Multilocation Without Time Travel

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1 Introduction

In contemporary metaphysics, it is easy to get the impression that time travel is a necessary prerequisite for the possibility of what I will call *synchronic multilocation* – roughly, the notion of being in two or more places at once. Thought experiments featuring an object in two or more places at once usually use some form of time travel to get the object so positioned. Having already persisted through a time t, an object travels back in time to show up at t again, at a different spatial location than before. But is this just a useful heuristic – a metaphysically superfluous adornment – or do we need time travel in order to synchronically multilocate an object?

The question is worth asking because time travel is afflicted by a horde of notorious paradoxes, and so any metaphysical thesis that depends on the possibility of time travel inherits a lot of baggage.[1] In what follows, I explore the relationship between multilocation and time travel, and I ultimately conclude that what we should say about this relationship hinges on contested issues regarding the nature of time and persistence.

[1] For a recent monograph on these paradoxes, see Wasserman (2018).

Before plunging ahead, let me say something a bit more precise about the question that I am exploring in this paper. First, I will restrict my attention to concrete material objects. So such things as human organisms, chairs, and rocks fall within my purview, while such things as God (who is usually taken to be concrete but not material) and immanent universals (which are usually taken to be neither concrete nor material) do not.

Second, I will take the multilocation relation to be the relation of being exactly located at multiple regions of space or spacetime, where 'exact location', as I will use the term, expresses Hudson's (2005 & 2008a-b) primitive location relation.[2] *Synchronic* multilocation occurs when an object exactly occupies multiple regions simultaneously (either *simpliciter* or relative to a given reference frame). Otherwise, multilocation is *diachronic*. My focus in this paper will be on synchronic multilocation.

Finally, I will borrow Wasserman's (2018) definition of time travel: a "discrepancy between time—*real* time[3]—and the kind of causal relations that make for identity over time" (8). For reasons that will soon become clear, my interest will be in the following two varieties of discrepancy between time and identity-preserving causal relations[4]: those where the causal relations run backward, i.e. in the opposite direction of time's arrow, resulting in backward time travel; and those where the causal relations hold between things at one and the same time, i.e. simultaneous causation.

One might balk at the suggestion that simultaneous causation – even when the causation is of the identity-preserving sort – counts as time travel. But we don't need to haggle about this. I'm going to continue to use the term 'time travel' in a broad and perhaps merely stipulated sense that

[2] Though I will be presupposing Hudson's view, I do not think that much depends on this. Any theory of location which permits synchronic multilocation at least in principle would do.

[3] Emphasis in original. The qualifier 'real' is meant to distinguish time from Lewis's (1986) notion of personal time, and to emphasize the unreality of the latter. On Wasserman's view, personal time is an assignment of coordinates to events in (real) time that tracks identity-preserving causal relations.

[4] This is Wasserman's term.

includes simultaneous identity-preserving causation, but if you prefer, the question of this paper can be recast as the question whether synchronic multilocation requires discrepancies of any sort (whether they count as time travel or not) between time and identity-preserving causal relations – including simultaneous identity-preserving causation. Since simultaneous causation can be used to construct analogues of standard time travel paradoxes, like causal loops and the Grandfather Paradox,[5] it is not only controversial, but controversial for some of the same reasons that backward time travel is. So, assessing whether synchronic multilocation requires either backward time travel or simultaneous causation should be more interesting than assessing only whether it requires the former.

2 What Is at Stake?

But just *how* interesting is this issue? Or, to be blunt: why should anyone care whether synchronic multilocation requires time travel? It seems to me that, if synchronic multilocation turns out not to depend on time travel, this would have three interesting ramifications.

First and most obviously, the overall case for the possibility of synchronic multilocation by concrete material objects – which I take to be an intrinsically interesting subject – will be stronger. For if this sort of multilocation does not require time travel, then evidence against the possibility of time travel is not ipso facto evidence against the possibility of such multilocation. Moreover, evidence *for* the possibility of time travel would still be evidence *for* the possibility of synchronic multilocation by

[5] For causal loops, it could be that some event A simultaneously causes another event B, which simultaneously causes A. For a variant of the Grandfather Paradox, suppose A simultaneously causes B, which simultaneously causes not-A (This second case is borrowed from Swinburne 1994, 82, who may have cases like the first implicitly in view as well, for he employs the second case in a general argument against causal loops, simultaneous causation, and backward causation).

concrete material objects because time travel (of the right sort) would still be sufficient for such multilocation even if it is not necessary.[6]

Second, there are other issues of considerable interest in contemporary metaphysics that hinge at least in part on the possibility of synchronic multilocation by concrete material objects. So if we can strengthen the overall case for the possibility of this kind of mulitilocation by liberating it from the paradoxes of time travel, this will have a reverberating effect on a whole web of other metaphysical questions.

For example, while some theories of location allow for the possibility of multilocation, some do not.[7] Less obviously, synchronic multilocation of concrete material objects by backward time travel has been used to sharpen the problem of temporary intrinsics (Sider 2001, 101-9; Carroll 2011; Wasserman 2018, ch. 6; Simon 2019); to construct violations of popular mereological principles such as Weak Supplementation (Effingham & Robson 2007; Smith 2009; Effingham 2010 & 2011; Donnelly 2011; Kleinschmidt 2011; cf. Bennett 2013); and even to formulate new material coincidence puzzles (Gilmore 2007).[8] And in all of these cases, it is synchronic multilocation, not backward time travel per se, that is doing the crucial work.

The third ramification has to do with possible applications of synchronic multilocation in constructing metaphysical theories. There are a

[6] There is at least one argument against multilocation that is probably stronger if multilocation does not require time travel: the 'Problem of Parsimony' (Hudson 2005). See Mooney (2018a) n. 10.

[7] Consider the clash between Hudson (2005 & 2008a-b) and Parsons (2007 & 2008). See also Donnelly (2010). Granted, the case for multilocation does not depend exclusively on the case for synchronic multilocation by concrete material objects, but the latter is clearly relevant. For example, a strong enough case for synchronic multilocation of concrete material objects would suffice to refute theories of location which rule out multilocation.

[8] Some of these applications appear in the context of arguments against endurantism or perdurantism. But below I will argue that whether synchronic multilocation requires time travel depends in part on whether endurantism or perdurantism is true. So arguments for one or the other of these accounts of persistence are not dialectically positioned to benefit from showing that synchronic multilocation can be freed from time travel.

number of such applications in the literature that make no use of time travel and are probably better off that way. These include Hudson (2001) on the problem of the many, McDaniel (2004) on modal realism, Miller (2006) and Dainton (2008) on fission, Tillman (2011) on works of music, and various issues in philosophical theology.[9] Freeing synchronic multilocation from time travel is the key to accommodating these applications.

For example, Tillman's view on works of music is that they are concrete material objects, and he prefers a version of this view on which they are wholly located at each place where they are manifested. Since a work of music can be manifested in more than one place simultaneously, Tillman's view seems to entail that concrete material objects are sometimes synchronically multilocated. But I doubt he would want to say that a work of music time-travels every time it is (e.g.) performed in two different concert halls at once.

In light of the foregoing, I think it is safe to say that the question of whether synchronic multilocation requires time travel should be of considerable interest to metaphysicians.

3 The Missing Link

Does synchronic multilocation of concrete material objects require time travel? There are a number of ways one might try to argue that it does not. For example, if any of the hypotheses mentioned in the previous section entail that concrete material objects can be synchronically multilocated without time traveling, then evidence for those hypotheses is evidence that concrete material objects can indeed be synchronically multilocated without traveling in time. But while I think these hypotheses should be taken seriously, they all remain highly contentious.

[9] Since I am focused on concrete material objects, hypotheses on which God and immaterial souls are multilocated are not relevant. But multilocation of concrete material objects shows up in literature on resurrection (Hudson 2010; Mooney 2018b) and the Eucharist (e.g. Pruss 2013).

One might think that recombinatorial reasoning speaks against a time travel requirement on synchronic multilocation of concrete material objects. Following Sider (2000), we could endorse the modest recombination thesis that all fundamental objects and properties/relations can be freely recombined. Sider uses this thesis to infer that multilocation is possible, given that simples, regions, and the occupation relation are all fundamental.[10] If we take the causal relation to be fundamental as well, then we can go a step farther and infer that it is possible for an object to be multilocated without standing in the identity-preserving causal relations that are involved in any case of time travel. But if the causal relation is not fundamental, then we may have to find the correct analysis of causation to assess the recombinatorial case against the thesis that synchronic multilocation requires time travel.[11]

I'm not much moved by these arguments and I won't dwell on them further. (Those readers who are moved by them may take the rest of my paper as an assessment of what a certain important subset of the relevant evidence supports.) Instead, I want to suggest that, unless there is a good reason to think that synchronic multilocation by concrete material objects requires time travel, it would be arbitrary to insist that it does. For the thesis that this sort of multilocation requires time travel imposes a constraint on concrete material objects, and, in general, it seems like bad practice to impose a constraint on what material objects can do in the absence of any reason to think there is such a constraint.[12]

But of course, this leads us straight to the question of whether there is any reason to think that synchronic multilocation by concrete material objects requires time travel. What 'link' might there be between the two? Given that I've adopted Wasserman's definition of time travel as

[10] See also McDaniel (2007) and Saucedo (2011) for recombinatorial arguments supporting the possibility of multilocation.

[11] The arguments of the last two paragraphs were suggested by a referee.

[12] The reasoning in this paragraph owes a debt to Rasmussen's (2014) modal continuity approach to the epistemology of modality.

discrepancies between time and identity-preserving causal connections, it seems that, if synchronic multilocation requires time travel, it does so either because it depends directly on these discrepancies, or because it depends on something else which occurs only if those discrepancies do. In this section, I will lay out what I take to be the most plausible reason for insisting on such a dependence.

It's standard to think that there are causal conditions on diachronic identity (persistence). That is, it's standard to think that, if an object x at a time t1 is identical to an object y at a later time t2, then x at t1 stands in identity-preserving causal relations to y at t2. But if this is right, then it's also natural to think that there are similar causal conditions on what Hudson (2005) calls *diachoric identity* - identity across space - because it's at least somewhat tempting to think that, by and large, what goes for diachronic identity goes for diachoric identity too. In fact, this thought plays a starring role in Hudson's 'problem of diachoric identity', and it also seems to be at work in an argument that Miller (2006) discusses (but does not endorse) for a view she dubs 'mega-endurantism': the view that objects are wholly located at every spacetime point they fill.

So, on the basis of an analogy between diachronic and diachoric identity, one might think that, necessarily, if an object x is exactly located at a region r1 and, simultaneously, an object y is exactly located at a distinct region r2, and x = y, then x at r1 stands in identity-preserving causal relations to y at r2. And that entails that there are causal conditions on synchronic multilocation by concrete material objects.[13]

What kind of causal connections are identity-preserving? One common thought is that identity-preserving causal connections are immanent-causal connections (Zimmerman 1997). In that case, an identity-preserving causal constraint on synchronic multilocation turns out to be an immanent-causal constraint on synchronic multilocation. So it's interesting

[13] Though I will speak unqualifiedly of 'diachronic identity' and 'diachoric identity', my claims in this regard should be understood as tacitly restricted in scope to concrete material objects.

that at least one author has explicitly suggested such constraints. In the context of discussing cases of synchronic multilocation by concrete material objects, Cody Gilmore (2007) writes:

> It… seems plausible to suppose that… necessarily, if O is a material object and O exactly occupies each of two distinct spacetime regions R and R*, then some sort of immanent causal relation holds between the contents of R and the contents of R* (179 n. 7).

I suspect that something like the line of reasoning suggested above, involving an analogy between diachronic and diachoric identity, is lurking behind Gilmore's comments here.

A referee objects that Gilmore's comment makes no distinction between diachronic and diachoric multilocation, and this suggests that the analogy between diachronic and diachoric identity is not the basis of principles like Gilmore's.[14] But notice that Gilmore doesn't say why his claim about immanent causal constraints "seems plausible"; the analogy between diachronic and diachoric identity has the virtue of being able to explain why it does.

More generally, for any philosophers who have the intuition that something like Gilmore's immanent causal condition is right, the analogy between diachronic and diachoric identity may be the source of the

[14] The referee also notes that even A-theorists, who reject the thesis that time is closely analogous to space, tend to require that a backward time traveler who has just arrived from the future is identical to someone in the future only if they stand in immanent causal relations to that future person. But the journey backward in time is a *diachronic* one, where the immanent causal relations hold between the person at a later and earlier time. So although the backward time traveler is synchronically multilocated, it is not at all clear that the synchronic multilocation, rather than her journey through time, lies behind the demand for an immanent causal link.

intuition. After all, since persistence is a more familiar subject of both experience and thought than the esoteric phenomenon of synchronic multilocation by concrete material objects, it's plausible that intuitions in favor of conditions like Gilmore's are parasitic on intuitions about diachronic identity, as they would be if they had their source in an analogy with diachronic identity. Finally, for philosophers like me who do not have a firm intuition in favor of Gilmore's immanent causal condition, the analogy between diachronic and diachoric identity seems like the most promising road to Gilmore's thesis.

With this in mind, let's formulate two different (but very similar) arguments for the conclusion that there are immanent-causal constraints on diachoric identity, and so also on synchronic multilocation. First, one might think that there is an immanent-causal condition that is both necessary and sufficient for diachronic identity, and so affords us a *criterion* of diachronic identity. The simplest such condition would be this: necessarily, an object x at a time t1 is identical to an object y at a later time t2 iff x at t1 stands in immanent-causal relations to y at t2. A condition like this generates what we can call 'the criteria argument':

The Criteria Argument

1. There are immanent-causal criteria of diachronic identity.
2. If there are immanent-causal criteria of diachronic identity, then there are immanent-causal criteria of diachoric identity too. So,
3. There are immanent-causal criteria of diachoric identity.

But one might instead propose that the immanent-causal conditions on diachronic identity are merely necessary conditions. Perhaps the simplest such condition would be this one: necessarily, an object x at a time t1 is identical to an object y at a later time t2 only if x at t1 stands in immanent-causal relations to y at t2. A condition like this generates what I will call 'the necessary condition argument':

The Necessary Condition Argument

1. There are necessary immanent-causal conditions on diachronic identity.
2. If there are necessary immanent-causal conditions on diachronic identity, then there are necessary immanent-causal conditions on diachoric identity too. So,
3. There are necessary immanent-causal conditions on diachoric identity.

If either of these arguments is sound, it follows that there are at least immanent-causal necessary conditions on synchronic multilocation. The simplest such condition would be this: necessarily, an object x that is exactly located at a region r is identical to an object y that is simultaneously exactly located at a region r*, where r* is distinct from r, only if x at r and y at r* stand to each other in immanent-causal relations. A bit more colloquially, an object that is in two or more places at once must be linked to itself across those different places by a trail of immanent-causal connections.

What does all of this have to do with time travel? If there is a concrete material object x and a concrete material object y in different places at once, and yet x and y are linked by a trail of identity-preserving immanent-causal connections, then that causal trail cannot simply follow the direction of time. Instead, it must either backtrack at some point – as in backward time travel – or traverse space without also traversing time – as in simultaneous causation, which, as we've seen, counts as time travel in the broad sense of the term that I am using in this paper. So, prima facie, the best way to defend a time travel constraint on synchronic multilocation of concrete material objects is to argue that the time travel constraint is undergirded by an immanent-causal constraint.

What should we make of the above arguments? Because they are so similar, I will consider them in parallel rather than taking them one at a time. In the next section I will discuss the first premise of each argument. Then, in the following section, I will discuss the second premise of each argument.

4 The First Premises

Both arguments begin with a premise that claims there are immanent-causal constraints on diachronic identity. But, between the two of them, the first argument makes the bolder claim: that there are immanent-causal *criteria* of diachronic identity. Let's begin there.

Criteria of diachronic identity are informative necessary and sufficient conditions on an object at one time being identical to an object at another time (Merricks 1998). A spatiotemporal criterion is tempting until one reflects on cases where an object is annihilated and replaced by an intrinsic duplicate that begins its trip through spacetime exactly where the original left off. These cases tend to pump our intuitions in favor of a causal criterion, and more specifically, an immanent causal criterion (Zimmerman 1997).

Here again is the simplest immanent causal criterion of diachronic identity: necessarily, an object x at a time t1 is identical to an object y at a time t2 iff x at t1 stands in immanent causal relations to y at t2. It's well-known that fission and fusion cases cause trouble here. For if this criterion is correct, then there are certain sorts of causal relations which are ordinarily sufficient for persistence, and so ordinarily immanent. But in fission and fusion cases, an object x stands in those causal relations to two or more distinct objects y and z. Assuming that x cannot be identical to both y and z, and that x can only stand in immanent-causal relations to itself, I think we will have to say that the sort of causal connections that ordinarily suffice for persistence fail to do so in cases of fission and fusion.

But, notoriously, this leads to a closest-continuer theory of identity, on which the identity of an object at one time with an object at another time depends on facts extrinsic to 'both'. For suppose that x stands in the sort of causal relations to y that are ordinarily immanent. Is x identical to y? That depends. Specifically, it depends on whether x also stands in such relations to some z, distinct from y. This is a violation of the highly intuitive 'only x and y principle', which denies that some objects x and y can depend for their identity on things that are blatantly extrinsic to them. So, for many

philosophers, a closest-continuer theory of diachronic identity is unacceptable.

In the end, I think the closest we can hope to get to a plausible criterion of diachronic identity will be something like sameness of 'particularity', where a particularity is a certain non-qualitative component of an object in virtue of which that object is the particular object that it is (Jacobs & O'Connor 2003 & 2010). Insofar as this is fairly uninformative, it probably doesn't count as a criterion of diachronic identity at all. So, perhaps I am with Merricks (1998): there are no criteria of diachronic identity. The first premise of the Criteria Argument is false.

But even if there are no criteria of diachronic identity - immanent-causal or otherwise - there may still be necessary conditions on diachronic identity. At the very least, it's clear that objects persist under some conditions and not others. So, let's turn from the first premise of the criteria argument to the first premise of the necessary condition argument, which claims only that there are necessary immanent causal conditions on diachronic identity. Here again is perhaps the simplest such condition: necessarily, an object x at a time t1 is identical to an object y at a time t2 only if x at t1 stands in immanent causal relations to y at t2.

As with the immanent causal criterion, this immanent causal necessary condition has the desirable result that spatiotemporal continuity is not sufficient for diachronic identity. An object x at a time t1 and an object y at a later time t2 can be spatiotemporally continuous – the latter beginning its journey through spacetime exactly where the former left off – and yet fail to be identical because they fail to stand in immanent causal relations. But unlike the immanent causal criterion, this time we don't run into the fission and fusion problem. For the immanent causal necessary condition does not so much as suggest that any sort of causal relations are sufficient for identity, so branching causal relations in cases of fission and fusion are no threat.

Still, this simple necessary condition seems to suffer counterexamples. For at least some objects seem to survive disassembly and reassembly, at least in some circumstances. To take a standard example, I

could disassemble and later reassemble my pocket watch, and if I did, I would have the same watch at the end of the procedure that I had at the beginning. In this case, the very same watch exists before disassembly and after reassembly, but the watch before disassembly does not stand in immanent causal relations to the watch after reassembly. So, the simple necessary condition won't do.

However, there is a weaker immanent causal necessary condition that might do the job. For notice that I can't reassemble the watch if all of its parts are annihilated. I might be able to reassemble it if I had to replace one or two parts, but I couldn't very well bring the same watch back into existence using only parts that never composed it. Reflecting on such observations, Olson (2010) suggests that the immanent causal relations running through the disassembled parts of the watch suffice for the possibility of reassembly. If he is right, then perhaps there is an immanent causal necessary condition on diachronic identity, albeit one which does not require the persisting object itself to always stand in immanent causal relations across time.

Here is a very plausible condition of that sort. Necessarily, an object x at a time t1 is identical to an object y at a later time t2 only if (i) x at t1 is immanent causally related to y at t2, or (ii) some proper part of x is immanent causally related to some proper part of y at t2, or (iii) there is some z and some t such that (a) x at t1 is immanent causally related to z at t and some proper part of z at t is immanent causally related to some proper part of y at t2, or (b) some proper part of x at t1 is immanent-causally related to some proper part of z at t and z at t is immanent-causally related to y at t2. Intuitively, the idea is that an object can be disassembled and then reassembled, and so survive the interruption of its immanent causation, only if the immanent causation in at least some of its parts is not also interrupted during the interval between it's disassembly and reassembly.

This necessary condition is not very demanding, but it is still strong enough to run an argument that synchronic multilocation by concrete material objects requires time travel, since an exactly analogous condition on diachoric identity would still impose a time-travel requirement on

synchronic multilocation. The analogous diachoric condition would be: necessarily, an object x at a region r1 is identical to an object y at a distinct simultaneous region r2 only if (i) x at r1 is immanent causally related to y at r2, or (ii) some proper part of x at r1 is immanent-causally related to some proper part of y at r2, or (iii) there is some z and some r such that (a) x at r1 is immanent causally related to z at r and some proper part of z at r is immanent causally related to some proper part of y at r2, or (b) some proper part of x at r1 is immanent causally related to some proper part of z at r and z at r is immanent causally related to y at r2. This allows for cases where (for example) an object is disassembled in the present, it's parts are sent back in time, and the object is reassembled in the past alongside its younger self. But even cases like this clearly involve time travel.

On the whole, then, it seems to me that the first premise of the Criteria Argument is false, but the first premise of the Necessary Condition Argument is true. There is no immanent causal criterion of diachronic identity. But, while the simplest immanent causal necessary condition on diachronic identity suffers counterexamples, it has a weaker cousin that seems much more plausible.

5 The Second Premises

What goes for diachronic identity goes for diachoric identity too. That, I have suggested, is the thought behind the very similar second premises of both the criteria and necessary condition arguments. But is it right? Should we treat diachoric identity just as we do diachronic identity? I say the answer depends on contested issues regarding the nature of time and persistence. Let me explain why.

Some metaphysicians are endurantists: they believe that objects persist by being exactly located at different times. More specifically, they are exactly located at each moment through which they persist.[15] Some

[15] I here adopt the locational rather than the mereological characterization of endurantism (Gilmore 2014).

endurantists are also eternalists: they believe that not only present objects and events, but also past and future objects and events, exist. For the eternalist, the universe is a four-dimensional spacetime block. Finally, some eternalists are also B-theorists: they believe that all true tensed sentences have tenseless truth conditions. The upshot is that there is no objective temporal passage.

For the moment, let's suppose that the conjunction of endurantism, eternalism, and the B-theory is true. Given B-theoretic eternalism, time is closely analogous to space, because it turns out to be the fourth dimension of a spacetime manifold. So, if we take this view together with the endurantist thesis that objects persist by being exactly located at different times, then a persisting object is exactly located at multiple regions throughout the manifold. Persistence turns out to be diachronic multilocation (Gilmore 2014).

If persistence is diachronic multilocation, then we have a good reason to endorse the premise that what goes for diachronic identity also goes for diachoric identity. After all, why would multilocation across time require immanent causal connections between a concrete material object's exact locations, while the closely analogous phenomenon of multilocation across space does not? And as we've seen, if there is such a constraint, then synchronic multilocation of concrete material objects requires time travel.

However, this argument depends on B-theoretic eternalist endurantism, and there are lots of ways not to be a B-theoretic eternalist endurantist. For example, you could reject endurantism in favor of either perdurantism, on which objects persist by exactly occupying a single, four-dimensional worm-shaped region (e.g. Lewis 1986), or stage theory, on which ordinary objects are restricted to a single three-dimensional region, but persist by having temporal counterparts exactly occupying three dimensional regions at other times (e.g. Hawley 2001; Sider 2001). On either view, objects do not persist by being exactly located at distinct times, and so persistence turns out not to be a variety of multilocation. Therefore, the analogy between persistence and synchronic multilocation breaks down,

and we are left with no clear reason to affirm that what goes for diachronic identity goes for diachoric identity as well.[16]

Or suppose you are like me: you accept endurantism but you are not a B-theorist. The B-theory's main rival is the A-theory, according to which there are irreducibly tensed facts. The A-theory is often regarded as providing a simple solution to the problem of temporary intrinsics. Suppose Steven is standing now but was sitting a moment ago. Then it seems that Steven has the property of being bent and he has the property of being straight. But how can Steven have both of these apparently incompatible properties? The A-theorist can endorse the commonsense answer: Steven is *not* both bent and straight. Rather, Steven *is* bent and *was* straight. Given the irreducibility of tense, this does not entail (as it does on the B-theory) the conjunction that Steven is bent and Steven is straight.

But, by the same token, if the A-theory is true, then endurantism does not entail that objects are multilocated across time. For given the A-theory, Steven is not both exactly located at the present time and exactly located at an earlier time any more than Steven is both bent and straight. Rather, Steven *is* exactly located at the present time and Steven *was* exactly located at an earlier time, and this does not entail the conjunction that Steven is exactly located at the present time and exactly located at a past time. And surely, if Steven is not exactly located at multiple times, then Steven is not multilocated across time.[17]

However, it is controversial whether the A-theoretic approach to temporary intrinsics on which I based this point about diachronic multilocation is successful, and some A-theorists prefer other solutions to the problem.[18] Here is one reason why. Non-presentist versions of the A-theory, such as the Growing Block and Moving Spotlight views,

[16] Alternatively, you might continue to insist on the analogy, and conclude that synchronic multilocation is impossible. Thus Hudson (2005).

[17] As a referee points out, there are many ways to characterize endurantism, and what I have written here basically reflects Skow's (2015, 184) characterization.

[18] Thanks to a referee for this point.

countenance non-present objects in their ontologies. This might commit them to what Fiocco (2010) calls ontological homogeneity - "that there are many moments of time and all have the same ontological status" (65). Fiocco contends that, given ontological homogeneity, Steven tenselessly exists at some past time t1 where he is bent, and also at the present time where he is straight, which - bracketing B-theory-friendly approaches to temporary intrinsics - seems to entail that Steven is (tenselessly) both bent and straight simpliciter. By the same token, it seems that Steven is (tenselessly) exactly located at t1 and at exactly located at the present moment.[19]

But it seems to me that any version of the A-theory which cannot successfully take advantage of the primitive tense solution to the problem of temporary intrinsics sketched above fails to capture our deepest intuitions about change and temporal becoming which make the A-theory plausible in the first place. For I take the primitive tense solution to be the commonsense solution to the problem of temporary intrinsics, and I take it to be commonsensical precisely because it tracks deeply ingrained intuitions about time and change.[20] Since those intuitions are the rock on which the A-theory is built, no version of the A-theory is successful unless it vindicates them. So by my lights, if there are any successful, non-

[19] Another worry some have about the primitive tense approach to the problem of temporary intrinsics - one which it is very natural to raise in this context - is that it doesn't help with cases of synchronic multilocation, e.g., a backward time-traveler who is simultaneously sitting over here and standing over there (the case is from Sider 2001, 101ff). On this point, I think the A-theorist should simply concede that a different approach is required for diachoric cases than diachronic cases. Given that time and space are disanalogous on the A-theory, this isn't terribly surprising. (Miller (2006) makes a similar point.) And even if the primitive tense solution to the problem of temporary intrinsics failed for this reason, it's not clear that this would undermine my point about diachronic multilocation given the A-theory. For that point depends on an appeal to primitive tense, but not on the A-theorist using primitive tense to solve the problem of temporary intrinsics.

[20] This point is inspired by similar comments made by Ned Markosian in a seminar.

presentist versions of the A-theory - and maybe there are aren't; I leave that open - then they will be able to use the primitive tense solution to the problem of temporary intrinsics, and similarly deny that persisting objects are diachronically multilocated.

For an A-theorist who is also a presentist, a second wedge is driven between persistence and multilocation across time. For given presentism, past and future objects and events don't exist. Steven may be exactly located at the present time, and he may have once been located at a past time, but the event of his being located at that past time no longer exists. Just as I am not synchronically multilocated because there presently exists only one event that consists of my being exactly located at some region, so Steven is not multilocated across time because there exists only one event that consists of his being exactly located at some time (namely, the present one).

So, for those who reject B-theoretic eternalist endurantism, persistence is not diachronic multilocation, and isn't really much like multilocation at all. But I've argued that this is the analogy that, for the B-theoretic eternalist endurantist, undergirds the premise that what goes for diachronic identity goes for diachoric identity too. So, I see no reason for those who reject B-theoretic eternalist endurantism to believe that whatever immanent causal constraints apply to the persistence of concrete material objects also apply to synchronic multilocation of such objects. She has no reason to affirm the second premise of either the Criteria Argument or the Necessary Condition Argument.

Above I suggested that it would be arbitrary to impose a time travel constraint on synchronic multilocation of concrete material objects unless there was some reason to do so. In light of what I have just argued, it seems to me that B-theoretic eternalist endurantists have a good reason to impose the time travel constraint, but, barring some reason to endorse such a cosntraint aside from the Criteria and Necessary Condition Arguments, perdurantists, stage theorists, and A-theorists do not. So they should say that, if concrete material objects can be synchronically multilocated at all, they do not have to travel in time in order to do it.

6 Conclusion

I've considered two related arguments that synchronic multilocation of concrete material objects requires time travel in the broad sense of discrepancies between time and identity-preserving causal relations. One argument claims that there are immanent causal criteria of diachronic identity; the other claims that there are immanent causal necessary conditions on diachronic identity. Both then claim that the immanent causal constraints on diachronic identity spread to diachoric identity, and so to synchronic multilocation. I've expressed my doubts about an immanent causal criterion of diachronic identity, and even about an unqualified immanent causal necessary condition on diachronic identity. But I've endorsed a weaker cousin of the latter thesis that can still be used to run an argument that synchronic multilocation of concrete material objects requires time travel.

In my view, the main issue is whether immanent causal constraints on diachronic identity plausibly carry over to diachoric identity, and so to synchronic multilocation. I've argued that this issue hinges on the nature of time and persistence. While the endurantist who is also a B-theorist should endorse this slide from diachronic to diachoric identity, the four-dimensionalist and the A-theorist – and especially the presentist – should not. Ultimately, I conclude that perdurantists, stage theorists, and A-theorists should maintain that synchronic multilocation of concrete material objects does not require time travel. The B-theoretic endurantist, however, should believe that it does.[21]

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