Temporal Scattering

Abstract
I show that the Eternalist faces a trilemma. Given their theory of time, three claims are each very plausible, yet together form an inconsistent triad. Denying any one of these claims will have significant consequences for how they can conceive of the material realm. I urge that the best strategy is to deny the first claim, and show that this would have a significant consequence: Perdurantism is false.

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The central purpose of this paper is to show that the Eternalist faces a trilemma. Given their theory of time, three claims are each very plausible, yet together form an inconsistent triad. This is a significant result in its own right. Eternalism is a popular and well motivated theory. So it's interesting that the Eternalist must suppose that one of these highly credible claims is false.

Whatever the Eternalist says in response to this trilemma will have significant consequences for how they can conceive of the material realm. It is beyond the scope of one paper to explore all the possibilities. Instead, I have two subsidiary aims. First, I urge that the most promising strategy is to deny the first of the claims in my triad. Second, I argue that this strategy has a significant consequence: Perdurantism is false.

Before presenting my arguments, I should explain some key notions. First, I will explain what I mean by Eternalism. Secondly, since two of the claims in my triad concern masses, I will explain what's meant by a mass.

Eternalism

I exist now, but back in the '50s I did not exist. Quine existed back in the '50s, but does not exist now. And the last human, let's hope, does not exist now, but presumably there will come a time at which he or she does exist. These are pre-theoretical truths concerning the times *at which* certain objects exist. Any theory of material objects ought to accommodate truths of this sort.

Eternalists make a bold and controversial claim about past, present and future objects. They claim that all of them, and the times they inhabit, are all equally real. Quine, me and the last human all exist; we are all among what there is, where 'is' is tenseless. They thus draw a distinction between existence *simpliciter* and existence *at a time*. The former is not a temporally relativised notion. To exist *simpliciter* is just to be among the totality of being, where 'to be' is tenseless. For the Eternalist, all past, present and future things exist *simpliciter*. Existence *at a time* is the temporally relativised notion mentioned above. For the Eternalist, Quine's existence in the '50s and absence from 2011 is a matter of him being somehow 'located' at the '50s, but not at 2011. A full Eternalist theory of material objects will involve specifying the sense in which Quine is located at 1950.[1]

Masses

Two of the claims in my triad concern masses, so I should elucidate what's meant by a mass. We won't require a theory of masses. All we need is the generally accepted characterisation of them; a list of their features that must be explained by any theory.[2]

Our language contains many mass nouns, such as 'milk' and 'gold'. Often, mass nouns can be used to form complex singular terms that denote particular portions of stuff. For example, imagine we have a jug filled with milk. 'The milk in the jug' denotes some milk, i.e. the milk that fills the jug. The material object denoted is called a mass.

A mass of milk is just a particular portion of milk. In my example, the mass of milk is in a jug.[3] But that very milk needn't be in that jug. That very milk might be poured into three smaller jugs, or down the drain. In both cases there would still be the milk, though it would be spatially scattered. A mass of milk needn't be any particular shape or volume. Since a mass of milk is just a particular portion of milk, it survives just so long as that very milk continues to exist.

[1] There have been many Eternalist's, including: Russell (1915), Quine (1960, sect. 36), Mellor (1981), Lewis (1986: 204) and Sider (2001).
[2] In this section, I draw mainly on Zimmerman's (1995). See his survey for a more in depth account of the "proto-theoretical" conception of a mass. Throughout my paper, I will make the highly reasonable assumption that there are masses.
[3] The example is from Fine (2006: 704).

Consider the milk that fills the top half of the jug. This mass of milk is *some of* the milk that fills the (whole) jug. Often, for a given mass of some kind, there are other masses of the same kind each of which is *some of* the first mass.[4] This is a piece of pre-theoretical data. A theory of masses must contain some account of exactly what being *some of* amounts to.

To present my triad, it will help to use the *some of* relation to define two other relations. First, say that:

> x is a *sub-portion* of y iff x is some of y.

Second, say that:

> A mass, M, is *formed from* masses $M_1,\ldots,M_n$ iff (1) each of $M_1,\ldots,M_n$ is a sub-portion of M, and (2) every sub-portion of M shares a sub-portion with at least one of $M_1,\ldots,M_n$.

So, for example, the milk in the jug is *formed from* the mass of milk that fills the bottom half of the jug and the mass that fills the top half.

The Trilemma

I am now in a position to state the Eternalist's trilemma. To make my presentation less abstract, let's always stick with the example of milk. Everything I say could be rephrased in terms of some other kind of mass, or more abstractly in terms of masses generally. Consider this triad of claims:

[4] This isn't always true. If x is a smallest possible mass of gold (perhaps a gold atom), then no masses of gold are some of x (cf. Zimmerman 1995: 62-5).

1) If a material object exists *simpliciter*, then there is some moment of time at which it exists.[5]

2) A mass of milk formed from masses of milk $M_1,\ldots,M_n$ exists at t iff $M_1,\ldots,M_n$ exist at t.

3) A mass of milk formed from masses of milk $M_1,\ldots,M_n$ exists *simpliciter* iff $M_1,\ldots,M_n$ exist *simpliciter*.

Although the Eternalist has very good reasons to accept these three claims, they cannot consistently endorse all of them. The trilemma they face is deciding which to reject.

To show that the Eternalist really does face a trilemma, I need to show both that Eternalism is inconsistent with (1) – (3), and that the Eternalist has good reasons to accept each of (1), (2) and (3). The first task is relatively straightforward. Consider the following example. Imagine a mass of milk, M_1, comes into existence on Monday morning, but in the evening is entirely annihilated (i.e. no sub-portion of it remains). On Tuesday morning a different mass of milk, M_2, comes into existence, but in the evening is entirely annihilated. Eternalism entails that M_1 and M_2 exist *simpliciter*. By (3), a mass formed from them, call it M_3, exists *simpliciter*. There is no time at which M_1 and M_2 both exist. So, by (2), there is no time at which M_3 exists. Thus (1) is false. We therefore see that, If Eternalism is true, (1)-(3) form an inconsistent triad.

It remains to show that the Eternalist has good reasons to endorse each of (1), (2) and (3). Let's consider each in turn.

In Defence of Claim 1

It would be very surprising if (1) is false. To posit a material object that never exists sounds as absurd as positing one that nowhere exists. To be material, it seems that an object must be in space and time, and that would seem to involve existing somewhere at some time.

[5] By 'moment of time' I mean a time with no sub-periods. That there are such things is something I will assume for ease of exposition. Hereafter I will just use 'time' rather than 'moment of time'. The substance of my arguments would not be affected if all talk of moments was replaced by talk of arbitrarily short periods.

Furthermore, (1) is a consequence of a very natural way of thinking about how material objects are in time. On this outlook, material objects come into being at one moment and then persist from one moment to the next until they expire. To persist over a life-span in this fashion, an object would have to exist at its first moment as well as each moment of its life after that.

The Eternalist therefore has good reasons to endorse (1): it seems bizarre to think that there can be a material object that never exists, and it seems that objects are in time by persisting through time, and thus existing at times.

In Defence of Claim 2

(2) is a straightforward consequence of what it is to be a mass. To illustrate this, consider the milk now in the jug. Call it M_J. And take any masses of milk from which M_J is formed, e.g. the top and the bottom half. Call them M_T and M_B.

First consider, in terms of this example, the right to left direction of (2): if M_T and M_B exist at t, M_J exists at t. As already stressed, M_J is just a particular portion of milk, i.e. the milk that now fills the jug. Plainly, then, if M_T and M_B exist at t, that milk exists at t. It doesn't matter how scattered M_T and M_B are at t. If those sub-portions of M_J exist at t, then the milk that now fills the jug (i.e. M_J) will exist at t. The example was picked arbitrarily. So we have the right to left direction of (2).[6]

Now consider, in terms of our example, the left to right direction of (2): if M_J exists at t, M_T and M_B exist at t. Since M_J is just a particular portion of milk, it can't exist when any of that milk is missing. In other words, if any sub-portion of M_J doesn't exist at t, then M_J doesn't exist at t. At best, only some of M_J exists at t. It follows that if M_J exists at t then so do M_T and M_B.[7] Again, the example was picked arbitrarily. So we have the left to right direction of (2).

[6] For the same sort of considerations, see Zimmerman (1995: 78-9).
[7] Zimmerman goes so far as to describe this as a truism (2003: 494).

We can conclude, therefore, that (2) is a consequence of what it is to be a mass. It is thus highly plausible.[8,9]

In Defence of Claim (3)

Let's turn now to (3). Note first that the left to right direction of (3) is surely true: if some milk formed from $M_1,\ldots,M_n$ exists *simpliciter*, $M_1,\ldots,M_n$ exist *simpliciter*. If a mass has another as a sub-portion, then the latter must exist *simpliciter*. Nothing can have a part which is not among what there is. So if there's a mass formed from some masses, then each of these masses exists *simpliciter*.

Consider now the right to left direction: if masses of milk $M_1,\ldots M_n$ exist *simpliciter*,[10] so does a mass formed from them. Now, suppose $M_1,\ldots M_n$ all exist and co-exist at some time, t. In that case, there's no doubt that there exists a mass formed from them. As we've seen from the discussion of (2), if some masses of milk exist at t, then so does a mass formed from them. It follows that a mass formed from them exists (*simpliciter*). This leaves the possibility that $M_1,\ldots M_n$ exist, but never co-exist at some time. If this is the case, does there exist a mass formed from them?

It seems to me that this question is the only aspect of (3) that could be controversial. However, there are at least two reasons why the Eternalist should claim that if some masses of milk exist but never co-exist, there exists a mass formed from them. First, the existence of such temporally scattered masses seems to be a straightforward consequence of what it is to be a mass. Secondly, the Eternalist will find good linguistic evidence for the existence of such masses.

Consider a concrete example: M_1 and M_2, the masses of milk that exist only on Monday and Tuesday respectively. Given that a mass of milk is just a particular

[8] Barnett (2004) has argued that (2) is false for some masses (e.g. oil), but true for others (e.g. carbon). For our purposes, we don't need to assess his argument. If his argument is sound, we should simply change our example to, say, carbon (and make clear that the Eternalist's trilemma only arises for kinds of mass relevantly like carbon).

[9] Fine has emphasised (2) (1999, 2006). In both papers, this feature of masses is used in criticisms of Perdurantism. As we'll see, I will also use (2) to put pressure on Perdurantism. However, my arguments are different from those used by Fine. Unfortunately, there is not space here to discuss his arguments.

[10] Hereafter I will drop the word '*simpliciter*' when it is clear that I mean 'exists *simpliciter*' by 'exists'.

portion of milk, it is difficult to see how there could be M_1 and M_2 without there being the milk formed from these masses. A mass formed from M_1 and M_2 would just be a particular portion of milk, i.e. the milk which is M_1 plus M_2. So surely all it takes for there to be a mass formed from M_1 and M_2 is for M_1 and M_2 to exist. No more is required for there to be the very milk which is M_1 plus M_2. So, it is a consequence of the nature of masses that non-co-existing masses of milk form temporally scattered ones.[11]

Another way to see this point is to consider what's possible for a mass of milk that now exists. Consider the milk in the jug before you. A possible world contains that milk just in case all of that very milk is in existence. There are worlds where that milk forms a large, shallow puddle, and worlds where it forms many disjoint puddles. Another possibility for this milk is that some of it exists only yesterday, and the rest exists only today. In this world, the milk that is actually in the jug is temporally scattered. Again, reflection on the nature of masses shows that non-co-existing masses of milk form temporally scattered ones.

The Eternalist will also find good linguistic evidence for temporally scattered masses. If there are some masses of milk, then regardless of whether they ever co-exist, it is perfectly natural to talk of the mass that is formed from them. For example, just as I may talk about the milk in the jug, so I may talk about the milk you drank last week, even if the sub-portions of that milk never co-exist. *Prima facie*, just as 'the milk in the jug' denotes a mass of milk in front of us, 'the milk you drank last week' denotes a mass of milk that is temporally scattered across last week.[12]

A more rigorous argument can be given to reinforce this initial impression. Consider two possible worlds, w_1 and w_2. In w_1, M_1 and M_2 exist only on Monday and Tuesday respectively, and you drink them and no other milk that week. In w_2, M_1 and M_2 co-exist on Monday, and you drink them and no other milk that week. In both worlds you truly assert, at the end of the week, "the milk I drank this week cost £1". My argument

[11] It is therefore not surprising that the existence of temporally scattered masses is a consequence of Zimmerman's pre-theoretical "proto-theory" of masses (1995: 66, see principle (A2)). Arguably, however, Zimmerman is not here sensitive to the distinction between existence *simpliciter* and existence *at a time*. So he might not mean to commit himself to temporally scattered masses.

[12] Anyone who denies the reality of this mass's sub-portions (e.g. a Presentist) will want to paraphrase here. But the Eternalist has no need to perform such contortions.

is as follows. Regardless of how we understand mass descriptions such as 'the milk you drank last week', the truth of your assertion in w_2 requires the existence of a mass formed from M_1 and M_2. But the assertion made in w_1 cannot have a different semantic structure to the assertion made in w_2. So the truth of the assertion in w_1 likewise requires the existence of a mass formed from M_1 and M_2. Therefore there is strong linguistic evidence for the existence of temporally scattered masses. Let's take each premise in turn.

Consider first the assertion made in w_2. Let's abbreviate 'the milk you drank this week' to 'the M' and the predicate 'cost £1' to 'C'. 'The M' is either a referring expression or a quantifier phrase. Suppose first that 'the M' is a referring term. If so, *prima facie* it picks out a past mass (one that existed last Monday), and our sentence predicates 'C' of this mass. Since the Eternalist believes in such past objects, they can give this *prima facie* interpretation, so presumably have good reason to do so.[13] In which case, 'the M' will refer to the mass formed from M_1 and M_2, so there will be such a thing. Alternatively, perhaps 'the M' is a quantifier phrase. There are two options. One option comes from Sharvy (1980). Applying this theory in a straightforward fashion to our sentence gives it the truth condition: there's a mass of milk you drank last week, any milk you drank last week is some if it, and it cost £1. The other option would be to stick to Russell's treatment of descriptions. Applying this theory in a straightforward fashion to our sentence gives it the truth condition: there's a mass of milk you drank last week, any milk you drank last week is identical with it, and it cost £1.[14] Since the Eternalist does quantify over past objects, they can give either *prima facie* interpretation, so presumably have good reason to do so.[15] Either way, the truth of our sentence requires there to be a certain mass of milk, plainly the one formed from M_1 and M_2. So whether 'the M' is a referring expression or a quantifier phrase, it is plausible that if Eternalism holds, the truth of the assertion made in w_2 requires the existence of a mass formed from M_1 and M_2.[16]

[13] A non-Eternalist would have to provide a paraphrase, but, again, the Eternalist has no need to perform such contortions.
[14] For this approach see, e.g. (Oliver and Smiley 2009). There would be familiar problems related to uniqueness here. The Russellian requires a strategy to ensure that our sentence is true because the maximal mass of milk you drank cost £1.
[15] See footnote 13.
[16] Another option is that 'the M' is a predicate (Graff 2001). This view gives our sentence the same truth conditions as the views which treat 'the M' as a quantifier phrase (ibid: 10).

Now, the sentence "the milk you drank last week cost £1" surely works the same way in w_2 to how it works in w_1. The semantic structure of this sentence doesn't depend on the order in which you drink M_1 and M_2. Moreover, a semantic theory that gave one account of the sentence in w_2 and a different account of the sentence in w_1 would be unsystematic and *ad hoc*. So, whichever account of 'the M' we give in w_2, we must give the same account of it in w_1. As we saw above, the result will be that the truth of the assertion made in w_1 requires the existence of a mass formed from M_1 and M_2. Since M_1 and M_2 never co-exist, the truth of the assertion requires there to be a temporally scattered mass. Therefore, the Eternalist has good linguistic evidence for the claim that, if some masses of milk exist but don't co-exist, then there is a mass formed from them.

To sum up: only the right to left direction of (3) is possibly controversial, and this is only because it's not obvious that if there are some non-co-existing masses of milk, then they form a mass. But, in fact, the existence of such temporally scattered masses seems to be a consequence of the nature of masses, and is something for which there is independent linguistic evidence.

How Should The Eternalist Respond?

The central task of this paper has now been achieved. It has been shown that the Eternalist faces a trilemma: they cannot endorse each of (1) – (3), yet they have good reasons to endorse all three claims. It seems to me that there is no obviously best way for the Eternalist to respond. However, in this section I'd like to urge that the best strategy is to deny (1). In the remaining sections, I'll discuss one significant consequence of this strategy.

Of the options available, denying (2) appears the least promising. Surely we would lose our grasp on the concept of a mass if we denied (2). If we supposed that a mass of milk could exist when some of it is missing, or could fail to exist when all of it exists, then we wouldn't really be talking about masses. We'd be talking about some other kind of thing; something with different existence conditions.

One might think that the most promising strategy is to deny (3). After all, (3) entails that there are these peculiar entities: temporally scattered masses. They exist yet never exist; they exist yet there's no period through which they persist. Furthermore, we can give an existence (*simpliciter*) condition for masses of milk that is very similar to (3), which doesn't entail that there are these strange things, and which the Eternalist can endorse in conjunction with (1) and (2):

3*) A mass of milk formed from masses of milk $M_1,\ldots,M_n$ exists *simpliciter* iff $M_1,\ldots,M_n$ all exist at some time, t.

However, (3*) is a poor substitute for (3). To exist, why should a mass of milk have to all exist at some time? This stricture seems in conflict with the nature of masses. As already stressed, a mass of milk is just a particular portion of milk. So all it takes for there to be a mass of milk is for that very milk to exist, regardless of how its sub-portions are distributed across time. The only existence condition that captures this fact is (3).

Furthermore, we've seen the semantic costs the Eternalist would incur if they tried to respond to my trilemma by denying (3). They would have to paraphrase away apparent reference to temporally scattered masses. They would also have to give a theory on which mass descriptions are treated differently depending on whether the mass they seem to denote would be temporally scattered. As we've seen, the result would be *ad hoc* and unsystematic.

Much better, I think, to deny (1). This way, rather than doing any messy violence to our ordinary concept of a mass, we can regard our triad as revealing an interesting discovery: not all objects are in time by persisting through a period of time. Masses can exist and be part of the natural order without there being any time at which they exist.

I don't insist that the Eternalist must deny (1). I only urge that, given what has been said in defence of (2) and (3), this strategy seems very promising. It is at least worth exploring. In the remainder of this paper, I will explore one consequence of denying (1).

A Consequence of Denying (1): Perdurantism is False

Since (1) is such a natural assumption, we should expect that denying it will have a number of surprising theoretical consequences. In particular, rejecting (1) will surely affect how we can theorise about the way objects are in time. In this section I will present one significant consequence of denying (1): Perdurantism, one of the main theories of how objects are in time, is false.

As noted at the start of this paper, Quine existed in the '50s, but I didn't. And I exist now, but Quine doesn't. In general, objects exist at some times, but usually not at all times. This is uncontroversial. What is controversial is exactly how objects manage this. Lewis made this very clear (1986: 202). Say that something persists iff "somehow or other, it exists at various times" (ibid). It is uncontroversial that Quine and I are persisting things. What's controversial is how we manage to exist at the times we do.

There are two main approaches to understanding how objects persist. On one, for Quine to exist at a time is for Quine – himself, no mere part of him – to be located at that time. As Lewis puts it, this view involves overlap: the content of two different times has a persisting thing (say, Quine) as a common part (ibid). This is often expressed by saying that Quine exists at a time by being "wholly present" at that time. If an object persists in this fashion, it is said to *endure*. And the theory of object-persistence according to which objects endure is called *Endurantism*.

Of course, more needs to be said to clarify this notion of endurance.[17] But, on the face of it, there seems to be no reason why commitment to Endurantism *per se* should make it impossible for an Eternalist to deny (1). For the Endurantist, an object's existing at a time, t, is a matter of that object – no mere part of it – being located at t. So suppose an Eternalist Endurantist accepts (2) and (3), and so thinks that temporally scattered masses exist *simpliciter*. They can plausibly suppose that there are no times at which a temporally scattered mass – that very object – is located. Rather, there are only times at which a mere part of such a mass is located. So it can be maintained that

[17] For attempts, see Hughes 2005, Hawthorne 2006, Fine 2006, Donnelly 2011.

while temporally scattered masses exist *simpliciter*, none is "wholly present" at any time, so none exists at any time. So the Eternalist Endurantist can consistently deny (1).

On the Endurantist view, an object can be located, in its entirety, at many times. (I.e. there are many times at which that object itself – no mere part of it – is located.) The second main theory of persistence assumes a different conception of objects. On this view, each object is located, in its entirety, at exactly one period of time. This period could be a moment, or a longer period. If an object is located, in its entirety, at a long period, then it is not similarly located at any sub-period. Rather, for each sub-period of the period at which it is entirely located, the object has a part that is entirely located at that sub-period. These parts are called the object's *stages*. For example, Quine is entirely located at the period 1908-2000. Quine himself is not located at any given time between 1908 and 2000. Rather, a mere part of him is, i.e. one of his stages. Using this theory of objects, the Perdurantist gives an account of what it is for objects, such as Quine, to exist at various times. They say that an object exists at various times "by having different temporal parts, or stages, at different times" (ibid.). For instance, what it is for Quine to exist at some moment in 1950, but not now, is for him to have a stage located at 1950, but lack a stage located now. In general, an object exists at a time, t, iff it has a stage that is located, in its entirety, at t.[18,19]

(1) is a straightforward consequence of the Perdurantist account of objects and existence *at a time*. Given their account of objects, each object, x, is entirely located at some period of time, P, and has a stage at each sub-period of P. Now, either P is a moment of time or it's a longer period. Suppose it's a longer period. In which case, P has moments as sub-periods. For each moment, t, that is a sub-period of P, x has a stage entirely located at t. So, given the Perdurantist account of existence *at a time*, x exists at some moment. Alternatively, P is a moment. In which case, since x is a stage of x,[20] x has a stage that is entirely located at a moment. So, again, x exists at a

[18] For ease of exposition, say that every object has itself as a stage. Then we get the correct result that Quine exists at the period 1908-2000, and generally that objects exist at those times at which they are entirely located.
[19] There have been many Perdurantist's, including: Quine (1950), Taylor (1955), Heller (1984), Lewis (1986), Sider (2001). In addition to Lewis, other examples of Perdurantist's being explicit about their theory of existence *at a time* include Heller (1984: 329) and Sider (2001: 59).
[20] See footnote 18.

moment. Therefore, Perdurantism has the result that every object exists at some moment. That is to say, Perdurantism entails (1).[21]

This is a noteworthy result. We've seen that the Eternalist must reject one of (1) – (3). We now see one consequence of denying (1). If the Eternalist addresses my trilemma in this way, they must deny Perdurantism, since Perdurantism entails (1).

Eternalist Perdurantist Responses

It seems, then, that a fairly good case can be made that the Eternalist ought to reject Perdurantism. As I urged above, the best response to my trilemma is to reject (1), but that entails that Perdurantism is false. However, many Eternalists will want to be Perdurantists. Indeed, all the Perdurantist's mentioned in note 19 are Eternalist's. They will therefore try, somehow, to resist the line of reasoning I've put forward. To finish this paper, I'll consider the available options. I'll argue that none seem promising.

Deny (3)

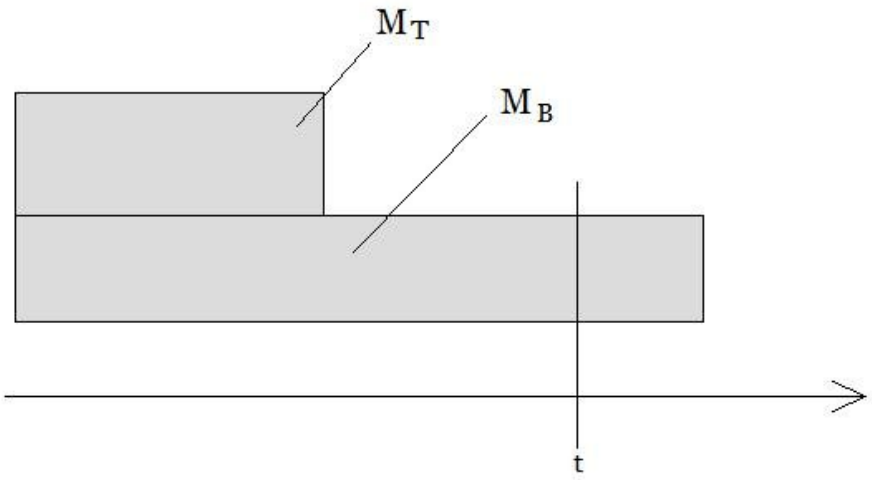
I had no knockdown argument that the Eternalist should reject (1). In particular, although there's much to recommend (3), I am not sure that it couldn't be coherently denied. So one option for the Eternalist Perdurantist is to explore denying (3). I have already said all I can to recommend against this: it is in tension with the most basic facts about masses, and it causes semantic difficulties. Let me therefore quickly move onto other options.

Deny (2)

A Perdurantist might claim that, when masses are viewed from their perspective, it becomes clear that (2) should be rejected rather than (1). Consider again the milk in the jug: M_J. M_T and M_B are each some of this milk, and nothing is some of this milk without sharing sub-portions with M_T or M_B. In my terms, M_J is *formed from* M_T and

[21] Recall that the assumption that there are moments is eliminable (see footnote 5). I could replace all mention of moments with talk of arbitrarily short periods.

M_B. Suppose that M_T is annihilated but M_B remains in existence. Here is a diagram of how the Perdurantist conceives of this situation:



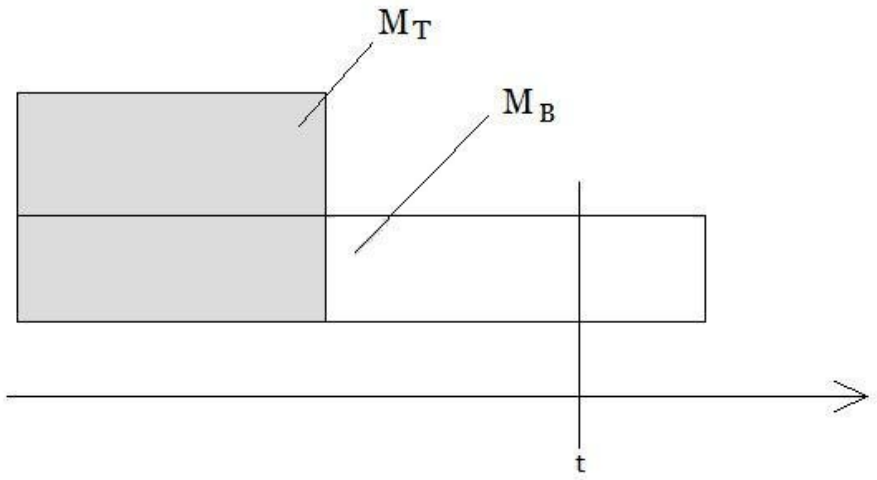
Now, it is very tempting to assume that if one mass is *some of* another, then the first is *part of* the second. It would follow that if a mass, M, is formed from $M_1,\ldots,M_n$ (in my defined sense) then M is a fusion of $M_1,\ldots,M_n$.[22] So, M_J is the fusion of M_T and M_B. For the Perdurantist, this means that M_J is the object represented by the shaded area above (i.e. the whole shoe-shaped figure). That object has a stage at t. So, given their account of existence *at a time*, the Perdurantist will say that M_J exists at t. However, M_T has no stages at t, so doesn't exist at t. Thus (2) is false.

This strategy, however, is disastrous. Recall that Perdurantism is a theory of how objects are in time. Specifically, we've seen that it's a theory of how objects manage to exist at the various times at which they do. Theorising about this phenomenon is constrained by many pieces of pre-theoretical data regarding when ordinary objects exist. For example: I exist now, but fail to exist at a later time at which all that remains of me is my nose. To deny that our theorising is so constrained would be to make the philosophical debate over persistence an undisciplined free-for-all. Now, that a given mass of milk, M_J, fails to exist once M_T is annihilated is one of the clear truths that constrains theorising about existence *at a time*. Just as I fail to exist when only my nose remains, so M_J fails to exist when only M_B remains. (Even though, in

[22] The proof is straightforward given the definition of fusion. x is a fusion of $y_1,\ldots y_n$ iff each of $y_1,\ldots y_n$ is part of x, and every part of x shares a part with at least one of $y_1,\ldots y_n$.

both cases, in some sense a bit of the original object stays in existence.) So, if Perdurantism cannot accommodate this fact about M_J, we ought to deny that theory.

Fortunately for the Perdurantist, they needn't deny (2). Instead, the moral of the above, for the Perdurantist, is that being *some of* a mass does not entail being *part of* it. For example, M_T is some of the milk in the jug, but given that it outlives that milk, it is not part of it. Of course, it would be absurd to claim that the *some-of* relation is not a kind of mereological relation. The Perdurantist must identify the *some-of* relation with some defined mereological relation other than parthood. And they must do so in a way that ensures that, given their account of existence *at a time*, masses never exist when any of their sub-portions do not. (For it is a pre-theoretical restriction on our theorising that they do not.) For example, their theory of the *some-of* relation must have the result that the mass *formed from* (in my sense) M_T and M_B is the object represented by the shaded area below.[23]



I believe the Perdurantist can meet this challenge, though the details are complicated. Roughly, 'some of' must be defined using the Perdurantist's notion of parthood *at a time* (see, e.g. Sider 2001: 57). For reasons of space, and since, for our purposes, it

[23] That the Perdurantist faces the challenge described above is one upshot of Fine's attack on Perdurantism in his (1999).

isn't of central importance how the Perdurantist meets this challenge, let's not concern ourselves with exactly how they may do so.[24]

Note, therefore, that the Perdurantist need not, and should not, identify all masses with the fusions of their sub-portions. For example, M_J is not the fusion of its sub-portions. One noteworthy result is that, even if they accept that any group of objects has a fusion, the Perdurantist is not forced to accept (3). Positing the fusion of two non-co-existing masses does not entail positing a mass formed from those masses. So, the Perdurantist can deny (3), can and must accept (2), and must accept (1).

Amending Perdurantism So That (1) Can Be Denied

There is one last strategy the Eternalist Perdurantist can pursue. Suppose they were convinced, as I am, that they ought to accept (2) and (3). In its standard form, Perdurantism entails (1). But perhaps it can be amended, while maintaining the spirit of the view, so that it doesn't entail (1). As I'll now explain, this is an option for the Perdurantist. However, it is difficult to see how the relevant amendments could produce an acceptable theory.

As I've presented it, Perdurantism is really the conjunction of two theses. The first is that each object is entirely located at exactly one period and has parts (stages) entirely located at each sub-period. The second is a theory of persistence, and thus of existence *at a time*. Existence *at a time*, t, is a matter of having a stage at t. So Perdurantism can be amended by changing either of these two theses.

Changing the first, say by adding some new kind of object, would be a radical departure from the standard Perdurantist outlook. We want some relatively minor amendment that will allow the Perdurantist to deny (1). Let us therefore set aside the option of changing the first thesis.

The alternative is to change their theory of existence *at a time*. We've seen what account of existence *at a time* the Perdurantist in fact gives: x exists at t iff x has a

[24] The strategy alluded to here has a precedent. The Perdurantist must define a relation other than parthood to link a chair to the leg that outlives it (Sider 2001: 57).

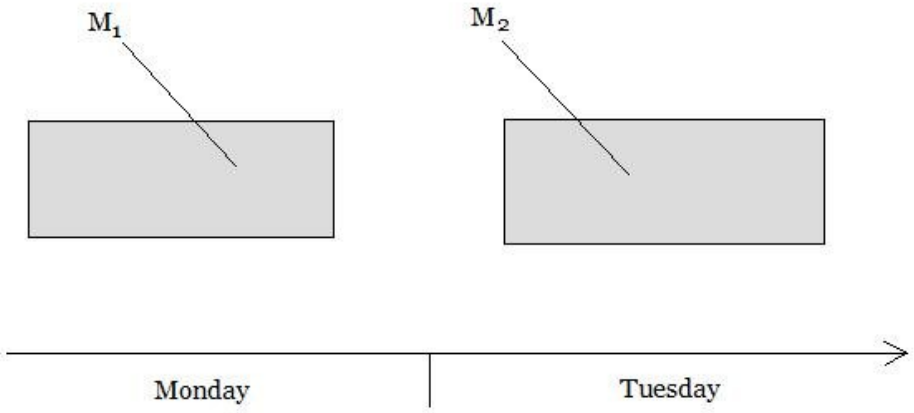
stage at t. This is the account one would expect given their ontology. If objects are sums of temporally smaller objects, then surely existence *at a time* is a matter of having a stage at that time. However, it does not seem that one who endorses the Perdurantist ontology must give this theory. Nothing about their ontological commitments *per se* forces them to define 'exists at' as they do. It seems that we should be able to tweak the account of existence *at a time* while still keeping the spirit of the Perdurantist outlook.

So, the following strategy opens up for the Eternalist Perdurantist who accepts (2) and (3) and thus must reject (1): assuming the ontology of objects made from temporally smaller objects, give an account of existence *at a time* on which it's possible for an object to never exist. Furthermore, identify temporally scattered masses with objects that, according to this account, never exist.

However, I do not see how this can be done in a satisfactory way. The only possibility I can think of results in an implausible view. Indeed, it seems that any attempt to relevantly amend Perdurantism will lead to views that are implausible in this way.

The possibility I have in mind is as follows. First, *contra* the previous section, identify the *some-of* relation with parthood. It follows that a mass formed from $M_1,\ldots,M_n$ is the fusion of $M_1,\ldots,M_n$.[25] In particular, the temporally scattered mass formed from M_1 and M_2 is their fusion, so is represented by the shaded area below:

[25] See footnote 22.



Now, the Perdurantist's account of existence *at a time* is, for all we've seen, unproblematic for non-masses, i.e. people, statues, etc. So the simplest amendment to their account would be to make an exception of masses:

x exists at t iff either (1) x is a non-mass and has a stage at t, or (2) x is a mass and all its sub-portions have stages at t.

Given this definition, the mass formed from M_1 and M_2, i.e. the mass which is their fusion, exists at no time. This is because there's no time at which M_1 and M_2 have stages. So, given the above theory of *some-of* and existence *at a time*, the Perdurantist can deny (1) and accept (3). We will also get the right results for non-temporally scattered masses. For example, we get the result that M_J doesn't exist at t. (So they can accept (2).) And since the account of existence *at a time* for non-masses remains the same, the Perdurantist will continue to give the right results for them.

Although this theory gives the right truth values to our judgements of existence *at a time*, it is theoretically unsatisfying. The main problem is that it makes existence *at a time* disjunctive in a way that it seems not to be. On the above view, what existence *at a time* amounts to for masses is different from what it amounts to for non-masses. This seems wrong. While there are distinctive conditions under which a mass exists at a time, there isn't a distinctive species of existence *at a time* that applies to masses. Existence *at a time* is a unitary phenomenon that applies to masses and non-masses

alike. To see this clearly, consider M_J, which doesn't exist at t, and a statue that does. There is an existential *difference* between M_J and the statue. The latter exists at t, *but* the former does not; this is a way in which they *differ*. To capture this fact, we must give an account of existence *at a time* on which it is a relation that the statue has to t but which M_J doesn't have to t. My amendment to Perdurantism fails because it doesn't do this: existence *at a time* is not identified with any one relation that the statue bears to t but which M_J does not. Rather, there are two relations (*has a stage at* and *has sub-portions all of which have a stage at*) and the statue bears one to t while M_J doesn't bear the other to t. So this theory can't accommodate the fact that the statue and M_J existentially *differ* with respect to t.

Now, my amendment was an attempt to change the Perdurantist's account of existence *at a time* so that they can deny (1). It is difficult to see how any such amendment could be given that won't suffer the problem presented for the amendment I've given. Given Perdurantism, existence *at a time* for non-masses is surely a matter of having a stage at the time in question. Masses will have to be an exception. But how can this be unless existence *at a time* is objectionably disjunctive?

Of course, my discussion here is not decisive. Perhaps a Perdurantist can find a satisfactory way to amend their account of existence *at a time* so that they can consistently endorse (2) and (3). I leave this as a challenge to those interested by it.

Conclusion

We have seen that the Eternalist must deny (1), (2) or (3), and that denying any of them will have significant consequences. Rejecting (2) would involve completely losing our grasp on the notion of a mass. Rejecting (3) is similarly in conflict with our mass concept, and would involve a difficult paraphrase project. Rejecting (1) is sure to have exotic consequences, since it is such a natural assumption. I have presented just one such consequence: only non-standard forms of Perdurantism can be true. I recommend searching out others.

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