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# Mereological Explanation and Time Travel

ABSTRACT: I have previously argued in a paper with Robson that a particular time travel scenario favours perdurantism over endurantism on the grounds that endurantists must give up on the Weak Supplementation Principle. Smith has responded, arguing that the reasons they provide are insufficient to warrant this conclusion. This paper agrees with that conclusion (for slightly different reasons: that even the perdurantist has to give up on the Weak Supplementation Principle) but argues that a new argument can be supplanted in its place.

## 1. Introduction

In a paper I wrote with Robson [2007] we presented a time travel scenario, and argued that it favoured perdurantism over endurantism. The reason for this was that endurantists had to give up on the Weak Supplementation Principle (WSP) whilst perdurantists (allegedly) did not. In §2 I briefly recount this argument. In addition, I demonstrate that time travel threatens more mereological principles than just WSP.

Smith [Forthcoming] offers a reply on behalf of the endurantist: that we should read our mereology off our metaphysics, and so endurantists should be happy to give up on WSP. In §3 I explain why I now agree with him – indeed, why I think we *must* agree with him as everyone, endurantist and perdurantist alike, must give up on WSP (and the other principles under threat). Robson and I wrongly conflated WSP, a principle of *temporally relativised* mereology, with the *atemporal* analogue of that principle. Whilst the perdurantist can have the *latter*, they are nonetheless stuck with denying the *former*. So I am obliged to agree with Smith that the original arguments for us having to accept WSP are flawed (indeed, I think Smith correctly diagnoses the flaws in those arguments, and so will not discuss them further in this paper).

However, this is not the end of the matter. WSP, and the other threatened principles, were introduced to rule out certain bizarre situations obtaining. Even given the possibility of time travel, these situations must still be excluded. In §4 I explain how the endurantist must revise WSP (etc.) leaving them with a complex principle, which they must take as a brute fact, in order to continue ruling out such situations. In §5 I detail how the perdurantist can instead continue to rely upon taking the (much simpler) principles of classical atemporal mereology as brute fact and still get the same result. So I offer a new argument for perdurantism: that it has greater explanatory power than endurantism, by getting the same results from simple, non-complex, principles.

§6 deals with a possible objection: that the definition of ‘instantaneous temporal part’ that the perdurantist must endorse makes their theory more complex than first thought. Finally, in §7, I end by discussing another argument Smith gives, and explain why this argument is ineffective against perdurantism.

## 2. Temporally Relativised Mereology

Sometimes objects stand in temporally relativised mereological relations e.g. a wheel can be part of a car at some times, and not others (such as when the wheel is removed for maintenance). Both endurantists and perdurantists accept that there are such relations (even though perdurantists will analyse them in terms of atemporal mereological relations – see §3). Standardly, temporally relativised mereological principles include:

*Weak Supplementation Principle (WSP)*: If  $x$  is a proper part of  $y$  at  $t$ , then there is some  $z$  that is a proper part of  $y$  at  $t$  that does not overlap  $x$  at  $t$ .

Widely accepted as it is, it turns out to be false given the possibility of time travel. Robson and I gave an example:

*Scenario (i):* Imagine a brick time travels back to time  $t$ , not just once, but two hundred times. Imagine we take all two hundred versions of the brick and build a wall out of it at  $t^*$ . The brick(s?) compose a wall (just as regular bricks would). That wall has the brick as a proper part at  $t^*$  such that there is no other proper part of the wall at  $t^*$  that does not overlap the brick at  $t^*$ . Thus WSP is false.

Whilst Robson and I (and, indeed, Smith) concentrated on WSP, I now think this is just one example of a temporally relativised mereological principle that fails given time travel. For instance, take some of the principles accepted by a classical temporally relativised mereology:<sup>1</sup>

*Asymmetry:* If  $x$  is a proper part of  $y$  at  $t$  then it cannot be the case that  $y$  is a proper part of  $x$  at  $t$ .

*Transitivity:* If  $x$  is a proper part of  $y$  at  $t$ , and  $y$  is a proper part of  $z$  at  $t$  then  $x$  is a proper part of  $z$  at  $t$ .

*Uniqueness:* If the  $y$ s compose  $x$  at  $t$  and the  $y$ s compose  $z$  at  $t$ , then  $x = z$ .

*Universalism:* A further object is composed by some  $y$ s at  $t$  iff those  $y$ s are distinct, and exist at  $t$ .

Just as scenario (i) threatens WSP, there are time travel scenarios that threaten each of these principles:

*Scenario (ii):* Imagine a cube, with each side measuring 10m, made of a homogeneous substance. Now combine sci-fi scenarios. Not only do we take it back to a time that it previously existed at, but we use a shrinking machine and miniaturise by a factor of 100. We then remove a cube-shaped portion, with edges measuring 10cm, from the earlier, larger version of the cube and replace that portion with the miniaturised future version (which now fits perfectly). The cube is now a proper part of itself at that time. So *Asymmetry* is false.

*Scenario (iii):* Imagine a car has a wheel as a part at  $t$ . At  $t^*$  the wheel is removed from the car, and then lined with exotic matter to facilitate its travelling through time. The wheel (but not the car) travels through time and returns to  $t$ . The car has the wheel as a proper part at  $t$ , and the future version of the wheel has a lump of exotic matter as a proper part at  $t$ , but it is false (contra *Transitivity*) that the car has a lump of exotic matter as a proper part at  $t$ .

*Scenario (iv):* Imagine I am composed of some atoms, the  $y$ s, at  $t$ . A million years in the future, at  $t^*$ , I will be long gone but those atoms may still be around. We can easily imagine that a *different* person happens to be composed of those atoms at  $t^*$ . If that person travels back in time from  $t^*$  to  $t$  then two distinct objects are composed at  $t$  of the same atoms. So *Uniqueness* is false.

*Scenario (v):* Given universalism it is necessary and sufficient that the  $y$ s are distinct for them to compose at times at which they all exist. Now look back at scenario (i). There we have a case of some non-distinct things (i.e. the time travelling brick) composing a further thing (i.e. the wall). So not only do all distinct things compose, sometimes identical things compose a further object too. So *Universalism* is false, for it is not *necessary* that the  $y$ s be distinct for them to compose a further object.

So the possibility of time travel threatens a variety of mereological principles, some which almost everyone accepts (WSP, *Asymmetry* and *Transitivity*) whilst others only some people accept (*Uniqueness* and *Universalism*). I will concentrate on the threat to WSP for the rest of this paper, although what I say for WSP applies *mutatis mutandis* to the other principles.

### 3. Perdurantism and WSP

I originally claimed with Robson that we can retain WSP if we accepted perdurantism:

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<sup>1</sup> For the purpose of example I will assume that it is classical mereology we find favour with. This is solely for the purpose of presentation. You could substitute different systems (for instance, see n8 where I suggest the perdurantist might want to give up the atemporal version of *Uniqueness*) and similar problems would still arise for the principles of those systems.

For the perdurantist the time travelling brick has numerous distinct temporal parts. When Marty constructs the wall the distinct temporal parts of the brick come to compose a temporal part of the wall. WSP doesn't fail since the wall has numerous distinct non-overlapping proper parts, namely the distinct temporal parts of the time travelling brick [Effingham and Robson 2008: 635]

I now see that this is simply false. Perdurantism can no more rescue WSP than endurantism. The first indication of this is that the scenarios above make no mention of perdurantism or endurantism. So the problems they cause *prima facie* appear to be independent of one's views in the metaphysics of persistence. We can also demonstrate perdurantists are lumbered with the above denials once we are clear on what perdurantists say about temporally relativised mereology.

Perdurantists don't just have temporally relativised mereological relations, but also have atemporal mereological relations, where the latter are just like the former except without the temporal relativisation (presentist-endurantists can say the same thing, but I deal with them below in *n3*). Perduring wholes stand in these atemporal mereological relations to their temporal parts (having them as proper parts, being composed of them etc.) and analyse temporally relativised mereology in terms of their atemporal mereology:

**(P@T):**  $x$  is part of  $y$  at  $t$  iff  $x$  and  $y$  each exist at  $t$ , and  $x$ 's instantaneous temporal part at  $t$  is [an atemporal] part of  $y$ 's instantaneous temporal part at  $t$ . [Sider 2001: 57]

So (given perdurantism) the atemporal mereological facts fix the temporally relativised mereological facts. And they fix them in such a way that the principles threatened by the time travel scenarios *still turn out to be false*. For instance, in scenario (i), at time  $t^*$  there are two hundred instantaneously existing objects (i.e. the instantaneous temporal parts of the brick) which compose the wall's instantaneous temporal part at that time. The brick's temporal parts at  $t^*$  are parts of the wall's temporal part at  $t^*$  so (given P@T) the brick is part of the wall at  $t^*$ , but any proper part of the wall at  $t^*$  (i.e. any object with an instantaneous temporal part that is an atemporal proper part of the wall's instantaneous temporal part at  $t^*$ ) overlaps the brick at  $t^*$  (i.e. each of those aforesaid instantaneous temporal parts atemporally overlap at least one of the brick's 200 instantaneous temporal parts from  $t^*$ ). So (given P@T) the brick is a proper part of the wall (at  $t^*$ ) and no proper part of the wall (at  $t^*$ ) fails to overlap the brick (at  $t^*$ ). So WSP is *still* false given perdurantism. *Mutatis mutandis* for the other principles.

What perdurantism *can* save is the atemporal *analogue* of the principle, namely:

*Atemporal Weak Supplementation Principle:* If  $x$  is an atemporal proper part of  $y$ , then there is some  $z$  that is an atemporal proper part of  $y$  that does not atemporally overlap  $x$ .

Even in light of the above scenarios, the perdurantist can carry on accepting this atemporal analogue of WSP (and similarly for *Asymmetry*, *Transitivity* etc. and their respective atemporal analogues). But the perdurantist shouldn't confuse having an atemporal analogue of WSP with *saving* WSP (etc.). As perdurantists are committed to WSP (etc.) failing given time travel, endurantists should feel no embarrassment saying likewise (and Smith is correct that we should revise our temporally relativised mereology in light of these scenarios). So, as yet, there's no reason to think the time travel scenarios favour perdurantism.

However, I believe we can introduce a new argument in favour of perdurantism: that perdurantism has more explanatory power than endurantism. §4-5 detail that argument.

#### 4. Endurantists and Revising Temporally Relativised Mereology

It is not good enough to simply cast aside principle like WSP and carry on regardless. WSP is introduced to rule out bizarre scenarios like:

*Scenario (vi):* A regular (non time travelling, non multi-located) brick,  $a$ , composes (at  $t$ ) an object,  $b$ , that has  $a$  as a proper part at  $t$  (and no other proper parts at  $t$  other than the proper parts of  $a$ ).  $b$  in turn composes  $c$  (at  $t$ ), which has  $b$  as a proper part at  $t$  (and no other proper parts at  $t$ )

other than the proper parts of *b*). Similarly, *c* composes *d* (at *t*), *d* composes *e* (at *t*) etc. So we end up with an infinite number of objects (presumably all of which are bricks), each exactly located at the same region of space.

That there could be such weird ‘towers’ of bricks is implausible, and such situations are exactly what WSP was conscripted in to rule out. WSP’s being true is the reason such situations are impossible i.e. the truth of WSP is meant to *explain* why scenario (vi) could not obtain. Now whilst time travel scenarios may mean we must give up on WSP, they *don’t* license us to then think that scenarios like scenario (vi) can take place. Time travel, and its ramifications, may be weird, but even in light of scenario (i), it is *still* ridiculous to think scenario (vi) could obtain. So if WSP is false, then we need a revised principle that rules out cases like (vi), ensuring that this revised principle still permits cases like (i). Similarly for the other principles (for instance, whilst *Asymmetry* fails given time travel, that doesn’t mean that regular objects can then be proper parts of themselves etc.).

Still sticking with WSP for purpose of example, imagine what revisions the endurantist must make to admit scenarios like (i) and exclude those like (vi). The endurantist cannot just say that all non-time travelling objects must obey WSP whilst time travelling objects are exceptions, for imagine a brick falls through a wormhole and travels back in time, but is *not* co-located with any past or future versions of itself (i.e. no situation like scenario (i) is taking place). *That* brick can no more breach WSP, and compose ‘towering objects’, than the regular brick from scenario (vi).

Here is a suggested alternative principle the endurantist may wish to endorse. Say that an object is multi-located *n* times at *t* iff it is exactly located at *n* distinct regions at *t*.<sup>2</sup> Say that an object composes with itself (and thus breaches WSP) when it is multi-located more than once, allowing it to compose  $2^n - n$  objects (so, as every object composes itself, it composes  $2^n - n - 1$  *further* objects). Ergo, the brick that simply falls through a wormhole, and is ‘multi-located’ once composes no further objects with itself (as it is ‘multi located’ one time, so there are  $2^1 - 1 - 1 = 0$  *further* objects) and so does not breach WSP. But just as (given universalism) 200 regular bricks compose  $2^{200} - 201$  further objects (one of which is a wall), the brick from scenario (i), in being multi-located 200 times at that instant, likewise composes  $2^{200} - 201$  further objects (each being a qualitative duplicate of the further objects that would’ve been composed had there been 200 regular bricks) which is as it should be. So we get:

*Revised Weak Supplementation Principle:* If *x* is a proper part of *y* at *t*, then there is some *z* that is a proper part of *y* at *t* that does not overlap *x* at *t*, except when *x* is multi-located *n* times in which case there are  $2^n - n - 1$  objects, the *ys*, that are such that for each *y*, *y* has a proper part (at *t*) such that no other proper part (at *t*) of *y* fails to overlap it (at *t*).

If the revised weak supplementation principle were true then scenario (i) could obtain whereas scenario (vi) could not. That principle, then, would be able to carry out the work that WSP was initially introduced to do. However this revised principle is more *complex* than the original WSP (and I think any alternative to the principle I have proposed will likewise be more complex). Furthermore, for the endurantist, this – more complex – principle will hold as a matter of brute fact, for an endurantist ontology does not have any resources to explain why the temporally relativised mereological facts are true (*a fortiori* no explanation of why the various principles are true). So, given the possibility of time travel, the endurantist must accept a temporally relativised mereology significantly more complex than classical temporally relativised mereology.

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<sup>2</sup> Even this revision won’t prove satisfactory, for objects could be multi-located when exactly occupying *identical* regions. For instance, a time travelling boson that superposes with itself will be ‘multi-located’ at exactly the same region (and just as two superposed bosons may compose a further object, there’s no reason to think the time travelling boson fails to either).

## 5. Perdurantists and Revising Temporally Relativised Mereology

To an extent, perdurantists are in the same boat as the endurantist. They, too, must permit scenarios like scenario (i), which breach WSP, whilst banning scenarios like scenario (vi). Just like the endurantist, they need an explanation of this fact. But whereas the endurantist relies upon their revised weak supplementation principle from above, taking that to be true as a matter of brute fact, the perdurantist can do better,

Perdurantism can do better because of the intimate connection between their atemporal mereology and temporally relativised mereology. Given (P@T), the temporally relativised mereological facts are fixed by the facts concerning (a) what things are temporal parts of what other things and (b) the atemporal mereological facts.<sup>3</sup> §3 has already explained how perdurantists account for scenario (i) (and, consequently, why they will deny WSP). But perdurantism, using only a *classical* atemporal mereology, can rule out scenario (vi).

Scenario (vi) requires brick *a* to compose brick *b* at *t*, such that no other proper part of *b* at *t* fails to overlap *a* at *t*. For the perdurantist, that would require *a*'s *sole* instantaneous temporal part at that time to (atemporally) compose the *sole* instantaneous temporal part of *b* at that time. But that's impossible given classical atemporal mereology, for then *b*'s instantaneous temporal part at *t* would have *a*'s instantaneous temporal part at *t* as an atemporal proper part such that no other atemporal proper part of *b*'s instantaneous temporal part fails to overlap *a*'s instantaneous temporal part.<sup>4</sup> That would breach the atemporal version of the weak supplementation principle (whereas, in scenario (i), as the wall's instantaneous temporal part is composed of *distinct* instantaneous temporal parts of the time travelling brick, the atemporal weak supplementation principle is *not* breached). Similar explanations will work in the case of scenarios (ii) – (v), where the principles of classical atemporal mereology (plus (P@T) and a principle determining what counts as a temporal part of what), will admit those scenarios whilst still ruling out unacceptable scenarios where mundane non-time travelling, non-multi located objects become proper parts of one another at one and the same time (thus breaching *Asymmetry*) etc.

So just as the endurantist takes their revised weak supplementation principle as a brute fact, and then uses that to explain why scenario (i) is permissible and (vi) is not, the perdurantist takes the principles of a classical atemporal mereology (plus (P@T) and the principles determining what counts as an instantaneous temporal part) as brute facts and uses them to explain why scenario (i) is permissible and (vi) is not. That's not to say that the perdurantist won't agree with the endurantist over what principle of temporally relativised mereology replaces WSP, but they won't take that principle to be true as a matter of brute fact.

Here's the rub: the endurantist takes their revised complex principles as brute fact, whilst the perdurantist takes their simple classical principles as brute fact. So whilst both the endurantist and the perdurantist can explain why scenario (i) is permissible and (vi) is not, the endurantist must rely upon brute facts that are significantly more complex than those the perdurantist relies upon. This gives perdurantism the upper hand, for in relying upon simpler principles, it offers the better explanation. Compare to a similar case in physics: Mercury's perihelion did not quite fit what Newtonian mechanics predicted. Some theories offered complex principles to fix this discrepancy, whereas general relativity offered a simpler explanation. Hence, both explained

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<sup>3</sup> Now we can see why being a presentist-endurantist won't help even if they do accept atemporal mereology. They *won't* accept (P@T) so their atemporal mereology won't explain the revisions. Indeed, just as the regular endurantist has to make revisions to temporally relativised mereology the presentist would have to make corresponding revisions to their atemporal mereology. So they'll end up with a system just as complex as the regular endurantist.

<sup>4</sup> Unless the two temporal parts were identical, but then if the 'tower' of bricks from scenario (vi) all shared one and the same temporal part there wouldn't be *lots* of bricks there at that time – as scenario (vi) demands – but just one brick.

Mercury's perihelion but general relativity was to be preferred in virtue of relying on simpler principles. This example is doubly instructive, as the more complex non-relativistic theories ultimately had holes in them and didn't guarantee exactly the right result, a problem which may well plague the endurantist's explanation, for it is not certain that even the complex revision made in §3 will ultimately prove satisfactory (see *n2*).

So whilst the argument Robson and I originally gave for favouring perdurantism over and above endurantism does not succeed, we now have a new argument: prefer perdurantism because it offers the better explanation.

## 6. Problems for the Simplicity of Perdurantism

This section sketches a reason to think that perdurantism ends up being more complex than endurantism, and explains why such a fear is misplaced. Certainly the mereological principles the perdurantist takes as brute will be simpler than those that the endurantist does as the perdurantist will continue to endorse the atemporal weak supplementation principle whilst the endurantist will endorse the, obviously more complex, revised weak supplementation principle from §4. So the perdurantist theory will be simpler on *those* grounds. But the perdurantist needs *more* than atemporal classical mereology. As made clear above, they also need (P@T) and a principle that determines what things count as temporal parts of what other things. The addition of (P@T) is not a problem. It is a simple and straightforward principle, and it would be an odd objection to think that adding such a principle to the theory outweighs the added complexity of the changes the endurantist must make to their temporally relativised mereology.

Problems arise when we turn to defining 'instantaneous temporal part'. At first glance it doesn't seem to be a problem as the standard definition is:

*x* is an instantaneous temporal part of *y* at time *t* =<sub>df</sub> (i) *x* is a part of *y*; (ii) *x* exists at, but only at, time *t*; (iii) *x* overlaps every part of *y* at time *t*. [Sider 2001: 60]

If *that* was the principle that the perdurantist was to rely upon, then I think it obvious that, along with (P@T) and the principles of classical atemporal mereology, the perdurantist *would* have a system that was simpler than endurantism. Alas, *that* definition of temporal part won't work. Sider makes this clear, pointing out that in time travel scenarios such a definition of temporal part breaks down [2001: 101]. For instance, in scenario (i) rather than the two hundred instantaneous brick-like entities turning out to be instantaneous temporal parts of the brick, given the above definition it is only their *fusion* that will be an instantaneous temporal part of the brick at that time. That would be calamitous, as that fusion would be identical to the instantaneous temporal part of the *wall* at that time, thus (given (P@T)) the brick *wouldn't* be a *proper* part of the wall at all at that time. But that's false (or so the thinking goes). The brick *is* a proper part of the wall at that time. Perhaps some perdurantists might bite the bullet at this point and just deny that the brick is a proper part of the wall at that time, but I don't feel inclined to take that route, and in any case if perdurantism generated odd results it would certainly count against it having more explanatory power than endurantism.

Sider does offer a remedy, however. With regards to time travelling people, he says that the objects that are important in determining their temporary intrinsic properties (what I have labelled 'instantaneous temporal parts') are the 'person-like' parts of the object that (i) exists at that instant, such that (ii) it overlaps all and only the parts of the person at that time. We can easily extend this definition to things other than people:

*x* is an instantaneous temporal part of *y* at time *t* =<sub>df</sub> (i) *y* is associated with a sortal *S*; (ii) *x* is a part of *y*; (iii) *x* exists at, but only at, time *t*; (iv) *x* falls under the sortal 'S-like'.<sup>5</sup>

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<sup>5</sup> Sider wants to retain 'instantaneous temporal part' for talking about the object that is the fusion of what I call the instantaneous temporal parts, and instead call the 'person-like' parts 'person-stages'. But it'll do no harm for me to instead label the person-like parts 'instantaneous temporal parts'.

Where the ‘associated sortal’ for people is ‘person’; for bricks it is ‘brick’; for walls it is ‘wall’ etc. Given that definition, the two hundred instantaneous brick-like entities from scenario (i) do indeed turn out to be instantaneous temporal parts of the brick, whilst the fusion of those entities (which would be wall-like rather than brick-like) will not. So the problem would be solved.

But whilst that solves the problem of ensuring the instantaneous temporal parts are what we would want them to be, the revision threatens to undermine the alleged simplicity of the perdurantist explanation. Given that revised definition, the perdurantist now needs not just the principles of classical atemporal mereology and (P@T), but also needs all of the facts about what sortal an object falls under in order to determine which things are temporal parts of what other things. The addition of the sortal facts as a requirement for the perdurantist to provide an explanation should at least give us pause for concern when evaluating the relative complexities of the perdurantist and endurantist theories.

But even if the perdurantist needs sortal facts to explain why scenario (i) is permissible and (vi) is not, they will still likely come out on top, for most endurantist theories *also* need such sortal facts anyhow. For instance, the Standard Account holds that every object is associated with a special sortal which determines its persistence conditions and also answers whether or not it can coincide with other objects [Lowe 1995; Wiggins 1980 *inter alia*]. Similarly, Burke’s account of persistence also demands the richness of sortal facts, where each object is associated with a special ‘dominant’ sortal [Burke 1994a; 1994b]. So whilst the perdurantist relies upon facts about objects being associated with some special sortal, so too do the endurantist theories. As the perdurantist is using a resource that endurantists themselves rely upon, there can be no accusation that their theory is more complex. If the endurantist takes those sortal facts to be brute facts, so too can the perdurantist. If the endurantist doesn’t take them to be brute, then whatever explanation they offer of them will (almost certainly) be one the perdurantist can accept also. So, either ways, the perdurantist theory won’t be more complex than the endurantist theory just because they need sortal facts. Admittedly, endurantists may not use these sortal facts to explain why scenario (i) is permissible and (vi) is not, but that’s no objection if those facts end up being included in the endurantist theory at the end of the day. Nor should the perdurantist feel shy about relying upon sortal facts, as they can be utilised elsewhere to yield further benefits [as detailed in Braddon-Mitchell and Miller 2006].

So the perdurantist’s classical mereology is obviously simpler than the revised mereology that the endurantist takes as brute fact. The addition of (P@T) is negligible when it comes to weighing up complexity. Similarly, the above definition of ‘instantaneous temporal part’ may look worrisome at first, but it looks as if the perdurantist is just helping themselves to facts that the endurantist will likewise want to use. Thus, it appears there is good reason to think perdurantism offers the simplest explanation as to why certain time travel scenarios are possible and others are not.

## **7. Perduring Catholic Saints and other exotica**

With this new argument in place, I want to finish by turning to another of Smith’s arguments. He says that the possibility of multi-location alone gives the perdurantist reason to give up on WSP:

To see this, note that perdurantism *per se* doesn’t preclude the possibility of an object’s being multiply-located at a single time. Perdurantism *per se* doesn’t, for instance, preclude the possibility of a perduring brick’s having a stage, Brick-Stage, that’s multiply located throughout a region in a way qualitatively similar to the way in [scenario (i)] [...] Upshot: The main source of conflict with WSP isn’t endurantism, but rather, the possibility of an object’s being multiply-located at a single time. [Smith Forthcoming]

As already has been made clear, I agree that perdurantism should give up on WSP. But I imagine that Smith might argue that the possibility of multi-location can prove similarly

problematic to the atemporal analogue of WSP as well. If that were the case, then perdurantism would no longer have a simple atemporal mereology to explain temporally relativised mereology with. Ergo, they would no longer have the upper hand.

But whether the argument works depends upon what *type* of multi-location is intended. Just as there are two types of mereological relation, temporally relativised and atemporal, there are two such types of relation between objects and the regions they are located at. Temporally relativised exact location is a three-place relation between an object, a region of space and a time. Atemporal exact location is a two-place relation between an object and a region of spacetime.

The possibility of temporally relativised multi-location causes no difficulties for the atemporal version of WSP. Of course, one example is scenario (i), and we have already seen that this poses no problem. There, the perdurantist explains the multi-location of the brick at time  $t^*$  by saying that the brick has two hundred *distinct* instantaneous temporal parts, and this explanation does not threaten the atemporal version of WSP. I think they can say similar things in all other cases of temporally relativised multi-location. For instance, an object may become multi-located without time travelling – the standard putative example being things like Catholic Saints [Gilmore 2006: 227n2; Lewis 2002: 3]. I see no reason why the perdurantist should be wedded to the impossibility of perduring Catholic Saints. But the perdurantist can just say the same thing – multi-located Saints are such that they have multiple distinct instantaneous temporal parts at every instant at which they are multi-located, and there's no reason to think this threatens the atemporal version of WSP. So for every putative example of temporally relativised multi-location, be it time travel, be it Catholic Saints, be it whatever you want, the atemporal version of WSP is consistent with it.

However, the possibility of atemporal multi-location *would* cause difficulties, for then a single object could be atemporally exactly located in an arrangement required to (atemporally) compose a further object. For instance, perdurantists think there can be arrangements of infinitely many distinct instantaneous objects that atemporally compose a human. If, instead, a single instantaneous object was atemporally multi-located in a qualitatively identical fashion, then that object would atemporally compose a human as well. So we would have (contra the atemporal analogue of WSP) an object with only a single (atemporal) proper part that didn't have any other (atemporal) proper parts that failed to overlap that multi-located proper part.

Now I admit that this scenario would be problematic for the atemporal version of WSP. But it's no problem for the perdurantist. I take the defining feature of perdurantism to be a denial that such atemporal multi-location can happen. If an object is atemporally multi-located, exactly occupying numerous spacetime regions, then it *endures*, not *perdures*! Many philosophers concur with this definition – that what it is to perdure is to be exactly located at but a single spacetime region and what it is to endure is to be exactly located at multiple spacetime regions [Gilmore 2007: 180].<sup>6</sup> So, given the definition I would like to endorse, Smith would be right that atemporal multi-location causes problems, but only because accepting such a possibility is what it is to endorse endurantism. So, in either the case of temporally relativised multi-location or atemporal multi-location, perdurantism is safe.

## 8. Conclusion

Smith is correct that the original argument given by Robson and me does not give us a good reason for thinking that we should give up on endurantism. However, I have detailed a new

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<sup>6</sup> Parsons [2007] demurs, arguing that enduring objects are exactly located at but a single spacetime region. But that wouldn't help here, for what is important is that he would *agree* that perduring objects must likewise be atemporally exactly located at but a single region, again ruling out the possibility of atemporal multi-location.

argument for preferring perdurantism – that the perdurantist has a simple theory to explain why certain scenarios are possible and others are not, whereas endurantists do not.<sup>7</sup>

I make no claims for the above argument being foolproof. For instance, in relying upon sortal facts the perdurantist theory I sketched above won't be simpler than an endurantist theory that avoided relying upon such things (although such theories are thin on the ground). Or, alternatively, there might be problems with Sider's revised definition of instantaneous temporal part just as there are with the initial definition. Further, we might wonder whether the complexity that must be added to endurantism is better than accepting perdurantism; or whether the endurantist can avoid the problem by making temporally relativised mereological relations four-place rather than three [see Gilmore Forthcoming]. Finally, it's still not obvious what the perdurantist should say about the problematic time-travel scenario Gilmore [2006] suggests, which is similar to scenario (i) in many ways.<sup>8</sup> But these are topics for another time.<sup>9</sup>

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<sup>7</sup> Whilst I am fixing errors in the original paper, I must note that the claim that given universalism and WSP it follows that if the *ys* are part of an object *x* then any object the *ys* compose is also a part of *x* [Effingham and Robson 2008: 636] is also false. You need *Uniqueness* as well, which may well be given up. This is only a minor problem, for one would think the theorem is intuitively plausible in its own right and should be derivable in any sensible mereology, and you would still be left with the other problems the paper describes in any case.

<sup>8</sup> For what it's worth I think the perdurantist should admit defeat, and give up on *Uniqueness* (other alternatives are surveyed by Eagle [forthcoming: § 6]). Note that whilst this means that the perdurantist won't be able to endorse a *classical* mereology, the mereology they do endorse will *still* be simpler than the revised system the endurantist endorses as they generally want to give up *Uniqueness* anyhow.

<sup>9</sup> Many thanks to an anonymous referee for this journal (particularly with §6), Philip Goff, Jon Robson, Michael Rush, Donald Smith and those who attended a presentation of this paper at the University of Birmingham. Thanks also to Cody Gilmore and Anthony Eagle for making available their papers to me.

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