What is it to "B" a relation?

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Abstract The purpose of this paper is two fold: first, I look to show Oaklander's (*The ontology of time*. New York: Prometheus Books, 2004) theory of time to be false. Second, I show that the only way to salvage the B-theory is via the adopting of the causal theory of time, and allying this to Oaklander's claim that tense is to be eliminated. I then raise some concerns with the causal theory of time. My conclusion is that, if one adopts eternalism, the unreality of time looks a better option than the B-theory.

Keywords Philosophy of time · B-theory

1 B-theory and eternalism[1]

Eternalists and B-theorists typically maintain that all times exist, that time is real and that the phenomenology of temporal passage is explicable in terms of the mental goings on of temporally cognizant agents having "tensed experiences". So much is largely the orthodoxy on the matter for eternalists [see Grunbaum (1971), Mellor (1981), Le Poidevin (1991), Falk (2003) and Oaklander (2004)]. In this paper, I propose a challenge to such views.

I hope to show two distinct claims to be true. First, the view that temporal relations are simple and unanalysable (e.g., Oaklander 2004, pp. 24–25) commits us to B-relations as ontological gratuities with no function. Second, it is not clear that the eternalist can endorse the view that B-relations are, in fact, reducible to or definable as some other sort of relations—e.g., causal relations (Le Poidevin 1991)—without significant cost to their

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[1] Everything I say here is predicated on the possibility of being able to form an adequate conception of what B-time is which is something I dispute in Tallant (2007).

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ontology. The plan is, then, to show that we can describe a world functionally equivalent to our own (assuming our world is as the eternalist says it is), without making reference to B-theoretic relations.

In the opening paragraphs I drew a distinction between eternalists and B-theorists. Such a distinction seems plausible. Eternalists claim that all instants are on an equal ontological footing. Most, if not all, B-theorists agree with this claim. But a B-theorist is, whilst an eternalist is not, committed to the further claim that there are temporal relations, of "earlier-than" and "later-than", that hold between these instants. Hence, an eternalist can hold their position without also being a B-theorist. McTaggart (1908) and Barbour (1999) might be good examples of C-theorists.[2]

2 C-theory

Let us proceed by way of an analogy. Take the numbers 1, 2, 3, 4, 5. These numbers, as I present them, clearly stand in a fixed ordering relation. 2 comes after 1 but before 5; 5 comes after 4, and 1 comes before all of the rest. Further, 1 is at the same point in the series as 1. Similarly, 5 is at the same point in the series as 5. We can establish three facts about this series that are relevant to us here.

First, the series is ordered. There are fixed relations that stand between the various parts of the series and in virtue of which we may say that the series is ordered, or, if one is so minded, the series is ordered *so* we can say that there are fixed and permanent relations that obtain between the various parts of the series. The fixed and permanent relations in question will be "greater than", "less than" and "equal to". The second thing to note, the series is explicitly not temporal. The relations that obtain between the various parts of the series clearly are not B-relations. They cannot be B-relations for the series 1, 2, 3, 4, 5 is not temporal. Finally, the, "less than" and "greater than" relations are asymmetric.

I take it that the series 1, 2, 3, 4, 5 is as good an example as any of a non-temporal, but logically structured, asymmetric series. Now, let us see if we can construct an analogical account of a logically structured, but non-temporal, reality.

What is a C-world, then? Consider, what we might think of as, a single instant. That is, a particular way that the world might be at any given time, a particular 3D arrangement of physical objects. The cricket ball is poised, millimetres away from the stumps having beaten the bat, the bathtub is full and just one more drop from the tap will send water cascading over the side, the water itself seems to form a column from the tap to the bath—but nothing moves. This single instant looks, if we could look at it, much as a paused video might. This is our single instant. Consider this instant to be world w: is time real in w? Seemingly not. There are no B-relations.[3] Now add another instant to this world. Do we now have a temporal world?

Intuitively I would suggest not.[4] In order for w to be a world in which time is real, the relation in which the instants stand to one another must be a timely relation. So far there is no reason to think that the mere creation of two instants is sufficient for there to be time. We have not arranged them properly. By extension, then, we could add an indefinite number of

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[2] "C-series" was McTaggart's term for a timeless, logically ordered series. I use the term "C-theorist" to indicate a proponent of a timeless series.

[3] I'm going to ignore the possibility of time being real in virtue of a simultaneous causal relation obtaining at this timeless instant and, in virtue of the causal relation, there being a B-theoretic relation that is reducible to a causal relation obtaining at the instant. I'll have something to say about the causal theory later on.

[4] Though see Sect. 8.

instants to w and still not have a world in which time is real. It is the arrangement of the instants into "earlier than" and "later than" relations that is crucial to this being a world in which time is real.

If we then import "earlier than" and "later than" relations, and place them between these instants in w, then clearly time is real in w. But what happens if we use some other relation to order these instants? Is time real? Plausibly it will depend upon the nature of the relation imported into w. Suppose we imported the relations "greener than" and "less green than" to separate the various instants, such that the series runs from instants that have most green objects at one end, to instants that have fewest green objects, at the other.[5,6] Is this series one in which time is real?

I would say not.[7] Ordering a series of instants according to how many green objects they contain does not seem sufficient to say that the series is temporal. It would seem wrong to say that a is later than b, simply in virtue of a having more green objects than b. As in the discussion of numbers above it would appear that we have an ordered, but as yet, non-temporal, series. So far so good, some arrangements of the instants are temporal, others are not. What now?

Now we need to find out whether we can order our instants in w in such a fashion as to give us the same series that we would expect to find in a world in which time is real, without using temporal relations, and we must do so using a relation or feature that is present in the actual world. If we could achieve such a task, if we can order instants into a series in the same way that temporal relations would order them, but without using temporal relations, then we would seem to have shown that a world ordered according to a non-temporal relation is just the same as one that *does* include temporal relations. That would *appear* to show that temporal relations are redundant.[8]

Suppose we arrange these instants in such a fashion as to recreate the counterfactual dependence that we find in our world. In order to achieve this we order the instants according to the level of entropy at the macro-physical state across the entire instant. So our series has a high entropy state at one end, and a low entropy state at another. Since entropy (at the macroscopic level[9]) increases towards what we think of as the future, this seems like an excellent way to order our series.[10]

Further, if the series *is* ordered in this way then it will preserve the counterfactual dependence that we have in our world.[11] For instance, in w the contents of instant 1 include my coffee cup resting seemingly precariously upon the edge of my desk. Further, instant 2 sees my coffee cup just away from the edge of my desk, and, some way down the line at instant n, my coffee cup breaks on the floor in w.[12] Entropy increases across these instants.[13] Thus, our possible world w is arranged in such a fashion that all of the typical counterfactual

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[5] It's probably false to say that the series runs "from" one end "to" the other—there is no inherent directionality to the series, but let it stand for now.

[6] Suppose also that each instant has a determinate number of green objects and that the number of green objects in each instant is not equal to the number of green objects in any other instant.

[7] Though again see Sect. 8.

[8] Note that through this section I will assume that causal relations are not temporal relations. Thus, the arguments in this section are aimed against the likes of Oaklander, not the causal theorist.

[9] At the micro-level the same may not hold true: c.f. Price (1996, p. 29).

[10] See Price (1996, pp. 37–40) for an interesting discussion of entropy and its potential relation to time.

[11] If only because our world *is* ordered in this way and our world exhibits counterfactual dependence.

[12] For ease of exposition I shall gloss over any potential worries that one might have concerning whether or not time is continuous or discrete.

[13] For instance, my coffee is no longer in the state of being contained within the cup and is free to spread out.

dependencies obtain. The arrangement in question is such that each instant marks an increase in entropy at the macroscopic level.[14]

I take it that in w it makes sense to say that in each relevantly close possible world, w^*, in which my cup falls from my desk, that my cup breaks, since w^* will presumably be a world which is also ordered with respect to macroscopic entropic increase. Hence, we may say that my cup falling off my desk causes my cup to break in this *seemingly* timeless world.[15] Is time real in w?

The answer given here will vary. Some B-theorists think that temporal relations are fundamental and exist quite independently of counterfactual or causal relations (e.g., Oaklander). If one were to maintain this position then it seems that one is obliged to conclude that time is not real in w. We have not, as yet, introduced any of these temporal relations. However, if one is a B-theorist who thinks that temporal relations are somehow identifiable with causal relations (e.g., Le Poidevin 1991), then it is likely that one will think that time is real in such a world, w.

My arguments from here-on are 2-fold. Against the first answer, against the sort of ontology defended by Oaklander, I look to show that one can account for persistence, change, causation and the phenomenology of temporal passage, without appealing to additional temporal relations over and above the relations of counterfactual dependence ordering the series in w. As such, I conclude that such B-relations are an ontological gratuity that we have no use for.

Against the second answer, against the causal theory of time, I offer two lines of response. First, I ask whether there are any reasons offered by the causal theorist to think that time *is* real in such a world, in the sense we shall see to be required. Second, I note the theoretical cost of answering the first question in the affirmative. Let us begin with a look over the next three sections at why we might suppose that time is real if B-relations are simple and unanalysable.

3 B-theory for causal reasons?

To give a crude example: if a causal relation holds between two objects, then one of them must be later than the other, since x causing y entails that x is earlier than y. One might think it integral to the nature of causation that it requires time. The reality of causation would then entail a difference between a timeless world and a timely one. However, as I show below there are at least plausible analyses of causation that do not entail the reality of time over and above the reality of the causation.[16]

For Lewis (1986), the counterfactual analysis of causation purportedly does two things: first, it offers us an analysis of causation (pp. 166–167); second, it secures the direction of time (pp. 32–52). The question I want to ask is whether or not this analysis entails the reality

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[14] Why not reduce B-relations to entropic relations? A sudden entropic decrease would not *appear* to entail the reversal of time, but the reversal of a given process *in* time. For instance, suppose that the entropy of the whole system decreased slightly, but that this was due to an isolated spike in some spatial region whereby a relatively small amount of matter dramatically decreased in entropy. The rest of the universe would still exhibit entropic increase, and that would appear to be the direction in which we would intuitively think that time is pointed. See also Price (1996, pp. 46–47). In any case, the position—entropy *as* time—has not been substantively defended or developed in the literature.

[15] According to the causal theory (Le Poidevin 1991, p. 103) this series just *is* temporal. Let this slide for the time being. I offer arguments below as to why we should not accept the arguments of the causal theorist.

[16] Here I only consider the counterfactual analysis of causation. However, it is not clear to me that any other account of causation will lead to the conclusion that time is real, either.

of time itself. My answer is that it does not for reasons that I shall explain shortly.[17] Let "c" and "e" stand for particular events, and "$O_{(c)}$" and "$O_{(e)}$" stand for "c obtains" and "e obtains", respectively. Then, e is causally dependent upon c iff:

$$O_{(c)}\square \rightarrow O_{(e)} \text{ and } \sim O_{(c)}\square \rightarrow \sim O_{(e)} \text{ (p.167)}$$

In words,

> A counterfactual "If it were that A, then it would be that C" is (non-vacuously) true if and only if some (accessible) world where both A and C are true is more similar to our actual world, over all, than is any world where A is true but C is false (p. 41)

The question, then, is whether or not the meeting of these criteria *entails* the reality of time. One might suppose it does since Lewis takes the direction of counterfactual dependence to provide the direction of time. But my concern is that the reality of time has not yet been shown. Until we show the reality of time, the direction of counterfactual dependence is entirely neutral on the matter of whether or not the series of events up for consideration is temporally asymmetric or merely asymmetric. The *directionality* of counterfactual dependence can only establish that there is an asymmetric series with a direction. But what about the occurrence of counterfactual dependence itself; is that sufficient to entail the reality of time? I think not for the reasons that follow.

I suggested that in a timeless reality counterfactual dependence could still obtain. In the actual (allegedly timely) world *a*, e counterfactually depends upon c, iff in all relevantly close possible worlds where c does not obtain, e does not obtain and in all other relevantly close possible worlds where c obtains e obtains.[18] Now imagine a timeless counterpart to this claim.

Consider the timeless worlds w, w^* and w^{**}. These worlds are, explicitly, time-*less*: that is, there are no temporal relations over and above the causal relations. They are internally ordered according to entropic ordering relation stipulated in Sect. 2. Is there any reason to think that counterfactual dependence might not hold between various timeless instants? Not obviously. In w my φing occurs at t. My ψing occurs at t*.[19] In the relevantly close world w^*, where I do not φ at t, my ψing does not occur at t*. In the relevantly close possible world w^{**} where I do φ at t, my ψing occurs at t*. In such a case there is clear counterfactual dependence. But do we have any reason to suppose that time is real? Not obviously. All that has been stipulated is that in certain worlds we have what looks to be counterfactual dependence across various instants. At all timeless worlds where I φ at t, my ψing occurs at t*. That's what counterfactual dependence *is*.

I can see no obvious reason to think that time obtains in these worlds.[20] There is counterfactual dependence just in case that at the closest timeless world w^*, where x occurs, y occurs. At the very least, there seems nothing conceptually prohibitive about counterfactual dependence obtaining across timeless worlds. This being so, it seems reasonable to suppose that an analysis of causation *can* be rendered that makes no mention of temporality.

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[17] I should note that I do not take Lewis to have attempted to prove that the reality of counterfactual dependence entails the reality of time. I am simply asking whether or not one *could* argue from the reality of causation to the reality of time.

[18] Compare with my discussion of a green-world above. If there had not been 4 green objects at the instant before this instant in the series, there would not have been 3 green objects at this instant. See also Sect. 8.

[19] Where "t" and "t*" name instants: for a discussion of instants in this sense see Sect. 2.

[20] Unless we identify causal relations with temporal relations.

The account that I have just offered is one to which temporal relations would have to be *added* in order to preserve the reality of time.[21] As yet, no good reason has been given for this addition. Recall, my argument here is that these C-theoretic relations—the entropic ordering relations—obtain in the actual world and that the B-theorist needs some reason to suppose that there are more than just these C-theoretic relations. If the Lewisian account of causation entailed the existence of time then that would constitute a reason for believing in the reality of time. But causation doesnot give us such a reason because it seems conceivable that we can give an account of counterfactual dependence in an apparently timeless world. Hence, we can have the reality of causation *without* the reality of time considered as B-theoretic relations over and above the causal relations.

4 B-theory: persistence and change

Change is intimately bound up with time. No time, no change. So here is a potential counter to my suggestion. Since change *is* real, *so* time, too, must be real. There are, I think, two good *prima facie* reasons for thinking that change occurs—in the sense we think of as entailing time (although I shall argue that upon further inspection these reasons turn out not to be so good as we might originally have thought). First, we have the experience of change. We experience change and so it is quite simply obvious to us that change must occur. Second, we persist through time. We cannot be said to persist if there is no time.

There is no good argument here from the nature of temporal phenomenology to the conclusion that time is real. The B-theoretic claim, that temporal passage is mind dependent, can be made to work for the C-theorist. Put simply, if temporal passage can be mind dependent in a B-world it can be mind dependent in a C-world. But there is no obvious need for anything over and above this variation of entropy and phenomenology. So, if the phenomenology of temporal passage is merely experience *at* any given timeless point, then there is no *prima facie* reason why occupants of a timeless reality could not also experience temporal passage.[22]

The second charge, that persistence entails the reality of time, seems rather more difficult to discharge. The issue is whether or not the reality of persistence in w entails the reality of time in w. I shall argue that there is persistence in w, but that it is not persistence "through time". The slight perversion in meaning of the term "persistence" is unfortunate, but I take it that a moderate deviation from the natural language meaning of certain terms (e.g. that "persistence" is not "persistence through time") is to be expected when dealing with the unreality of time.

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[21] Assuming the causal relations are not temporal relations.

[22] If one substitutes talk of B-times for C-timeless-instants in the description of B-theoretic accounts of the phenomenology of temporal passage the descriptions look *prima facie* no less viable. Certainly, none of the temporal relations postulated by the B-series are typically supposed to be causally efficacious in the production of said phenomenology. For a particularly good summary and analysis of these accounts, see Falk (2003). Notably, Falk *does* talk in terms of events at one time being "later than" others in his formulation of temporal phenomenology. Is this decisive? There seems no reason to think so. If the timeless reality I have stipulated is coherent, which it seems to be, then there seems no barrier to providing a timeless translation of Falk's view, e.g., the truth about a timeless instant is only in consciousness at the timeless instant that it is about, not at some other instant that counterfactually depends upon that instant or at an instant upon which this instant is counterfactually depends. Cf. Falk 2003, p. 225. See also the account of the awareness of passage given in Barbour (1999, pp. 28–30) where time *is* taken to be unreal.

First, I am allowing an eternalist ontology, at least in so much as there is a series of ordered timeless instants.[23] Second, I am prepared to admit that there is persistence—provided that one does not then argue simply by *fiat* that this entails the existence of time. In a fairly loose sense I take persistence to be that which underpins (perhaps *makes true*?) our common sense intuition that, "I am the same person at this moment that I was when I first wrote this paper" (or, in the semantics of timelessness that, "I, at this timeless instant, am the same entity that exists at some other timeless instants, that engaged, at still further timeless instants, in the acts of producing this paper").

So can we come to a coherent understanding of the two main models of persistence, endurance and perdurance, within the confines of a C-theoretic reality; that is, without making recourse to talk of temporal relations? Moreover, can I show that temporal relations over and above causal relations are superfluous to the pictures presented?

Let us take the perdurance account first since it is rather easier to see how this story will go. Perdurantists typically admit a close relationship between the nature of temporal part-hood and the nature of spatial part-hood (e.g., Sider 2000, pp. 214–215). Now, let us construct, not an account of persistence through time, but an account of persistence through entropic increase. So, a part of S, "s" is f-at-t (where "t" is understood to be a timeless instant), and a part of S, "s*" is g-at-t*. There looks to be nothing particularly odd about the account. Indeed, apart from the differing ontological commitment with regards the "t" variable the B-theoretic and C-theoretic descriptions will be identical.

Once again, since the C-theoretic relations will obtain in the B-world, it seems incumbent upon the B-theorist to explain why we ought to accept temporal relations when the C-theorist appears to have everything in hand.

Endurance goes like this: S is f-at-t, and S is g-at-t*. Of course, the "persisting" object will have to be "wholly-located" at each of the timeless instants in order for this to be an account of endurance. But, once again, this seems to be a complete account of endurance that does not require us to make recourse to the reality of B-relations.

The endurance/perdurance distinction within a C-world then appears to come down to a question of whether the entity at a point in the timeless reality derives its identity in virtue of being a part of a "persisting" object, or whether it has its identity in virtue solely of its "whole" existence at a timeless instant. This seems more or less in keeping with the debate between endurantist and perdurantist. I take it to be important that the C-theoretic model shows itself competent to deal with these twin accounts of persistence since otherwise there would be an obvious difference in what could successfully be modelled in the B- and C-theoretic ontologies. A difference in what could be modelled would presumably indicate a difference between the ontologies.

5 Redundancy and realism

Let us suppose, just for the sake of argument, that we allow the eternalist temporal relations of the sort specified by Oaklander—simple and unanalysable. Granted, we could then say that time is real. But what does that *mean*? Allow me to recap: we have fixed and permanent asymmetric relations that stand between the timeless instants. We have a full and complete account of the phenomenology of temporal passage. We have accounts of causation, change

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[23] Perhaps timeless point might be a better term for what I mean. However, in Sect. 2, exegesis made the term "instant" more apt. I shall keep it here.

and persistence; none of which require the reality of time. We have all of this within a C-theoretic world.

Should we make an apparently ad hoc revision to our ontology, despite its explanatory completeness and without appreciating any difference between the two worlds? If we are to accept that numerous temporal relations obtain we should want reason to do so. In the absence of any strong reason to think that there are temporal relations *over and above* causal relations there seems to be no room within this particular ontology for the reality of time. Temporal relations would just be redundant.

One might worry, at this stage, that my argument is assuming a particularly robust form of realism on behalf of the eternalist.[24] After all, in the C-theoretic world we still have the resources available to us for true temporal talk. There are the relevant non-temporal relations, standing between instants. There is a perfectly obvious sense in which non-temporal relations will at least give us the truth conditions of statements about the temporal.[25] So temporality is not eliminable, it is just reducible. If temporal talk is *true* then all that we are really saying is that the truthmakers for timely talk are not themselves temporal. But that is consistent with a weaker form of realism whereby time is still real.[26] Temporal relations are real, it's just that they're analysable too.

I believe the B-theorist is committed to a stronger brand of realism. B-theorists argue that the A-series is not real. The motivation for this is that they take the reality of the A-series to entail a contradiction. However, most B-theorists allow that we can have true tensed talk. Such true talk is permissible because the truth-conditions for tensed sentences are given in a tenseless, B-theoretic, semantics. The typical assumption, however, is that the B-theorist is able to eliminate the A-series *because* they can give a tenseless account of the truth-conditions of tensed sentences. So the B-theorist seems committed to the claim that being able to state truth-conditions for x's in terms of non-x's entails a reduction of x's to non-x's and that this reduction does not commit us to the reality of x's. This is no reduction, this is elimination. This being the case it seems that the B-theorist is committed to a very strong form of realism on pain of generating a contradictory A-series.

By parity of reasoning, if we can give the truth-conditions for B-theoretic statements in terms of C-relations, and if we can explain everything about the B-relations in terms of the C-relations, then we can reduce them to entropic relations.[27] And by performing the reduction we perform the elimination: this seems to be the B-theorist's approach to realism when dealing with the A-series, so it should be their approach to realism when dealing with other matters, too.[28] If, in the A-theoretic case, this is sufficient to rid us of ontological commitment to the A-series, then, in the entropic case, this should be sufficient to rid us of ontological commitment to the B-series. So this looks like a dead-end for the B-theorist.

However, Oaklander (2004) does not take the view that we can have true tensed talk. So it looks like he might not have to face the dilemma presented above. We must be careful here

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[24] Thanks to Robin Le Poidevin and Andrew McGonigal for pressing me on this point.

[25] See the timeless semantics given in Sect. 4 and note 13.

[26] For recent discussions of the varieties of realism and time see Fine (2005: Chap. 8) and Parsons (2005).

[27] Still assuming that causal relations are not temporal relations.

[28] At least it should be if they are to take a unilateral line towards realism. It may be open to the B-theorist to take a different stance on matters of realism: see, e.g., Wright (1992). But note, this would then require the B-theorist to state precisely how matters of realism should be read and would entail they adopt a substantive position on the matter of realism. Since no such position has yet been taken in the literature I shall not move to attack such a position here.

as there are two components to Oaklander's view. First, B-relations *are not* reducible to any other relations. Second, there are no tensed truths. Let us take the points in order.

His positive claim is that B-relations are not reducible to any other relation. But this seems to fall foul of the redundancy objection. What do temporal relations do? What do they add to reality? It will be granted that such temporal relations *may* exist, but we seem to lack a coherent reason for supposing them to do so, after all, what would simple and unanalysable B-relations add to a C-theoretic ontology? We already have a fixed and ordered asymmetric relation, why time too?

Second, according to Oaklander, because there are no tensed facts there can be no tensed truth-makers. If there are no tensed truth-makers there can be no tensed truths—not in a robust metaphysical sense at any rate (cf. Oaklander 2004, pp. 265–294). So although there *might* be tenseless truth-conditions for certain tensed sentences there are no genuinely tensed truths, for there exists nothing that is "tensed". In a strict sense, Oaklander is an eliminitivist about tense.

But then Oaklander cannot object that simply being able to give the truth-conditions for talk about B-relations is sufficient for us to be realists about B-relations. If there must be *tensed facts* in order for tensed sentences to be true (over and above tenseless truth conditions that we can give for them), then there must be *B-theoretic facts* (over and above their causal truth-conditions that we can give for them) in order for B-theoretic "truths" to be true. And in order for there to be B-facts, there must be B-relations. Then, of course, we are back to the question as to why we should think there are B-relations. I have argued above that we *have* no good reason, for such relations will be redundant.

6 The recalcitrant B-theorist

A first objection from the B-theorist might go like this. They may grant that some of what I have said is true, but instead of endorsing what I say about realism they may take my arguments to point, not to the timelessness of eternalism, but to the fact that the typical B-theoretic reading of realism is at fault. They may argue that being able to give the truth conditions for the B-relations *is* sufficient for their reality. Indeed, accepting the reality of some entity or type is simply to agree that there can be true talk about it.

But this route is not open to the B-theorist. If the B-theorist allows that being able to state the truth-conditions of some x (and those conditions being met) entails the reality of x, then they shall have to admit the reality of the A-series. After all, B-theorists typically agree that we can give the truth-conditions for tensed sentences—and that these are met (e.g., Dyke 2003). If simply stating and meeting the truth-conditions for the A-series is sufficient for the reality of the A-series then we shall find contradiction. For example, the battle of Hastings will turn out to be past, present and future—which of the three we find it to be will depend upon our perspective, of course, but if the A-series is real then all three will be genuine properties borne by the battle itself.

Here's a second objection: Oaklander argues that there are no tensed truths, he eliminates tense. His general claim seems to be this: if we can find the truthmakers for a given truth, where the truthmakers are themselves of a different type (e.g., tenseless truthmakers for tensed truths), then we can eliminate ontological commitment to the type that the sentence appears *prima facie* to be about. So there are only truths about the mental if there are things that have the property (distinct from a physical property) of mental-hood. There are only truths about time if there are timely (distinct from, e.g., causal) things.

To alleviate the redundancy concern, we might try to ally the claim that B-relations are *identical* with causal relations to Oaklander's eliminative strategy concerning tense.[29] We eliminate the tensed truths by stipulating that sentences about x's are only true if there are entities of the type specified by the term "x", and we eliminate commitment to the reality of the A-series by stipulating that since there is nothing of the type "tense" that exists in this world, that there can be no tensed truths. We still have the unreality of the A-series, but we have rid ourselves of the possibility of eliminating the temporal relations in favour of the causal because they are now taken to be identical.[30]

7 Conceivability cases against the causal theory of time

First consider an analogy with mereology. Dorr and Rosen (2002) argue that there is little to choose between the following two states of affairs:

1. There are no such things as objects. Simply particles arranged x-wise. Hence, there are no chairs, simply particles arranged chair-wise.
2. There are such things as objects, composed out of particles.

In other words, everything that is done by the addition of a composition relation can be achieved without the composition relation. We can explain natural language assertions of "there is a chair" by appealing to a tendency to treat particles arranged x-wise as distinct things. We explain persistence by saying that, at any two different instants, there are particles arranged x-wise etc.

My claim parallels this. I think that we can explain a B-theoretic reality, without having to make recourse to B-relations. Consider:

1*. There is no such thing as time, there are simply instants arranged according to a non-temporal relation
2*. There is such a thing as time, composed of instants and their temporal relations[31]

What I have shown is that 1* *is plausible*. If we consider there to be nothing more than entropic relations generating counterfactual dependence, we can still order our world and explain persistence, causation etc.

What I now want to show is why I think we should take timelessness to be more than a mere possibility, why I don't think that we *should* identify temporal relations with causal relations if we're eternalists. But here, at least, is the minimal claim. We can order our world, generate the same world that the causal theorist of time says that we have, without claiming that time is real. I don't think I need to be accused of making A-theoretic assumptions when I say that I don't understand how it is that ordering apparently timeless instants according to entropic increase is sufficient for the reality of time. The notion is certainly fairly counterintuitive. In any case, in what follows I offer a number of reasons for thinking that counterfactual dependence of the sort specified by the causal theorist is not sufficient for the reality of time.

Imagine the following "sphere-case" (SC). We have a possible world *p* where there are two spheres, SP1 and SP2. These are moving towards one another; though they will never

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[29] Finally we get to the causal theory of time!

[30] It might also be questioned whether or not the B-theorist oughtn't to justify this particular form of realism. Why, for instance, is it not possible for something to be reducible, but real?

[31] Obviously the two positions are not formally analogous. This loose analogy is only intended to be illustrative.

meet. They will pass one another by. Now, in *p* there are no causal relations—at least not *prima facie*. Put another way, there is no increase in entropy in *p*. Nor have the instants been structured according to any other relation. We simply have a series of instants in which the movement occurs. All that we have is SP1 moving in roughly the direction of SP2 and SP2 moving in roughly the direction of SP1.

I take it that if temporal relations and causal relations are identical, then they are necessarily so and that the eternalist does not want to violate the necessity of identity. In this world *p* two points appear to follow. First, it is at least possible that *p* is a world in which time is real. Given some suitably far-flung world this looks like a possibility. Second, there look to be no causal relations. If there are no causal relations then there can be no temporal relations. This, then, looks to violate the claim that temporal relations are identical with causal relations.

In reply the B-theorist might say three things. First, the B-theorist might suppose that the reality of the temporal relations in *p* entails that there *must* be causal relations linking each point in the journey of the spheres with a previous point. After all, temporal relations just *are* causal relations. An obvious way to make sense of this claim is to cite the counterfactual dependence of some later instant of the journey on some earlier part. So, in order for the sphere to have reached point S2 at t2, it must have gone through point S1 at t1. The latter part of the journey is caused by the earlier part. That this kind of counterfactual would not normally be regarded as causal is beside the point: a counterfactual analysis of the movement of the spheres can be rendered so we can call the relation causal.[32]

Although this might get the B-theorist out of the sphere case (albeit at some cost when it comes to how we think about causation), identifying causal relations with temporal relations seems to land them in trouble elsewhere. Take, for example, a time-travel case. Suppose that Elizabeth goes back in time. Whilst in the past, she accidentally treads on an ant. It seems perfectly sensible to say that Elizabeth being at this point in time caused the death of the ant. It also seems perfectly sensible to say that her time machine caused her to go back in time. So, by the transitivity of causation, it seems perfectly sensible to say that the time machine caused the death of the ant. We have a causal relation. If there is a causal relationship that obtains from the time machine, to the death of the ant, then there must be a "later than" relation that also obtains. But, that would leave us in a situation where Elizabeth squashing the ant is both earlier than her moment of time travel and later than it. Earlier than the squashing of the ant on the assumption that the moment at which she departed in the time machine is causally connected to the region where she squashes the ant, and later than the squashing of the ant on the grounds that there is a causal relationship issuing from the time machine to the death of the ant. I assume that it is logically contradictory for an event to be both earlier than and later than some other single event.

So, assuming the *logical possibility* of time travel and the necessity of identity, it follows that B-relations cannot be identical with temporal relations. Of course, the B-theorist could choose to deny the possibility of time travel. But now the B-theorist has to admit strange causal relations in the sphere case (SC) *and* deny the possibility of time travel. The costs are mounting, though granted the contested nature of time-travel such an argument from exotica may be of limited persuasive power. In response to the third objection I state what I take to be the pressing dialectical problem for the B-theorist.

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[32] One potential reply would be to question whether or not the B-theorist has a sufficiently clear handle on which counterfactuals are temporal. How do we differentiate counterfactual dependence from counterfactual dependence that is timely? However, such an option seems unattractive here since the B-theorist might turn to an alternative analysis—perhaps something like that offered by Tooley (1997, p. 103). Tooley's model, although not B-theoretic, explicitly avoids mentioning temporality as he uses causal relations to analyse temporal relations.

The second way the B-theorist might reply to the SC case is to suggest that the asymmetric ordering relations are insufficient to play the ordering role I attributed to them in our world. If such cases as SC cannot be rendered using the non-temporal relations, then we need a temporal relation to order *that* world, p. In other words, in p there are no entropic relations, so is this really a fair comparison?

I have two things to say in reply: first, SC is supposed to be about some very strange possible world p. My claim above is that *our* world need not be described as having any temporal relations if one is an eternalist. So I am quite open to the claim that p exist, that time is real in p, but that such states of affairs never arise in our world. Indeed, I would take it to be incumbent upon the B-theorist to point to some temporal interval in our world and show that there are not entropic relations that obtain across it if they wish to refute my arguments in such a way.

But, even if they were to do so (and here is the second part of the response), it isn't clear to me that *some other* asymmetric ordering relation might not do the job just as well. I've focused upon entropy and causation here. But there is no reason to think that thermodynamics or the like might not produce *some* ordering relation according to which we might generate an ordered asymmetric series: call it a "time substitute" relation. So I take it that the B-theorist must show that there is something which B-relations add over and above all of the other potential "time substitute" relations. Only then will they defeat the redundancy objection *in our world*. That there are no "time substitute" relations in p, is no reason to think that time isn't real in p. Indeed, the point of SC is to show that, contra the identification of time with some "time substitute" relation, it appears that time might well exist in the absence of such relations. And, in such a world, we might have reason to think that there are B-relations of the sort specified by Oaklander.

Finally, the B-theorist might respond to SC by saying that because time and causation just *are* identical, that any case where I may conceive that there is one without the other is mere illusion of possibility.

I would have grave concerns with regard to the claim that causal relations are identical with temporal relations and that any possibility that one can conceive of is mere illusion, not least because the claim is bold and unmotivated. Shoemaker (1969) cases appear to imply the possibility of time without causation; SC appears to also demonstrate just such a possibility and the case from time travel appears to show that the B-theorist cannot allow for even the logical possibility of time travel if they identify causal relations with temporal relations (not without contradiction, anyway).

8 Counterfactual dependence and green-worlds

Another case: in Sect. 2 I introduced the idea that a series of instants—ways the 3D world might be—could be ordered according to how many green objects they contained. I suggested that, intuitively, to order the instants according to the number of green objects that they contained is insufficient for there to be time. But if the causal theorist is right we may have to revise this claim. Consider w to be a world composed in just such a way—instants composed of 3D objects, and the instants ordered according to the number of green objects they contain. The following claim then looks true: if the instant located one instant further towards the "greener" end of the series than this instant had not had five green objects, then this instant would not have had four green objects. If that instant has three green objects, then this instant has only two green objects etc. Thus, counterfactual dependence appears to hold. If counterfactual dependence holds between the various points of the series, then time

is real. So, if we group physical objects together into apparently timeless instants and order these groups according to how many green objects they contain, then time is real. This looks to be a strange conclusion.

But the generalisation is even more strange. When we group 3D objects together—and call these groups instants—and then order these instants according to *any* regulative principle, then we will generate counterfactual dependence. Consider a world q where the instants are ordered according number of objects that exist in each instant. Assuming that one of the criteria for closeness of world is the maintaining of laws, then any world relevantly close to q will preserve that law. Thus, at one of our instants n, it is true to say that had the instant one removed from this one in the direction of fewer objects not contained n objects, that this instant would not have contained $n + 1$ objects. Thus, counterfactual dependence can be generated in any world where we find 3D objects grouped together and where those groups are ordered—according to *any* regulative principle.

But this seems to make a mockery of McTaggart's original claim that the C-series—a logically ordered non-temporal series—was non-temporal. For according to McTaggart, the C-series is ordered according to the relations "more inclusive" and "less inclusive". According to the causal theorist, this series will be temporal. Had the instant located one instant in the more inclusive direction, not been inclusive of n objects, this instant would not have been inclusive of $n - 1$ objects. Thus, according to the causal theorist of time, there is no such thing as the logical possibility of timelessness in any physical world where objects are grouped together and where those groups are ordered according to *any* regulative relation *at all*.[33]

This looks to be a deeply odd result. I should add, though, that I have nothing more serious than this to offer by way of complaint. I cannot think of any *compelling* argument to not think of series ordered according to numerical value as temporal. If the B-theorist is prepared to endorse these apparent deficiencies of the position, then so be it. But the conclusion simply seems deeply counterintuitive.

So in the face of such counterintuitive consequences, the B-theorist should have strong theoretical reasons for supposing B-relations to be causal relations. After all, the view seems to entail some pretty contradictory results in Green worlds and sphere cases. So let's hear these reasons.

But in Sects. 2–5 I argued that the B-theorist has *no* good reason for thinking that there are temporal relations and that positing them would constitute an ontological gratuity. We then saw that *if* the B-theorist is prepared to make certain moves with regards realism and elimination, as well as give up the logical possibility of time travel and commit themselves to the view that temporal relations just *are* causal relations (and so admit some very peculiar results), *then* B-relations look to be *possible*.

So the B-theorist can, then, show that time is real on the eternalist model if they're prepared to do all of that. But I don't think that anyone who accepts what the B-theorist has to say about realism *has* got any reason to do all of this. That was supposed to be what we learned in Sects. 2–5. We can do everything we need to in this world *without* identifying temporal relations with causal relations, and by doing so we would avoid all of the problems raised by Green worlds etc.

Two *prima facie* good reasons for thinking that time is real haven't yet been explored. The first lies in the mathematical and logical works of the late 19th and early 20th century, which did much to clarify the notion of a dimension and show that time could be considered

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[33] Notice, too, that in section two I proceed under the assumption that a series ordered according to numerical value was non-temporal. The above examples appear to show this to be false. A series of instants ordered according to the *number* of green objects that they contain *is* temporal—according to the causal theorist.

as a dimension.[34] This, famously, culminates in Minkowski's (1923, p. 75) grand (if rather vague) dictum, that our concepts of time and space may now fade away, to be replaced by a conception of space–time. Second, contemporary physics appears to strongly favour the reality of a temporal dimension. So why are these not good arguments for the reality of time?[35]

We saw in Sects. 5 and 6 that the B-theorist seems committed to the view that, for any x, x can only be real if x exists and is not reducible to some further non-x. The consequence of this is that in order for us to be a realist about B-relations there must be irreducible B-relations. It would seem, then, that in order for time to be real for the B-theorist, there must be B-relations.[36]

So my claim that the B-theorist has no reason to endorse the reality of time amounts to this: I am happy to allow that we have an eternalist ontology, a fourth dimension and so on. We have the whole four-dimensional (so-called) space-time structure that is required by modern physics. Let's give the eternalist all of that. But then note; the presence of a four-dimensional structure does not entail the presence of B-relations, nor does it appear to give us reason to think that B-relations obtain.[37]

Let us allow that this fourth dimension is a dimension of counterfactuality and that it is distinct from the spatial dimensions (ignoring the "Newtonian" mode of presentation).[38] The B-theorist says (or should say) that simply being arranged thus isn't enough for time to be real. For time to be real there must be irreducible B-relations, that was the lesson learned about realism. In other words, the counterfactual relations must *be* B-relations, not merely counterfactual relations. So, to accept the B-theory, we must have some reason to think that one of the dimensions is B-theoretic. And whilst Mathematics and physics may give us

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[34] One might then worry that in Sects. 2–5 I ignored whether or not entropic and/or counterfactual relations are sufficient for dimensionality. Perhaps the function of B-relations is that they, unlike their timeless counterparts, generate dimensionality. The problem with this line of argument is that it isn't clear why one relation—a B-relation—should be capable of creating dimensionality, when another—counterfactual relations—may not. In any case, if the B-theorist wished to argue that the difference between the two types of relation is that B-relations can generate a dimension where counterfactual relations may not, it would be incumbent upon them to explain how and why this is the case.

Moreover, if counterfactuality *cannot* be dimensionalised, then this would represent an argument against the causal theorist of time who argues both that time is a dimension *and* that temporal relations are reducible to counterfactual relations. If counterfactuality cannot be dimensionalised then, being identical with time, time would not be dimensionalisable, either. So as far as I can see, then, it is an implicit assumption of at least some B-theorists that counterfactuality can be dimensionalised and in the absence of an argument *against* the causal theorist I shan't consider the matter further. See, further, note 38.

[35] With many thanks to an anonymous referee for forcing me to bring this point out.

[36] If you think that time can be real without B-relations you aren't a B-theorist, so far as I can tell.

[37] Is counterfactual dimensionality enough to say that this *is* a world arranged such that there are B-relations? No. Imagine that the Green world has three spatial dimensions and another putative dimension. At point one in this dimension d, there is one green object. At point two in dimension d, there are two green objects, and so on. That *looks* like a plausible candidate for a four dimensional world but doesn't look to be one in which there are B-relations. The fourth dimension is the dimension of how many green objects there are. For an account of dimensionality, see note 38.

[38] If we can't dimensionalise counterfactuality then this theory will be false anyway since temporal and counterfactual relations are taken to be identical. But there is no reason to think that this will happen. For instance, suppose we say that, the dimensionality of a given feature is the number of ways in which objects can, continuously and independently, differ with respect to that feature. Anything we substitute for time should be one-dimensional. That would leave no obvious problem for treating counterfactual dependence as a dimension, though it *might* require us to help ourselves to simultaneity. Thanks to Robin Le Poidevin for his thoughts on this matter.

excellent reason to think that the world *is* arranged four-dimensionally etc., that does not then give us reason to identify counterfactual relations with B-relations.[39]

For the B-theorist to argue otherwise, they must point to some physical theory that requires, or at least suggests, the existence of a B-relation, and the whole point of Sects. 2–5 was to show that there *is* no feature of our world that needs B-relations in order to be explained satisfactorily and, to the best of my knowledge, no physical theory posits any phenomena that could not be explained in non-temporal terms (though obviously I cannot translate *every* theory here). One can still make use of a dimensional framework, it's just that the "t" variable doesn't indicate a point that stands in any B-relations, but a point that stands in counterfactual relations.

Further, the Green worlds case, the time travel case and sphere case showed us that there is a cost to be borne if we identify B-relations with counterfactual relations. So, the question remains, why make the identification? It looks to be all cost, no reward. We have four dimensions, and one of them (or so we are supposing here) is counterfactual; but so far as I can see, we have no reason to *identify* those counterfactual relations *with* temporal relations.

The choice: B-relations might be simple, but if they are, then they're an ontological gratuity. B-relations might, then, be causal relations. I have argued that though one *might* identify B-relations with other non-temporal relations that this incurs heavy cost (the lessons from the Sphere cases, time travel and Green-worlds), and that we have no *positive* reason to make the identification anyway. So if you're a B-theorist, you shouldn't think that time is real.

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[39] Putnam (1967, p. 247) says, "[w]e have learned that we live in a four-dimensional and not a three dimensional world, and that space and time—or, better, space-like separation and time-like separation—are just two aspects of a single four-dimensional continuum with a peculiar metric which sometimes permits distance $(y, x) = 0$ even when $x \neq y$."

But whilst we are forced by the physical theory to admit the presence of "non-spatial separation", it is not clear at all why this has to require the existence of B-relations. Why, for instance, would counterfactual separation not be enough? Remember, we've already conceded that there *are* counterfactual relations. The question we're pursuing is whether or not to then identify causal relations *with* B-relations.

Consider the mereology analogy once again. Physics gives us excellent reasons to think that there are particles arranged, "object-wise", but that is no reason to suppose that the relevant spatial relations in which the particles stand to one another is *also* something like a composition relation. Similarly, then: we have plenty of reasons to think that entities are arranged, "time-wise" (four dimensionally, counterfactually, etc.), but that doesn't give us a reason to claim counterfactual relations *are also* B-relations.

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