For example, we might say that Philip manages to be both drunk and sober by having distinct temporal parts, one of which is drunk and the other of which is sober. Or we might deny that Philip manages to be both drunk and sober at all—rather, he is both *drunk-at-t1* and *sober-at-t2* for some distinct times *t1* and *t2*.²⁹ However, such solutions do not carry over well as responses to McTaggart's argument. The first solution fails because everyone who believes that time passes believes that events can be wholly future, then wholly present, and then wholly past; but the temporal parts solution makes no provision for change which cannot be analyzed as the having of different parts with different properties. The second solution fails because applying it would involve treating A-determinations as permanent relational properties which, *ex hypothesi*, they aren't. The other solutions in the literature compatible with (A) suffer from similar defects. Thus, it would appear that the only responses available to McTaggart's argument are either to grant the conclusion—that A-determinations are not transitory—or to reject (A).

Rejecting (A) amounts to denying that tense is appropriately disregarded in the formulation of the puzzle. For this reason, I'll call any solution to McTaggart's problem which involves rejecting (A) a *tenser* solution. There are at least two different kinds of tensor solution.

The *strong* tensor solution denies that there are any tenseless facts at all. On this view, there is no meaningful sense at all in which something is F which is not presently F. If Philip was drunk and is now sober, there is no way of analyzing this fact in the manner of (1) and (2). Philip-drunk, insofar as he is just Philip, is not drunk; he was drunk. Similarly, there is no time t such that he is drunk at t (unless t is present). On this view, (A) is equivalent to the obviously false assumption that if an object x has ever been F, it is presently F. The *weak* tensor solution, on the other hand, grants that there are tenseless facts but simply denies that facts about A-determinations are reducible to such facts. This view offers no general solution to the problem of change; for it does not rule out the following restricted version of (A):

(A*) For any x and ϕ (such that ϕ is not an A-determination), if x is, was, or will be ϕ , then x is ϕ .

(A*) will suffice to generate the problem of temporary intrinsics and various other instances of the problem of change. However, rejecting (A) without rejecting (A*) will at least solve McTaggart's problem since that problem is specifically about A-determinations.

As should already be clear, presentism solves McTaggart's problem by entailing the strong tensor solution. Given presentism, there are no past or future objects; thus, it is trivially true that something is ϕ just in case it is presently ϕ . Still, two questions linger. First: Is a tensor solution coherent? If not, then presentism is skewered by McTaggart after all. Second: Can a non-presentist accept a tensor solution? If not, then for those who find it counterintuitive to reject the idea of temporal passage, presentism offers a distinct advantage over four-dimensionalism.

In presenting his argument, McTaggart considers and rejects a response that superficially resembles a tensor solution. He observes that the natural reply to his argument is to deny that E *is* past, present, and future and to insist instead that tense be retained: E *was* future, *is* present, and

will be past. But, he argues, making this reply launches an infinite regress. The regress arises as follows. Suppose E is present and will be past. One way to understand this is to suppose that (a) past and future times exist, (b) every event is (tenselessly) present at every time at which it exists, (c) every event is (tenselessly) past from the point of view of times later than those at which they exist, and (d) our point of view is from a time at which E exists rather than from a time later than all times at which E exists. But, of course, this is not something that a *tenser* could endorse; for it takes A-determinations to be permanent properties which are reducible to B-relations, and it explicitly allows that every event is (tenselessly) past, present, and future. Apparently, however, the only other way of understanding it is to suppose that there exists a time t_1 at which E is present and that there *will* exist a time t_2 at which E will be past. This avoids committing us to the idea that E is both present and past. But it seems to leave us right back where we started. After all, an event E is present if and only if the time at which it exists is present; thus, to say that there is a time t_1 at which E is present and there will be a time t_2 at which E will be past entails that t_1 is present and will be past. But now from (A) it follows that t_1 is both present and past—contradiction again. McTaggart notes that we can try to understand the claim that t_1 is present and will be past by saying that there is a time T_1 in some higher level time series at which t_1 is present, and there *will be* a time T_2 at which t_1 will be past. But this, in turn, entails that T_1 is present and will be past, and so we face the same problem all over again. Hence our regress.

Of course, in saying all this, McTaggart is simply taking it for granted that (A) is true and presupposing that it is unacceptable to dodge the regress by saying that tensed facts are unanalyzable. Thus, in the end, McTaggart fails to rebut the tensor solution because he fails even to consider it as a serious option. For this reason, C. D. Broad and others have characterized his

argument as a “howler”.³⁰ Broad writes: “The fallacy in McTaggart’s argument consists in treating absolute becoming as if it were a species of qualitative change, and in trying to replace temporal copulas by non-temporal copulas and temporal adjectives.” (Broad 1938, p. 317) On his view, an event’s coming to be present isn’t a matter of its acquiring some qualitative property. Rather, an event’s coming to be present is just its *coming to be*—absolutely, independent of any relations to external times. Temporal becoming (and therefore tense) is not reducible to tenseless facts about properties had at different times.

Two features of Broad’s response are worth attending to. First, Broad takes it for granted that there is a real distinction to be drawn between becoming on the one hand and change on the other. Second, he takes it for granted that it is a fallacy to treat becoming as if it were an essentially temporal process. Both claims are suspect, however. As Aristotle famously observed, when substances are generated, qualitative change *is* involved; and the generation takes place in time. When a horse comes into existence, some matter changes from being arranged non-horse-wise at one time to being arranged horse-wise at some other time. Similarly for any other case of substantial generation. So why think that matters could be any different for times and events? Given my own acquaintance with familiar cases of generation, I find it absolutely impossible to understand the view that times are generated without being generated *at a time* in some higher-level temporal series. Broad’s notion of absolute becoming seems unintelligible.³¹

But should a presentist be moved by this? I doubt it. For the intuition that absolute becoming is unintelligible just boils down to an intuition that tensed facts are reducible to tenseless ones. Thus, it boils down to an intuition that presentism is false (which, presumably, a presentist either won’t share or, for independent reasons, will find unmoving). If asked for a reason why I find absolute becoming unintelligible, all I could offer is the brute intuition that

part of what it means to say that something is present and will be past is that there is some time at which the thing is present and some later time at which it is past. To say this is just to engage in the same “fallacy” as McTaggart; only it is *not* a fallacy, but a difference of intuitions. And, if the literature is any guide, once we have uncovered this difference, there is little else to be said on either side.

Let us now waive worries about absolute becoming and focus on our second question: the question whether, if coherent, a tensor solution is available to non-presentists. Initially, one might think that it is not. For example, Dean Zimmerman (1998) argues that the primary motivation for taking tense seriously is “the desire to do justice to the feeling that what’s in the past is over and done with, and what’s in the future only matters because it will eventually be present.” (Zimmerman 1998, p. 212) But, he says, on the supposition that past or future objects (or both) exist, we have no resources for doing justice to this claim. “If yesterday’s headache still exists and remains as painful as ever,” he asks, “why should I be relieved now?” (Zimmerman 1998, p. 212). And if we try to avoid this consequence by admitting tenseless quantification but not tenseless predication—e.g., if we allow that the headache exists but deny that it is dull, sharp, painful, painless, or anything else—then we end up with a view according to which past objects are like bare particulars: they exist, but they have no properties.³²

I agree that it is a bad idea to admit tenseless quantification without tenseless predication; and so I am also inclined at least tentatively to agree that four-dimensionalist tensors will need some further solution to the problem of temporary intrinsics. If Philip exists, and if we admit tenseless predication, then we are committed to saying that he is both drunk and sober. Hence, our contradiction remains. A tensor *might* try to respond by saying that tenseless contradictions are okay; it’s the tensed ones that we want to avoid. This is certainly one way of taking tense

seriously. But it is also a very hard pill to swallow. Most four-dimensionalist tensors seem to prefer the doctrine of temporal parts.³³

But I don't think that these considerations on their own show that a weak tensor solution to McTaggart's problem is untenable. For one thing, they do not at all challenge the coherence of the solution; and, indeed, there's good reason to think that presentists *can't* challenge its the coherence. Presentism requires absolute generation; but once absolute generation is admitted, there's no reason to doubt that a growing-block theory is coherent. Thus, the weak tensor solution is on no worse footing than presentism with respect to coherence. Furthermore, even if we grant that four-dimensionalist tensors can't meet Prior's famous challenge to explain what we are thanking goodness for when we say "Thank goodness that's over!", there are other motivations for being a tensor besides the desire to meet that challenge—foremost among them being the intuition that time passes.³⁴ Moreover, Prior's challenge seems overrated. No one asks who or what we are thanking when we say "Thank goodness that's over!"; and no one thinks that there is a sound argument for theism or Platonism lurking in the neighborhood. But our feelings of gratitude at the passing of a headache are just as much—or as little!—in need of philosophical explanation as our feelings of relief.

So the weak tensor solution, if coherent at all, is readily available to four-dimensionalists. Growing block theorists may follow Broad in characterizing the passage of presentness as the absolute generation of times. Shrinking block or shrinking tree theorists may characterize it as the absolute destruction of times. And eternalists may characterize it as absolute qualitative change in times. Broad himself would balk at the idea of absolute qualitative change; but given that substantial generation always occurs in time and always involves qualitative change, it is

hard to see what grounds one could have for objecting to such change that would not also be grounds for objecting to absolute generation.³⁵

Presentism, then, offers no special advantage over four-dimensionalism with respect to solving McTaggart's problem. On the other hand, presentism solves McTaggart's problem only if the strong tensor solution is coherent; and, for some, there are strong intuitive grounds for thinking that that solution is not coherent. As we have already seen, however, the intuition that the tensor solution is incoherent is equivalent to the intuition that presentism is false; hence, it is not an intuition that presentists can reasonably be expected to share. The argument from the impossibility of temporal passage thus concludes in stalemate.

3. Truthmakers

Many philosophers are attracted to the idea that *truth supervenes on being*, or that *every truth has a truthmaker*.³⁶ To what extent these ideas are equivalent is a matter of some dispute. To say that truth supervenes on being is just to say that any world that duplicates ours with respect to what there is and how things are also duplicates ours with respect to what is true. Whether this is sufficient for every truth's having a truthmaker will depend in part upon what you think truthmakers are and what you think the relation of truthmaking amounts to. Typically, the claim that truth supervenes on being is taken to be weaker than the truthmaker principle (the claim that every truth has a truthmaker). But exploring this matter in detail would take us too far afield; so for present purposes I'll just assume that the truthmaker principle is satisfied if and only if truth supervenes on being. Our focus will be on the question whether the truthmaker principle thus conceived offers any convincing reason to reject presentism in favor of four-dimensionalism. I'll argue that it doesn't.

Ignoring details for the moment, there is a very quick way of seeing why the truthmaker principle won't be an effective weapon against presentism. In describing the principle, David Lewis concedes that it might take different forms for different philosophers. Which form it takes depends on what sorts of objects, events, properties, and relations the philosopher in question countenances. So, for example, Armstrong (1997) requires that truth be grounded in states of affairs; Lewis (1992) requires that it be grounded in "things and which perfectly natural properties and relations they instantiate." Others might impose different requirements, depending on their particular ontological views. But now it should be clear why the principle will be dialectically impotent. Targets of truthmaker objections may simply respond by expanding the class of objects, events, properties, and relations that are taken to serve as truthmakers. And once such a response is given, reviving the objection is difficult. One can call it a cheat; or one can heap disparagement upon the newly introduced class of entities; but, if the literature is any guide, such further objections are typically (and rightly) taken with a grain of salt.³⁷ Such, in fact, has been the fate of the truthmaker objection against presentism.

That said, however, let us now explore in some detail the truthmaker objection against presentism and some of the replies that are available. The objection takes the form of a *reductio ad absurdum*: (i) Suppose presentism is true. Then (ii) our world doesn't include past or future objects or events. But (iii) if our world doesn't include past or future objects or events, then there is nothing in the world that could ground propositions about the past or future. Therefore, (iv) propositions about the past and future lack truthmakers. Therefore, (v) if the truthmaker principle is true, then propositions about the past and future are not true. But (vi) the truthmaker principle is true, and (vii) at least some propositions about the past and future are true. Therefore, (viii) presentism must be false.³⁸

If we grant the truthmaker principle, the crucial premises in this argument are (iii) and (vii). The choice between the two is essentially a choice between supplying truthmakers for propositions about the past and future or somehow making plausible the claim that many or all of those propositions are false. Happily (for presentists) there are strategies available for accomplishing each of these tasks that do not exact a high ontological or intuitive price.

Toward understanding how presentists might supply truthmakers for truths about the past and future, it will be instructive briefly to consider another domain of truths for which the truthmaker principle raises *prima facie* problems: the domain of modal truths. As in the temporal case, the problem in the modal case is that there seems to be no object or event in the actual world that could ground truths about what *could have been* the case or about what *must be* the case. But, of course, there are many such truths. There could have been a tenth planet in our solar system; there couldn't have been a round square automobile on top of the number seven. David Letterman could have been shorter; he couldn't have been a golf ball. Therefore, we have a problem.

One response to this modal problem is to follow David Lewis (1986) in taking the modal operators 'possibly' and 'necessarily' to be quantifiers over concrete possible worlds. On Lewis's view, to say that there could have been a tenth planet is just to say that there exists a concrete world spatiotemporally disconnected from ours that includes a counterpart of our solar system which has a tenth planet. This response is the analog of four-dimensionalism, which takes the temporal operators 'was' and 'will be' to be quantifiers over concrete times. Thus, there is nothing in this response that will be of use to presentists.³⁹

Another response to the modal problem is to suppose that true modal propositions are grounded in irreducible modal properties of material objects.⁴⁰ On this view, what makes it true

that (e.g.) David Letterman could not have been a golf ball is just the exemplification by Letterman of the primitive property *being essentially something other than a golf ball* (or, more likely: *being essentially a human being*). What makes it true that our solar system could have included a tenth planet is either the exemplification by our solar system of the primitive property *being possibly such as to include an additional planet*, or some combination of simpler irreducible modal properties exemplified by objects in our solar system and in relevant other places throughout the universe. Likewise, then, a presentist might respond to the temporal problem by saying that truths about the past and future are grounded in irreducibly *tensed* properties of material objects.⁴¹ Some philosophers will be uneasy with the idea that there are irreducible modal properties and irreducible tenses. But commonsense presentists should not be. As we saw in Section 2, commonsense presentists avoid McTaggart's problem only by taking tense as irreducible. Thus, irreducibly tensed properties are already built into the commonsense presentist's view; and if irreducible tenses are unproblematic, irreducible modal properties should not be either.

So far, then, it appears that the presentist can dodge the truthmaker objection without incurring any ontological cost that is not already built into her view. Still, we are not out of the woods yet. For there is the further problem of accounting for the truth of singular propositions involving past objects. Various examples have been raised to illustrate this problem. Two that are particularly worthy of attention are the following, both borrowed from Sider 1999:

(7) Abraham Lincoln was tall.

(8) David Lewis admires Frank Ramsey.

Dualism and other immortality-entailing theories aside, (7) attributes a property to a past object, and (8) implied, at the time it was published, that past objects can be related to present objects.

The trouble is that, if presentism is true, then past objects don't exist and so they aren't available to have properties or to stand in relations. The names 'Abraham Lincoln' and 'Frank Ramsey' would appear to be non-referring, since there is nothing in the universe of a contemporary presentist to which they *could* refer. But if the names are non-referring, then it is hard to see how the sentences could be true.⁴²

Once again, however, we have a (rough) modal parallel. It is possible that David Lewis not exist. So there is a world in which David Lewis does not exist and in which the following proposition is true:

(9) David Lewis does not exist.

But if David Lewis does not exist in that world, then he's not around to occur in or be the subject of the proposition that he does not exist; so how could (9) possibly be true? The answer, according to some, is that, strictly speaking, Lewis himself isn't the subject of (9). Rather, Lewis's *essence* (the property of being identical to Lewis) is the subject. On this view, (9) does not predicate non-existence of Lewis. Rather, it predicates the property of being non-exemplified of Lewis's essence. Since Lewis's essence exists necessarily, (9) can be true in worlds where Lewis doesn't exist.⁴³ Thus, on the very plausible assumption that there could have been things that don't exist, our world also contains essences that could have been exemplified but aren't; and if only we were acquainted with those essences, we could truthfully assert propositions like (9) without (absurdly) committing ourselves to the conclusion that things presently non-existent can nonetheless presently have properties.

A presentist, then, might say that we *are* acquainted (by virtue of causal relations to past events) with some of the essences of non-existent objects, and this is what explains our apparent

ability to attribute properties and relations to those objects. On this view, (7) and (8) are equivalent to something like the following:

(10) The property of being identical to Lincoln was co-exemplified with the property of being tall.

(11) The property of being identical to Ramsey was co-exemplified with various other properties in such a way as to give rise (through some complex causal chain) to feelings of admiration in David Lewis.

Lincoln and Ramsey don't occur in these propositions; so there is no problem arising from the fact that *they* do not exist. The properties *being identical to Lincoln* and *being identical to Ramsey* do occur in these propositions and are presently unexemplified; but, again, our acquaintance with them can be explained by the causal connections between present events and the past exemplifications of those properties. Of course, it might seem a little odd to suppose that (7) is really about Lincoln's *essence* rather than about Lincoln himself. And the alleged equivalence of (8) and (11) might seem to have the even worse consequence that Lewis's feelings of admiration, rather than being *about* or *directed toward* Ramsey, are instead about or directed toward either nothing or Ramsey's essence (which would be absurd). But concerns about these consequences are misplaced. Even if Lincoln is not strictly the subject of (7), there is a clear intuitive sense in which (7) and (10) are *about* Lincoln. (7) and (10) tell us about a property that was co-exemplified with Lincoln's essence; and in so doing, they tell us about Lincoln himself, albeit without referring to him. Similarly, it is quite plausible to think that feelings of admiration are about or directed toward an individual just in case they are, in the right sort of way, *caused by* that individual; but (11) is consistent with—indeed, entails—that Lewis's feelings are caused by Ramsey. Thus, there seems to be no obstacle to saying that Lewis's

feelings of admiration are about Ramsey, even though Ramsey himself isn't available as an object of reference.

One might object that we haven't really solved the problem yet because we are simply taking it for granted that non-existing things can stand in relations to existing things. Causal relations *are* relations, after all; and, quite plausibly, they are existence entailing—i.e., it is plausible to think that, necessarily, only existing things are causally related. Perhaps a presentist could simply abandon this idea.⁴⁴ But even if she doesn't, there are other ways around the problem. One is to suppose that causal relations hold not between objects but between propositions or states of affairs. Another is to suppose that causal relations hold between irreducibly tensed properties of the world (e.g., the property of having had a certain sort of past, or the property of being pregnant with a certain sort of future), each of which presently exists and is presently exemplified.⁴⁵ Either way, the presentist can maintain the view that causal relations obtain only between existing things; for propositions, properties, and the world all presently exist. But she can also give sense to the claim that we are causally related to past objects like Lincoln and Ramsey and that such causal relations explain our ability to assert truths about their essences. The way to do it is just to reconstruct the causal chains leading from Lincoln and Ramsey to us in terms of true tensed propositions involving relations between their essences and ours, or in terms of tensed world properties involving their essences and ours.

The cost of embracing the package of views just described is a commitment to individual essences which exist even when the individuals of which they are essences do not exist, and a commitment to the claim that causal relations are relations among things other than concrete objects or events. Since there is independent motivation from other quarters for accepting individual essences which exist even in *worlds* in which the corresponding individuals fail to

exist, I see no reason to think that the former cost is one that a presentist should be worried about.⁴⁶ And the latter cost does not seem especially objectionable either.

So, presentists are committed to irreducible tenses in any case; and in light of the foregoing, it would appear that, at most, the only other commitment they would need to incur in order to solve their truthmaker problem is a commitment to necessarily existing individual essences. Perhaps they could even get by with less. After all, there are other, ostensibly more conservative strategies for solving the modal problem; and perhaps those strategies will have coherent temporal parallels.⁴⁷ But the modal strategies described above strike me as eminently plausible and acceptable, and so it is hard to see why presentists should not be able to adapt them for their own purposes.

However, one might think that the truthmaker problem doesn't *need* to be solved. Or, at any rate, it is not clear that it needs to be solved in a way that supplies truthmakers for *all* of the tensed propositions we take to be true. Theodore Sider (1999), for example, has recently argued that irreducible tenses alone will suffice to supply truthmakers for many tensed propositions (in particular: propositions describing purely qualitative states of affairs not involving spatio-temporal positions or relationships), and that the rest may plausibly be regarded as strictly false, but nonetheless *quasi-true*.⁴⁸ On his view, a tensed sentence S is quasi-true just in case there is some true proposition that would have been true and would have entailed S had eternalism been true.⁴⁹ That true proposition is an *underlying truth* for S. Thus, the basic idea is that sentences like (7) and (8) are strictly false, but are nonetheless close enough to the truth for presentist purposes so long as there are underlying truths for them. Though it initially seems counterintuitive to say that (7) and (8) are false, Sider points out that, in general, quasi-truths are simpler to assert than their more accurate underliers, and empirical evidence alone won't

distinguish between the two. Thus, he argues, there is a plausible psychological explanation for why quasi-truths might appear to us to be genuinely true, and presentists who endorse this solution aren't committed to rejecting the claim that we have empirical justification for our (merely quasi-true) beliefs about the past.

As Sider himself notes, it is not obvious that the quasi-truth strategy for defending presentism will take the presentist all the way home. He argues persuasively that sticky problems arise in accounting for cross-time spatiotemporal relations and causal relations. (Sider 1999, 2001) But the approach is at least promising. Still, there is an important cost associated with the strategy. Underlying truths are *purely qualitative*—i.e., they make reference only to properties and relations that can be multiply exemplified. But underlying truths in conjunction with eternalism are supposed to entail the truth of sentences like (7) and (8), which refer to specific individuals. Thus, the view implies that the exemplification of some set of purely qualitative properties might, in conjunction with eternalism, be sufficient for the existence of some specific individual (e.g., Abraham Lincoln). But many philosophers find this implausible. Suppose we managed to create a perfect atom-for-atom duplicate of Abraham Lincoln just as he was ten minutes before his death. Would our technological activity be sufficient to recreate *Lincoln himself*? If we did it twice, would we recreate him twice over? Presumably not. But if not, then why think that a purely qualitative underlier in conjunction with eternalism would *entail* that *Lincoln* was tall? Plausibly it would only entail that someone exactly like Lincoln was tall.

Of course, this objection assumes what Sider would deny—namely, that it is implausible to suppose that there are no individual essences.⁵⁰ But once this is clear, we can see that, for present purposes, the objection in no way damages the presentist arsenal. What we have now is a reply to the truthmaker objection that will suit those who like individual essences, and a

different reply that will suit those who don't. Each has its cost; but the important thing to see is that those who are troubled by the costs of one solution are extremely unlikely to be troubled by the costs of the other.

So there are various ways in which presentists might resist the truthmaker objection without paying a substantial intuitive or ontological price. Thus, I see no reason to think that the truthmaker objection on its own lends any great support to four-dimensionalism. Before closing this section, however, I should like to observe that there is another side to this coin. Thus far, I have focused exclusively on the four-dimensionalist challenge that presentists cannot supply truthmakers for tensed truths. But I would be remiss if I did not mention the fact that there are resources in the literature for presentists to raise precisely the same challenge against four-dimensionalists.

To appreciate this fact, one must first understand in a little more detail the central issue in the tensor/detensor debate. Earlier in this century, the debate between tensors and detensors concerned the question whether tensed sentences were *translatable* by tenseless sentences.⁵¹ For example, detensors held that sentences like R1 below were synonymous with sentences like R2 (where the words in parentheses represent various options for finishing the sentence that were offered by different theories):

(R1) It is now raining.

(R2) The occurrence of rain is simultaneous with (this utterance/the tokening of R1/this sense datum/etc.)

Similarly, sentences like R3 below were taken to be synonymous with sentences like R4:

(R3) It was raining yesterday.

(R4) The occurrence of rain is a day earlier than (this utterance/the tokening of R3/this sense datum/etc.).

Tensors, on the other hand, disagreed.

The tensors won this particular debate. The view that tensed sentences can be translated by tenseless sentences is now referred to as the *Old Tenseless Theory of Time*—old because it is now generally agreed to have been refuted.⁵² But detensors have regrouped in support of the *New Tenseless Theory of Time*, according to which tensed sentences aren't translatable by tenseless sentences but can, nevertheless, be given tenseless truth conditions.⁵³ As with the old theory, the underlying idea is that there is no need to regard tense as a real, intrinsic feature of the world in order to account for the truth of tensed sentences. Tensors, on the other hand, continue to press for the conclusion that tense *must* be taken to be an intrinsic feature of the world if tensed sentences are to come out true.⁵⁴ In effect, then, tensors are raising a truthmaker objection.

Well, not quite. Truth conditions are different from truthmakers. Truthmakers provide a sufficient condition for a proposition's truth; but truth conditions are necessary and sufficient conditions. Still, I think it is reasonable to see the issue in terms of truthmaking because if tenseless truthmakers can be supplied for tensed truths, the tensors' position is vitiated—and this regardless of whether the truthmakers happen also to qualify as truth conditions.

So if we agree with the tensors that a tenseless world lacks truthmakers for tensed truths, then we have a truthmaker objection against any theory that postulates a tenseless world. This isn't quite a truthmaker objection against four-dimensionalism, since growing block, shrinking block, shrinking tree, and moving spotlight theories are all four-dimensionalist theories that recognize tense as an intrinsic feature of the world. But if we add the premise (which many seem to find plausible) that four-dimensionalism is incompatible with the thesis that presentness is an

irreducible transitory property of events, then our truthmaker objection will rule out four-dimensionalism after all.

I am inclined to think that the detensers have the better of the tensor/detenser debate, and that tensed sentences can have tenseless truthmakers after all. But whether I am right about this does not really matter for present purposes; for I have already argued that it is a mistake to think that presentism is coherent *and* that four-dimensionalism is incompatible with the thesis that presentness is an irreducible transitory property. If I am right, then the truthmaker objection against four-dimensionalism is a non-starter and, indeed, the whole tensor/detenser debate is irrelevant to the question whether four-dimensionalism is true. This is a significant point in its own right since it might otherwise be tempting to think that an argument for the conclusion that tense is irreducible is *ipso facto* an argument for presentism. But that is incorrect.

4. Relativity

By far the most well-known and widely discussed claim advanced on behalf of four-dimensionalism is the claim that presentism is incompatible with the Special Theory of Relativity (SR for short).⁵⁵ Toward justifying this claim, I'll first provide a brief intuitive explanation of the central claims of SR and the reasons why one might think those claims conflict with presentism. I'll then present a somewhat more formal argument for the conclusion that SR conflicts with presentism.

In short, SR is the thesis that the laws of physics and the speed of light are constant in every inertial frame of reference. A frame of reference is a coordinate system defined with respect to a particular object in spacetime. An inertial frame of reference is a coordinate system that is not accelerated. For example: imagine two particles A and B floating past one another in

outer space at a constant rate of 10 km/hr; and imagine further that each particle is at the origin of its own distinct coordinate system. The coordinate systems will then be frames of reference defined with respect to each particle; and they will be *inertial* frames of reference because neither particle (and hence neither coordinate system) is accelerated. If particle A accelerates, say because it comes under the gravitational influence of a nearby asteroid, then the corresponding frame of reference accelerates and so ceases to qualify as an inertial frame of reference. To appreciate the significance of the thesis that the laws of physics and the speed of light are constant in every inertial frame of reference, it will help to consider a pair of examples.

First example (borrowed from Geroch 1978): There are certain particles called *mu mesons* which, when produced under laboratory conditions, have a life-span of one microsecond. The same sorts of particles, however, are produced in nature by the collision of cosmic rays with atoms in the upper atmosphere. The mu mesons that are thus produced naturally travel toward the earth at high speeds and have a life-span of 10 microseconds. According to SR, however, the laws of physics are the same in every frame of reference; thus (contrary to appearances) mu mesons produced in a lab and mu mesons produced in nature decay at the *same* rate in their respective frames of reference. The upshot is striking. If SR is true, it follows that observers at rest with respect to naturally produced mu mesons would observe those particles to have a life-span of one microsecond whereas we would observe the very same particles to have a life-span of ten. Thus, SR entails that different observers in different frames of reference may disagree about durations.

Second example (adapted from Einstein 1961): Suppose you are traveling on a very long train (a train that is 1 light-second long, as measured by someone on the train) which is moving at a speed of 1000 m/sec relative to its track. Suppose further that, at time t_1 , the rear end of the

train is at point A on the track, and that at time t_2 (one second later than t_1) the front end of the train is at point B on the track. Standing at point A at time t_1 , you emit a light signal. Given that the speed of light is constant in all frames of reference, and given that the length of the train as measured by someone on the train is 1 light-second, it follows that the signal takes exactly one second to reach the front end of the train, which would then be at point B on the track. But notice: if, as seems plausible, the length of the train as measured by someone on the train is the *same* as the length of the train as measured by someone on the track, it follows that the distance between point A and point B is 1000 meters *more* than one light second. But if that is right, then we are committed to saying either that the light signal traveled, relative to the track, a distance greater than one light-second in one second, or that, relative to the track, the trip taken by the light signal took more than one second. The thesis that light travels with constant velocity in all frames of reference rules out the first alternative; thus, if we accept SR we are forced to affirm one or both of the following claims: (i) a trip that takes one second in the train's frame of reference takes longer in the track's frame of reference, or (ii) an object 1 light-second long in the train's frame of reference is shorter in the track's frame of reference. In other words, SR commits us to the conclusion that observers in different frames of reference may disagree about distances, durations, or both.

In Newtonian physics, distances and durations are invariant across inertial frames of reference. In SR, they are not. SR entails that observers in different inertial frames of reference will disagree about distances and durations; but they will agree about a quantity called the "interval" between two events. The interval is a kind of combination of distance and duration, including as "components" all three spatial dimensions and the temporal dimension. What it measures is a separation in *spacetime* rather than a separation in space or time. Still, physicists

do speak of *spacelike* separations and *timelike* separations between events; and since the facts about such separations depend exclusively on facts about the interval between the separated events, those facts too are invariant across inertial frames of reference. Events are spacelike separated when the interval between them is positive, timelike separated when the interval is negative, and *lightlike* separated when the interval is null. Timelike separated events are events such that signals traveling slower than light could reach one from the other; spacelike separated events are events such that only signals traveling faster than light could reach one from the other; and lightlike separated events are events such that only signals traveling at the speed of light could reach one from the other. For example, suppose you watch a batter at a distance hit a baseball. You see the hit; a moment later you hear the crack. Intuitively, what you see (like what you hear) occurs some time *after* the actual hitting itself. So: let E1 be whatever event in your life happened simultaneously (in your frame of reference) with the hitting of the baseball; let E2 be your seeing the hit; let E3 be your hearing the crack. The actual hitting of the ball was spacelike separated from E1; no causal signal slower than or equal to the speed of light could have put E1 in touch with that event. But the hitting of the ball was perhaps lightlike separated from E2 (since it is the light signals coming from that event that are responsible for your seeing it), and it was clearly timelike separated from E3 (since slower-than-light signals could and did travel from that event to E3). We should note that it is a mistake simply to equate spacelike and timelike separation respectively with our intuitive notions of spatial and temporal separation in a frame of reference. But timelike separation does seem to *entail* temporal separation in a frame of reference. At any rate, events that are timelike separated are typically said to be in each other's absolute past or absolute future; and it is hard to see how those descriptions could possibly be inappropriate.

Geometrically, the explanation for why observers in different frames of reference disagree about distances and durations while agreeing about intervals is that such observers are rotated with respect to one another. In other words, SR implies that uniform relative motion *just is* rotation in spacetime. But now it is easy to see why SR poses a problem for presentism. Earlier, we said that in a relativistic context times are plausibly taken to be sums of events sharing a plane of simultaneity in a frame of reference (or, alternatively, the state of the universe on such a plane).⁵⁶ So far so good; but the fact is, given commonsense assumptions about what other objects exist in the world, there are objects that share a plane of simultaneity with me which are also in relative motion (and thus rotated) with respect to me. But this implies that a plane of simultaneity defined relative to my frame of reference will *intersect* (rather than completely overlap) a plane of simultaneity defined relative to their frame of reference. So consider some such object X. X will be on my plane of simultaneity, but I will not be on X's. Furthermore, events that are in my absolute past or my absolute future might be on X's plane of simultaneity. Thus, if I define 'the present time' as the sum of all of the events that share a plane of simultaneity with me in my frame of reference, and if I also say that only present events exist, then I arbitrarily privilege my own frame of reference over X's. Furthermore, if someone in X's frame of reference offers the same sort of definition and then goes on to accept presentism, her view will have the (obviously false) consequence that I don't exist. Thus, it would appear that SR is inconsistent with presentism.

There are, of course, various ways of resisting this argument. But before presenting those, I would like first to offer a somewhat more formal presentation of it. The argument runs as follows:⁵⁷

- (1) SR is true. (Premise)

- (2) The present time relative to an event x on the worldline of an object O is the sum of all of the events that share a plane of simultaneity with x in O 's frame of reference. (Premise)
- (3) There is at least one event E that (a) exists at the present time in my frame of reference and (b) is on the worldline of an object in motion relative to me. (Premise)
- (4) Therefore: There is at least one event E such that the present time relative to E is not identical to the present time relative to me. (From 1, 2, 3)
- (5) Presentism is true only if there is a unique present time. (Premise)
- (6) Therefore: Presentism is false. (4, 6)

No one denies that the sub-argument for (4) is valid. Given this, there should be no question that the rest of the argument is valid either. Thus, all that is left for a presentist to do is to reject one of the unsupported premises: (1), (2), (3), or (5). I'll briefly consider each of these alternatives, beginning with the denial of (2).

First response: Deny that the present time relative to an event x in the career of an object is to be defined as the sum of all of the events sharing a plane of simultaneity with x in the object's frame of reference. One who endorses this solution (and who believes that she exists at the present time) rejects the general view that a time is to be identified with a sum of events on a plane of simultaneity in some frame of reference.⁵⁸ This seems sensible enough at first glance. On presentism, the present time is ontologically privileged (by virtue of being the only time that exists). But SR countenances no privileged planes of simultaneity or frames of reference. Therefore, on presentism, the present time should not be identified with a sum of events on a plane of simultaneity in a frame of reference. But what are the alternatives? Broadly speaking,

three have been taken seriously in the literature: define the present time relative to an event E as the sum of all or some of the events that are spacelike separated from E; define it as the sum of all or some of the events that are either timelike or lightlike separated from E; or define it as including nothing more than E itself.⁵⁹ The trouble is that all of these suggestions imply one or more of the following claims: (a) what events count as present vary from observer to observer, (b) for some observers, past or future objects exist, or (c) there are no objects which are present but not coincident with E. Which of these claims are implied depends on the way in which the various suggestions are developed; but the important thing to notice is that the first conflicts with premise (5), the second conflicts with the fundamental presentist thesis that past and future objects don't exist, and the third conflicts with premise (3). What we need, then, to escape the argument is some plausible way of defining 'the present time' that will not imply any of (a) - (c). Unfortunately, contemporary physics seems utterly devoid of resources for doing this.

Second response: Deny that there exists at the present time at least one other event on the worldline of an object in motion relative to me. One who endorses this view *might* accept the fact that other objects exist but (bizarrely) deny that any of them are in motion. More likely, one who accepts this view will simply deny that there are any other objects in the world at all. In other words, the rejection of (3) is most naturally accompanied by a very extreme form of solipsism. (Not only are there no other minds; there are no other *things*.) Surprisingly enough, this response has been recommended in the literature, though generally in conjunction with the relative-existence response discussed below.⁶⁰ But most, I think, will agree that if this is the best that can be done to save presentism, four-dimensionalism comes out the clear winner.

Third response: Deny that presentism implies that there is a unique present time. Presentism, again, is the view that no times other than the present exist. But, in light of the above

considerations, there are at least two ways of understanding this. So far I have been understanding presentism as equivalent to the claim that, always, there exists exactly one time. But one might instead take presentists to be asserting that, always, there exists *relative to them* exactly one time. In other words, one might take presentism as implying that existence is observer-relative.⁶¹ If ‘the present time’ is defined in terms of simultaneity, this view will imply that existence is *frame*-relative; if ‘the present time’ is defined in terms of spacelike, timelike, or lightlike separation, it will imply that presentness is *event* relative; and if ‘the present time’ is identified with the single event which is “here and now”, it will imply a “pluralistic solipsism”.⁶² Admittedly, embracing relative existence avoids the conflict between presentism and SR. But is presentism really *so* powerfully intuitive that we should be willing to relativize existence in order to save it? My own inclination is to say no—mainly because I find the notion of relative existence wholly unintelligible. Moreover, even if this relative-existence brand of presentism were intelligible, it is not at all clear that it would offer any real advantage over four-dimensionalism. After all, in some sense it actually *preserves* the four-dimensionalist intuition that all events in spacetime are ontologically on a par.⁶³ The main difference is that instead of all existing *simpliciter*, they all exist from some points of view but not from others.

Final response: Reject SR. This is by far the most popular response; and, though I am not convinced that it is an especially reasonable response, I do think that it is at least *much more* sensible than any of the alternatives we have just considered. There are various arguments in the literature for the conclusion that it is reasonable to reject SR. Among the more well-known claims that have been made (individually or jointly) on behalf of rejecting it are the following:

- (A) The thesis that there is a privileged reference frame was rejected by Einstein for verificationist reasons. But verificationist reasons are not good reasons.⁶⁴

- (B) It is possible to construct theories that are empirically equivalent to SR and according to which there is a privileged frame of reference.⁶⁵
- (C) The thesis that there is a privileged frame of reference is actually favored by other scientific theories (e.g., general relativity and quantum mechanics).⁶⁶
- (D) SR is not really a theory about *time* at all. Rather, it is a theory about observable luminal relations among physical events, and nothing more. Construed as such, it may be true; but construed as a theory about time, it is false.⁶⁷

It is beyond the scope of this paper to assess the merits of these claims. But we should notice that, apart from endorsing (D), anyone who pursues this route in replying to the argument from SR has effectively *conceded* that SR conflicts with presentism. The only question once this has been conceded is whether SR itself should be the victor in the conflict.

For the moment, let's ignore option (D) and take it for granted that SR *is* a theory about time. Obviously if the empirical evidence ultimately goes against SR, the threat it poses for presentism will evaporate. The more interesting question is what we should say if it turns out that the empirical evidence does not favor SR over some non-relativistic rival. One might think that pragmatic considerations (appeals to elegance, ease of exposition, ontological economy, and so on) should guide our choice. But, though there may well be non-relativistic rivals to SR, it is doubtful that any extant rival would be favored over SR by such criteria as these. Indeed, part of the complaint against SR is that pragmatic criteria seem to play *too much* of a role in explaining why it is favored over its rivals.

Alternatively, one might try to settle the matter by an appeal to intuition.⁶⁸ This, in fact, is the most common sort of appeal made on behalf of presentism. Intuition speaks strongly in favor of the conclusion that presentness is a temporary intrinsic property. It also speaks strongly in

favor of the conclusion that there aren't any dinosaurs, that Julius Caesar is no more rather than very far away, that we who are alive today are not in any sense unborn or already dead, and so on. Furthermore, many of our ordinary attitudes toward time—for example, our tendency to experience indifference toward events we believe to be in the distant future and relief or nostalgic longing toward various events that are in our past—seem to reflect a belief that past and future events don't exist.⁶⁹ So one might think that, insofar as presentism is not decisively ruled out by empirical evidence, these sorts of intuitions may and should take the lead. But here too I think that presentists are on shaky ground. For one thing, many of us have intuitions that conflict with presentism (for example: the intuition that absolute becoming is unintelligible). For another thing, both SR *and* its non-relativistic rivals entail that space and time are very different from what ordinary intuition takes them to be. Nobody, pre-theoretically, thinks that objects shrink when they go very fast or that time speeds up as objects slow down. But, so far as we can tell now, these consequences (or relevantly similar ones) will be implied by *any* physical theory consistent with the empirical data. These considerations do not all by themselves reveal that our intuitions about space and time are worthless. But they should give us pause about trusting them too far.

As I mentioned above, some philosophers think that the problem with SR lies not in its claims about the observable behavior of light, rigid bodies, and other physical objects, but rather in its claim to tell us something about *time*. The motivation for thinking that SR is not a theory about time comes in large part from the idea that objects not existing in our spacetime might nonetheless stand in temporal relations. Thus, for example, Quentin Smith (1995) argues that propositions and mental states are not in physical spacetime but nonetheless stand in temporal relations; and William Lane Craig (1990) argues that God is in time without being in physical

spacetime.⁷⁰ One who accepts this sort of view can deny what I said in the previous paragraph about physical theories implying that time is not what we imagine it to be; for (as I understand it) their view implies that the nature of “real” or “metaphysical” time is not described by physical theory.

I have some sympathy with this sort of view. I am somewhat attracted to the idea that God is in time, but that his time is not physical time. I also think that mind-body dualism ought to be taken seriously. (For those inclined to scoff at mind-body dualism, see Rea 2002, where I argue that even naturalists are committed to it.) But both of these views seem to imply that there are events that are in time but not in physical spacetime. Still, I see no reason to think that adopting the view that SR is not a theory about time will be of any real help to the presentist. Admittedly, she dodges the conclusion that past and future *times* exist by going this route. But even on a non-temporal construal, SR will still imply that past and future *physical objects and events* exist. Thus, one who accepts such a construal of SR will still be committed to the claim that dinosaurs, Julius Caesar, our births and deaths, and everything else that ever was or will be all exist just as we do. So it is not at all clear that, in going this route, the presentist manages to save anything that is worth saving. She will preserve the intuition that time passes and that tense is an objective feature of the world. She may also preserve the bare claim that non-present times (whatever times might be, on this view) do not exist. But, as we saw in Section 2, presentism offers no special advantage over four-dimensionalism with respect to accommodating tense and the passage of time; and once we have conceded the existence of all past and future physical objects and events, it is hard to see why we should care about, or be motivated to accept the view that there are no times other than the present. Denying that physical time is real time saves presentism only by stripping it of all that makes it attractive.

5. Conclusion

Ultimately, then, presentism has very little going for it. It is committed to what some take to be an incoherent notion of absolute becoming; it offers no advantage over four-dimensionalism with respect to accommodating tense or temporal passage; and the only viable alternatives to admitting that it conflicts with SR involve a commitment to extreme solipsism, relative existence, or both. Furthermore, even if SR is false, there is no reason to think that intuition will generally favor presentism over four-dimensionalism. As I see it, then, all of this together constitutes a strong cumulative case in favor of four-dimensionalism.

NOTES

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¹ Presentism is compatible with the view that there neither were nor will be objects other than those present; but I am not aware of any presentists who endorse such a view. Defenders of presentism include Bigelow (1996), Chisholm (1990), Merricks (1994, 1995, 1999) Hinchliff (1996, 2000), Markosian (2002), Prior (1959, 1962, 1967a, 1968, 1970, 1996), and Zimmerman (1996, 1997, 1998) . Sider (1999) offers important arguments on behalf of presentism, though he himself does not endorse it. See also Crisp's contribution to this volume.

² See for example Heller 1990, Heller 1993, Sider 1997 and Sider 2001

³ In support of endurantism, see Chisholm 1976 (Appendix A), Haslanger 1989, Hinchliff 1996, Johnston 1987, Merricks 1994, Rea 1998, van Inwagen 1990, Zimmerman 1998.

⁴ In support of perdurantism, see Armstrong 1980, Lewis 1986 (pp. 202-204), Lewis 2002a, Heller 1990, Heller 1993, Sider 1997, and Sider 2001. Whereas orthodox perdurantism says that familiar objects persist by having distinct temporal *parts* at different times, there is a variation on perdurantism according to which familiar objects persist by having distinct *counterparts* standing in for, or representing, them at various times. This view is described and defended in Sider 1996, Sider 2000, and Sider 2001.

⁵ See, for example, Armstrong 1980, Balashov 2000, Broad 1927 (ch. 2), Carter & Hestevold 1994, Christensen 1981, Gödel 1949, Merricks 1995, Merricks 1999, Quine 1960 (sec. 36), and Smart 1962. Note too that some think the implication goes the other way: perdurantism implies

the denial of presentism. See, for example, Carter & Hestevold 1994, Merricks 1995, Merricks 1999, and Oaklander 1992. In Rea 1998, I argue against the view that four-dimensionalism implies perdurantism. However, the argument works only if WP (1998: 234) is amended so that condition (b) reads as follows: (b) it is not the case that the x s t -compose a proper part of y .

⁶ See, for example, Grünbaum 1963, LePoidevin 1991, Mellor 1981a, Mellor 1998, Minkowski 1908, Quine 1960 (sec. 36), Russell 1915, Smart 1962, Sider 2001, and Williams 1951.

⁷ See Adams 1986, Broad 1927 (ch. 2), Tooley 1997, Rakić 1997, and Zeilicovici 1989.

⁸ The ‘moving spotlight’, or ‘policeman’s bullseye’ metaphor is due to, but not endorsed by, C.D. Broad (1927, chap. 2).

⁹ Thanks to Richard Hanley for this point. More on possible worlds in Section 1 below.

¹⁰ Some characterize presentism as the view that, *necessarily*, no non-present objects exist. (See, e.g., Bergmann 1999 and Sider 2001.) However, I see no reason to dismiss at the outset the possibility that presentism and its denial are contingent.

¹¹ For a characterization of planes of simultaneity and frames of reference, see Section 4 below. Alternative ways of characterizing times in a relativistic context correspond to the various alternatives for defining the ‘present time’ that are discussed in Section 4.

¹² See Williams 1996 for references illustrating how the two debates have been conflated in the literature. After exposing various ways in which the A-theory/B-theory debate has been misunderstood, and after showing how various ways of characterizing the debate fail, Williams challenges subsequent workers on the issue to find in the debate a “genuine contrast of believable theories”. Below I characterize the debate in a way that I think provides a satisfactory answer to this challenge.

¹³ Following Sosa 1979, I say that a property is transitory iff it may be exemplified by some entity without being eternally exemplified by that entity. Thus, a property may count as transitory even if it is had essentially by the things that have it.

¹⁴ See, e.g., Craig 1997.

¹⁵ There is some debate about whether a B-series could exist without an A-series; but we'll leave that debate aside. Also, some—e.g., Craig (1998)—differentiate between a “pure A-theory”, a “pure B-theory”, and a “hybrid A-B theory”. On this view, presentism is a pure A-theory, eternalism is a pure B-theory, and dynamic versions of four-dimensionalism are the hybrids. However, I see no reason to deny that presentism is an A-B hybrid. Presentists face a *prima facie* problem of explaining how present events could stand in B-relations with non-present events (there being no such things). But any plausible presentism will have to find *some* way to make sense of cross-time relations; and once this is done, presentism will have the resources to accommodate B-relations.

¹⁶ See Broad 1927 (ch. 2), McCall 1976, McCall 1994, and Tooley 1997. Others who have (apparently) accepted an A-theory without accepting presentism include Bigelow (1991) and Smith (1995). Bigelow has more recently accepted presentism (Bigelow 1996). Smith accepts a doctrine which he *calls* presentism but which differs from what presentism is ordinarily taken to be.

¹⁷ See, e.g., Craig 1997. Cf. also Zimmerman 1998.

¹⁸ See references in note 16.

¹⁹ Cf. Larry Lombard's remarks on the apparent triviality of presentism in Lombard 1999, p. 254. For responses to this sort of worry, see Zimmerman 1996, Zimmerman 1998, and Sider 1999. My own responses below mirror and borrow examples from theirs.

²⁰ Cf. Adams 1986, Markosian 2002, and Sider 2001 (ch. 2).

²¹ Cf. Plantinga 1974, Plantinga 1976.

²² Cf. Lewis 1986.

²³ More carefully: Presentists hold that *actual* existence trivially implies present existence. After all, a presentist who accepts a Lewisian brand of possibilism might think that there are other concrete *worlds* (that don't exist at the present time), but not other concrete *times*. Since most presentists are actualists, however, I'll ignore this complication in what follows. Except where possibilism is explicitly under discussion, I'll assume that the unrestricted quantifier ranges only over actual things.

²⁴ Important treatments of McTaggart's argument may be found in Broad 1927, Broad 1938 (Bk. 7, Chap. 35), Christensen 1974, Craig 1998, Dummett 1960, Gale 1968b, Horwich 1987, Lowe 1987, Lowe 1992, Mellor 1981a, Mellor 1998, McCall 1994, Prior 1967a, Schlesinger 1980, Shorter 1984, Smith 1995, Tooley 1997, Zeilicovici 1986, and Zeilicovici 1989. See also Sosa 1979 for a brief critical survey of the main options in explaining the phenomenon of temporal passage.

²⁵ See Craig 1998. Cf. also Broad 1927 (ch. 2).

²⁶ The most famous recent statement is in Lewis 1986 pp. 202-3. But see also Broad 1927 (ch. 2).

²⁷ The example is due to C.S. Peirce, quoted in Chisholm 1976, Appendix A.

²⁸ We could even do away with the assumption that *presentness* is a property. But, again, for the sake of convenience I am ignoring such complications.

²⁹ Lewis (1986, 2002a) recommends the first solution; Mellor (1981a, ch. 7 & 1998, ch. 9) and van Inwagen (1990) recommend the second. For other, somewhat more complicated solutions, see, e.g., Haslanger 1989, Johnston 1987, Paul (unpublished), and Sider 2000.

³⁰ Broad 1938, p. 316; Sider 2001, ch. 2, n. 29. See also Prior 1967, pp. 4-7 and Christensen 1974.

³¹ Smart 1949 and Smart 1980 also offer criticism of the notion of absolute becoming.

³² Cf. Zimmerman 1998 and Sider 2001 (ch. 4).

³³ Cf. Broad 1927 (ch. 2).

³⁴ Prior's challenge appears in Prior 1959. Garrett 1988, MacBeath 1983, Mellor 1981b, and Mellor 1983 offer responses compatible with four-dimensionalism.

³⁵ Craig (1997) argues that an A-theory can't be accepted by a four-dimensionalist who regards A-properties as intrinsic properties. But, as I see it, his argument fails because, like Broad, he fails to take seriously the very close connection between absolute becoming and absolute qualitative change.

³⁶ For starters, see Armstrong 1989, Armstrong 1997, Bigelow 1988 (pp. 122, 132-3), Lewis 1992, Lewis 1998, and Lewis 2002b.

³⁷ An abundance of examples illustrating this point may be found in the literature on modal realism, realism about universals, and truthmakers for counterfactuals.

³⁸ This way of putting it generalizes a variety of more specific truthmaker objections, the most significant of which are discussed below. Among the most important discussions of these objections and related issues are Adams 1986 Bigelow 1996, Chisholm 1990, Fitch 1994, LePoidevin 1991, Markosian 2002, Prior 1962, Prior 1967, Sider 1999, Sider 2001. See also Gale 1968b and Sprigge 1992.

³⁹ Well, there is this much: A presentist might say to a four-dimensionalist: "Look how incredible the Lewisian response is in the modal case! Are you sure you want to embrace it in the temporal case?" This is surely to be taken seriously, but it is far from decisive.

⁴⁰ Alvin Plantinga (1974) is plausibly read as endorsing a view like this; however, one must be careful about attributing it to him since elsewhere (Plantinga 1985, p. 374) he explicitly expresses hesitation about the truthmaker principle.

⁴¹ This sort of view is endorsed by Bigelow (1996), Chisholm (1990), Markosian (2002), and Prior (1962, 1967a). Cf. also Zimmerman 1997, p. 91-92. Sider 1999 offers important critical discussion and expansion of the view.

⁴² All of the references in note 38 discuss the problem of referring to past objects, the problem of attributing properties to past objects, the problem of cross-temporal relations, or all three.

⁴³ Or so says Plantinga (1976). For disagreement, see Adams 1981.

⁴⁴ Hinchliff (1996, pp. 124-5) appears to be content with this suggestion.

⁴⁵ Bigelow (1996) discusses both alternatives and endorses the latter. Cf. also Prior 1962, Prior 1967 (ch. 8), and Zimmerman 1997, pp. 91-92.

⁴⁶ See Plantinga 1976 for the relevant motivation. See Markosian 2002 for objections about the cost. Adams (1986) also objects to the claim that individual essences can pre-exist the objects of which they are essences; but unlike Markosian, he allows that essences of past objects continue to exist.

⁴⁷ See Sider's contribution to this volume for some of the available options.

⁴⁸ See also Markosian 2002 for a different but related approach.

⁴⁹ For those who think that eternalism and presentism are necessarily true if true at all, there are *prima facie* problems about counterpossibles that crop up here. Sider addresses those concerns, but for purposes here we'll just leave them aside.

⁵⁰ Sider 1999, p. 335, n. 13.

⁵¹ See, e.g., Smart 1949, Smart 1963, Grünbaum 1963, Prior 1967b, and Gale 1968b.

⁵² See the introductory chapters of Oklander & Smith 1994 for a concise summary of the history of this debate.

⁵³ See, especially, Smart 1980, Mellor 1981a, Mellor 1998, and the essays by Oklander, Beer, and Williams in Oklander & Smith 1994.

⁵⁴ See, especially, Smith 1995 and the essays by Smith in Oklander & Smith 1994.

⁵⁵ See, especially, Christensen 1981, Christensen 1993, Putnam 1967, Rietdijk 1966, Sider 2001, Sklar 1981, and Smith 1995. See also references listed in notes 59-67. Further arguments arise out of General Relativity. Perhaps the most well-known is that presented in Gödel 1949. We will not discuss this argument here; but see Savitt 1994 and Yourgrau 1991 for discussion and further references.

⁵⁶ As Einstein defines it, two events x and y are simultaneous in a frame of reference S just in case light signals traveling from x and y would be observed at the same time by a detector which is at rest in S and equidistant from x and y . A plane of simultaneity in S passing through an event x is just the a set of all events in spacetime which are simultaneous (by the above definition) with x in S .

⁵⁷ This formulation supersedes my earlier formulation in Rea 1998. As formulated there, the argument begs the question against the presentist.

⁵⁸ She also rejects the general view that a time is to be identified with an abstract state of affairs corresponding to the total state of the universe on such a plane. Henceforth, I'll continue to ignore the view that times might be thought of as states of affairs; but the reader should keep in mind that, for every claim I make about concrete times, there are parallel claims that could be made about abstract times.

⁵⁹ See, e.g., Christensen 1981, Christensen 1993, Fitzgerald 1969, Godfrey-Smith 1979, Hinchliff 2000, Maxwell 1985, McCall 1976, McCall 1994, Mellor 1974, Rakic 1997, Savitt 2000, Sider 2001, Smith 1995, Sklar 1974 (ch. IV), Sklar 1981, Stein 1968, and Stein 1991.

⁶⁰ See, especially, Stein 1968 and Stein 1991. For criticism, see Rietdijk 1976.

⁶¹ See, especially, Fitzgerald 1969, Godfrey-Smith 1979, Hinchliff 2000, McCall 1994, Sklar 1974 (pp. 274-5), and Sklar 1981.

⁶² Cf. Stein 1968, p. 18 and Godfrey-Smith 1979, pp. 242-3.

⁶³ Cf. Sklar 1981, p. 297.

⁶⁴ See, e.g., Craig 1990 and Swinburne 1983. Sklar (1981) also observes that verificationism lies at foundations of relativity theory; but he stops short of recommending that the theory be dropped or amended.

⁶⁵ See, e.g., Craig 1990 and Tooley 1997 (ch. 11).

⁶⁶ See, e.g., Craig 1990, Swinburne 1983, and Tooley 1997 (ch. 11).

⁶⁷ See, e.g., Craig 1990, Prior 1996, and Smith 1995.

⁶⁸ Here and throughout I am thinking of intuitions simply as pre-theoretical beliefs about *either* contingent or necessary matters.

⁶⁹ On this, see, especially, Prior 1959 and Cockburn 1997. But see also references in note 34.

⁷⁰ For criticism of Smith's view, see Nerlich 1998b.

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