Persistence of Objects Through Time-Travel

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I. Introduction

Perdurantists claim that persisting material objects are four-dimensional objects, extended in time as well as in space. Just as the computer in front of me occupies not just one point in space but a whole collection of points, so too, my computer occupies a locus of temporal points that span the time interval of its existence.\(^2\) And just as my computer consists of spatial parts—a monitor over here, a keyboard over there—so too, it can be broken down into temporal parts; my computer of yesterday, for instance, is a temporal part of my computer itself. A persisting material object, then, is an aggregate of spatio-temporal points, and is said to exist, albeit somewhat indirectly, at a given time in virtue of its having a temporal part that exists at that time. So says the perdurantist.

Endurantists, on the other hand, reject the notion that persisting material objects are extended in time. My computer is no space-time aggregate, says the endurantist, but rather a collection of spatial points, a three-dimensional object that exists in time. A material object, then, does not consist of temporal parts, and therefore is said to exist at a given time just in case it is “wholly present” at that time. So says the endurantist.\(^3\)

Presumably, the motivation for endorsing one of these ontological theses over the other stems from what strikes many as a fundamental problem concerning the persistence of objects over time: How can my computer of today be identical to my computer of yesterday if they do not share all of the same properties? (For instance, my computer of yesterday does not have the property of having this paper saved on it, which my computer of today does have.) The debate over which of these two theses provides a better explanation of persistence over time is a lively and interesting one, but it will not concern us presently.\(^4\) Instead, I would like to focus on what seems to be a sharp difference
between these two views with regards to a particular metaphysical issue: the possibility of time-travel.

It is my feeling that the endurantist faces a serious and specific problem in trying to make sense of the possibility of time-travel, a problem which the perdurantist does not run into in his parallel efforts. In the end, we will see that unless one is willing to give up one or another basic ontological intuition, the bilocation problem constitutes a serious threat to the endurantist’s belief in the possibility of (at least certain types of) time-travel.

II. Two Ontologies of Time

Before delving into the topic of time-travel, it is only natural for us to first take a moment and briefly discuss the nature of time itself. There are currently two general, opposing views maintained by philosophers concerning the ontology of time: (1) eternalism, the thesis that all times (past, present, and future), and all entities existing at those times, are equally real; and (2) presentism, the thesis that the only truly existing time is the current one, and the only truly existing entities are those that exist now.\(^5\) Eternalists view time as a fourth dimension, orthogonal to and just as real as our three familiar spatial dimensions. They are typically reductionists about tense (i.e., they consider all tensed propositions to have tenseless truth conditions), and claim that one cannot non-indexically refer to one single moment as the present.\(^6\) Presentists, on the other hand, deny the eternalist analogy between space and time; the presentist’s universe is a three-dimensional manifold that flows through time. Presentists are necessarily\(^7\) antireductionists about tense, and consider ‘the present moment’ to refer to the present in some absolute sense.
Now, there are two aspects of the presentist’s view in particular that will be important to take note of for our purposes. First, to a certain extent, presentism seems to lend itself quite naturally to endurantism, as does eternalism to perdurantism. And generally speaking, philosophers tend to endorse one of these two combinations of views. Second, presentism is often thought to rule out the possibility of time-travel: if the past (or future) doesn’t exist, how can we travel to it? But now, if endurantists are presentists, and time-travel is incompatible with presentism, then don’t we immediately have an argument (and it’s only section II!) for the impossibility of endurantist time-travel?

Well, perhaps; and perhaps not. Despite the fact that endurantism and presentism appear to be a natural fit, showing that endurantism entails presentism is by no means a straightforward task. In fact, a few certain philosophers have been known to maintain eternalist theories of endurance, and Theodore Sider has offered what seem to be coherent formulations of both eternalist endurantism and presentist perdurantism. That being said, I tend to be sympathetic to arguments like Trenton Merricks’s. Without going so far as claiming that endurantism logically implies presentism, Merricks argues that without the supposition of presentism, endurantism is left untenable as a thesis of persistence (more on this later).

Similarly, the intuition that presentism precludes the possibility of time-travel might not be as reasonable as it first seems. Though it feels natural to say that we cannot travel to a time that does not exist, the presentist is, in fact, committed to the idea that we are traveling in this way all the time: we are persistently “time-traveling” at one-second-per-second into the nonexistent future. So the mere fact that presentist time-travel
requires traveling to a nonexistent time does not in any way show that such time-travel is impossible. But presentism is not in the clear. Sider has recently offered a convincing alternative argument to the claim that presentism is incompatible with (at least backward) time-travel. He demonstrates that (backward) “time-travel” in a presentist universe does not constitute genuine travel, but rather just amounts to an occurrence of temporally discontinuous, backward causation.

With these issues regarding endurance, presentism, and time-travel now on the table, I want to make the following disclaimer: If it turns out that endurantism entails presentism and that presentism precludes the possibility of time-travel, so be it. What I want to show is that the endurantist faces serious difficulties in making sense of the possibility of time-travel that are above and beyond those that presentism alone implies. Thus, it would be ideal if, to this end, I could assume no particular ontology of time for the endurantist throughout this paper. But this can only be done to a certain extent. When we begin to give a careful analysis of the endurantist’s predicament (section VII), we will have no other choice than to adopt presentist language, since I truly think that a tenable formulation of endurantism can only be made on presentist grounds. Still, doing so will not undermine the goal of this paper, since by the end I think it will be clear that the bilocation problem (which we will get to shortly) is a problem for endurantist time-travel that is distinct from any problem for presentist time-travel, despite the fact that describing the problem seems to require the use of presentist language.
III. Time-Travel and Personal Time

Time-travel, in the words of David Lewis, involves a “discrepancy between time and time.”\textsuperscript{15} For any normal kind of travel, the duration of one’s journey is equal to the difference between the time of arrival and the time of departure. I leave at one o’clock; I drive for an hour; and I arrive at my destination at two o’clock. Not so in the case of time-travel. If I am a time-traveler, I leave at one o’clock; I travel for an hour; and I arrive at my destination at three o’clock, say. The duration of my journey is one hour, but the difference between my arrival and departure times is two. So how can this be? How can it be that the same two events, the time-traveler’s stepping into his time machine and his stepping out, are separated by two unequal amounts of time?

The answer lies in recognizing the difference between external time and personal time.\textsuperscript{16} External time is simply time itself; it is what we are referring to whenever we talk about time in any sort of objective sense. Personal time, on the other hand, is the ordering of events in one’s life that preserves the normal continuity and forward direction of causation that we are so familiar with.\textsuperscript{17} Following one’s personal time, hair gradually grows, memories accumulate, and birth precedes death. Personal time is not actually time, but is a time-like ordering of events in one’s life.\textsuperscript{18}

In normal everyday life, for normal everyday people, one’s personal time coincides exactly with external time; the direction of causation of the events in our lives is the same direction along which time itself progresses moment by moment. But for the time-traveler, as you might have guessed, this is not the case. If I go back in time far enough, I might die before I was ever born with respect to external time. But in my
personal time, in the temporal order in which the events of my life are causally related in the normal way, I will die long after I am born.

It is because of this distinction between external time and personal time that we are able to make sense of our earlier claim that the duration of the time-traveler’s journey is unequal to the difference between his arrival and departure times. The time-traveler’s journey is his voyage as he experiences it; its duration therefore is measured with respect to his personal time. The difference between arrival and departure times, on the other hand, is a difference between two external times, and is therefore measured in external time. There is no inconsistency in saying that these two amounts of time are unequal.

Now that we have a grasp on what time-travel is, and how we can sensibly talk about it, let us take a moment to indulge in a little drama.

IV. A Short Time-Travel Story

Meet Tim. Tim was born in 1945, and had been living a relatively normal and uneventful life up until he was twenty years old, at which point something peculiar happened: One night in 1965, Tim was sitting at a bar by himself. His friends had gone, and he too was getting ready to pay his tab and leave when an old man approached him and asked to buy him a drink. Tim, not usually one to pass up a free drink, sat back down and accepted the offer. The old man began to talk.

He said his name was Sam and that he lived in Montana, and continued to ramble on about this or that for the next few minutes with Tim half-listening on the next stool over. But just as Tim was about to excuse himself and head home, Sam grabbed his arm and turned to him. “Don’t marry that girl Penelope,” said Sam. “Whatever you do, Tim,
don’t ask her to marry you.” Tim stood there baffled for a second, then shook his arm from the old man’s grasp and quickly walked home.

Forty years later, Tim wakes up to find his wife of thirty-nine years, Penelope, lying in bed next to him. He is miserable. He detests Penelope, and blames her for all the misfortunes he’s experienced since he married her. He’s mulling over (as he does every morning) what a mistake it was to marry her. If only there were some way…. Tim decides that there is only one reasonable course of action: he must build a time machine. He devotes all his efforts from then on to this task, and one year later Tim hops into a box and steps out into the year 1965 with the sole intent of sabotaging his proposal to Penelope.

You know how the rest goes: Tim hunts down his younger-self; he walks into the bar; he buys his younger-self a drink; he says his name is Sam; he rambles for a few minutes; and finally he leaves his younger-self with the most important advice that he will ever receive. He walks out of the bar and mopes back to his machine, realizing the hopeless futility of his efforts, knowing his younger-self all too well to think that he will actually take the advice. He steps into the box and back to the year 2006.

V. The Endurantist’s Story and the Bilocation Problem
Anyone who has ever read a book or watched a movie about time-travel is surely familiar with something along the lines of the preceding story. But is such a chain of events possible? Or is it mere science fiction? There appear to be no logical inconsistencies with Tim’s experiences as told, and so it seems natural to ask if this story really describes a metaphysical possibility. How we answer this question will depend on what
metaphysical doctrine we presuppose from the outset. But whatever view we choose, if it is to be consistent with the above story then we must be able to coherently retell the story in its language and according to its rules. So let us now see if we can tell Tim’s story from an endurantist perspective.

According to the endurantist, Tim is an enduring, three-dimensional object.\[21\] He exists in time, but does not occupy time. He persists through time by moving along moment-by-moment on time’s arrow. He has no temporal parts, and so, in typical endurantist language, is said to be “wholly present” at each moment of his existence.\[22\] Accordingly, Tim is wholly present in 1945 when he is born; he is wholly present in 1965 when he is at the bar with his friends; he is wholly present in 2005 when he is lying in bed; he is wholly present in 2006 when he steps into the time machine.

Now consider the time interval $T$ in which twenty-year-old Tim (Tim$_1$) is in the bar talking to his older-self from the future (Tim$_2$).\[23\] On the endurantist picture, Tim$_1$ is wholly present sitting on his barstool during $T$. Similarly, Tim$_2$ is wholly present during $T$ and is sitting right next to Tim$_1$. But Tim$_1$ is identical to Tim$_2$!\[24\] How can one thing be wholly present in two different places at the same time? Is this possible? Let us call this the bilocation problem for endurantist time-travel.\[25\] Whatever reasonable interpretation we give to ‘wholly present’, it does not seem sensible to suppose that something could be wholly present in two different places at the same time. In trying to tell our time-travel story on endurantist grounds, it appears we have run into a wall.
VI. The Perdurantist’s Story

Just because the endurantist seems to face a problem of bilocation with regards to our time-travel story, it does not mean that this problem is particular to the endurantist account. For all we know, the perdurantist might face a similar problem in trying to explain time-travel. It is appropriate, therefore, for us to take a moment here and (briefly) tell Tim’s story from a perdurantist perspective.

According to the perdurantist, Tim is made up of temporal parts. Tim at a time $t$ is a part of Tim himself, and Tim at $t$ is distinct from Tim at $t+1$. Tim exists at a time $t$ in virtue of his having a temporal part that exists at $t$, but Tim is not identical to that temporal part. So now let us look at some moment $t^*$ in $T$, the potentially problematic time interval during which Tim$_1$ and Tim$_2$ are conversing at the bar. Tim$_1$ at $t^*$ and Tim$_2$ at $t^*$ are temporal slices of Tim, and neither one is identical to Tim. Instead we have one temporal slice of Tim talking to another. Hence Tim is not wholly present at $t^*$ (in any place, let alone two different places), and we do not run into the bilocation problem that makes trouble for the endurantist.

But perhaps there is a different, though just as troubling problem on the perdurantist account. According to the perdurantist, a temporal slice of an object at an instant $t$ is simply the mereological sum of that object’s spatial parts at $t$. Thus the temporal part of Tim at the time $t^*$ consists of all the spatial parts that make up Tim$_1$ at $t^*$ and all the spatial parts that make up Tim$_2$ at $t^*$. In other words, Tim’s temporal part at $t^*$ consists of two heads, four hands, twenty toes, and so on. This, though not entirely incoherent, is surely an odd result. Luckily though, the perdurantist has a ready response to this problem.'
If we think of Tim’s temporal slices as corresponding not to moments in external
time but rather to moments in Tim’s personal time, we can get the perdurantist out of this
jam. Considered this way, one of Tim’s (personal) temporal parts will consist only of the
physical parts of Tim₁ at (external time) \( t^* \). The physical parts of Tim₂ at \( t^* \) will make up
a different (personal) temporal part of Tim, as Tim₂ exists at a much later time than Tim₁
in Tim’s personal time. Hence we will have no (personal) temporal part of Tim existing
with two heads, four hands, and so on. Still, we might ask, given that personal time is not
actually time, is this really a legitimate move for the perdurantist to make?

I think it is, and here’s why. If we are going to describe a world in which time-
travel is actual, but at the same time insist on only talking in terms of external time, we
will be sure to encounter a whole slew of odd results for certain time-traveling people:
death will come before birth; hair will grow backwards; “memory” will be considered
clairvoyance. Now, none of these things is an impossibility, either logically or
metaphysically; they are mere oddities. But to make sense of such oddities we need to
talk in a different language, despite how superficial it might be, and that is the language
of personal time.

The same goes for Tim. That a temporal part of Tim has two heads, four hands,
and so on is not a metaphysical impossibility; it is simply peculiar. And we can make
sense of such a peculiarity by describing it in reference to Tim’s personal time.
Depending on our ontological view of time, we might have to admit that a temporal part
of Tim really does (in some deep metaphysical sense) consist of two heads, four hands,
and so on. But again, this is not an impossibility, and for all intents and purposes we
should be satisfied with making sense of this oddity in terms of personal time.
VII. On Being Wholly Present

So far we have said that, *intuitively*, it appears that the endurantist faces a serious difficulty in trying to explain bilocation. *Intuitively*, it does not seem right to think that I could be wholly present here, and at the same time wholly present over there. But I think we can go further than mere intuitions. Whether or not there is actually something troubling about an object’s being wholly present twice over will depend on what our definition of ‘being wholly present’ is. So let us take a moment here to explicate this notion.

A. Being Wholly Present at a Time

The most natural, though still rather vague, understanding of ‘$O$ is wholly present at $t$’ is to say that a material object $O$ exists at $t$ in a similar way to how a universal, if there are such things, is instantiated at a time. After all, a universal, too, is typically described as being wholly present at every time (and place) that it is exemplified. But a mere correspondence to the way in which universals are instantiated is hardly enough to give us a precise meaning of ‘$O$ is wholly present at $t$’, since I take it we have no better idea of what it is for a universal to be wholly present at a time than we do for a concrete object.

We need a definition of ‘being wholly present at $t$’ that will reflect the endurantist’s central claim that persisting objects have no temporal parts. It seems only natural to say that because $O$ does not consist of temporal parts, $O$ must be wholly present at any time that it exists. That is, $O$ must have *all of its parts* at any given moment that it exists, since $O$ at $t$ is not a mere temporal part of $O$, but rather *is $O$ itself*. Hence our *desideratum*: a definition of ‘being wholly present at $t$’ should at least include
O’s having all of its parts (in some sense) at $t$ as a necessary condition for O’s being wholly present at $t$.

Sider and Merricks, however, have both pointed out the difficulty in trying to reasonably fulfill this desideratum in an eternalist framework: any definition for ‘being wholly present at $t$’ that is framed within an eternalist perspective and that also meets our desideratum will either turn out to be utterly trivial or else will entail mereological essentialism.29 Hence, if we are to proceed, we must assume a presentist perspective in our understanding of ‘being wholly present at $t$’.

Merricks has offered a simple presentist definition of ‘being wholly present at $t$’ which I take to capture much of our intuition regarding the meaning of the phrase:

\[ (*) \text{ An object } O \text{ is wholly present if and only if all of } O \text{'s parts exist.}\]

The definition clearly satisfies our desideratum, in that for $O$ to be wholly present, all of $O$’s parts must exist. And, as we would expect, it follows from the fulfillment of our desideratum that if $O$ is wholly present at $t$, then $O$ has no temporal parts (otherwise $O$ would have parts that did not exist at $t$), thereby reflecting the central claim of endurantism.31 But is (*) really a definition of ‘being wholly present at $t$’? Where did the ‘at $t$’ go? No worries: the time in (*) is implicit. Given that (*) is a presentist statement, we must read it taking tense seriously. Therefore, (*) can be read more explicitly as:

\[ (*t) \text{ An object } O \text{ is wholly present at } t \text{ if and only if } t \text{ is present and all of } O \text{'s parts simpliciter exist at } t. \]

(Here and elsewhere, ‘parts simpliciter’ refers to parts that are temporally unmodified.)33 Of course, (*) and (*) need not account for any times other than the present, since the present is the only time that presentism acknowledges as real.
B. Being Wholly Present in a Place at a Time

Merricks’s definition, (*), seems to me to capture the essential content of what it means for an object to be wholly present at a time. But the bilocation problem, what we are ultimately seeking to analyze, consists of an object’s being wholly present at the same time in two different places. What, then, does it mean for an object to be wholly present in a place at a given time?

Endurantists, presumably, and philosophers in general, don’t spend much effort trying to give precise meaning to phrases of the specific form ‘$O$ is wholly present in $S$ at $t$’, where $S$ is some region of three-dimensional space. The reason for this is quite simple: endurantism, in as much as it is a theory about the way in which objects exist in and persist through time, has little need for a semantics of claims concerning how an object exists in space. Consequently, there is no definition that we can turn to already in the literature. But luckily a precise meaning of ‘being wholly present in $S$ at $t$’ turns out to flow quite naturally from (*$t$).

Let $O$ be an object wholly present at $t$, and consider the following line of reasoning: First, by (*$t$) it follows that all of $O$’s parts exist at $t$, and hence that $O$ does not have temporal parts. Second, because $O$ is material and $O$ does not consist of temporal parts, all of $O$’s parts must be spatial. Third, spatial parts necessarily exist in space; hence all of $O$’s parts exist in some region of space, $S$. Fourth, we can assume, without loss of generality, that all of $O$’s parts exhaust $S$; that is, that no proper sub-region of $S$ contains all of $O$’s parts. Therefore, for any material object $O$ and any time $t$ at which $O$ is wholly present, there exists a region of space $S$ such that all of $O$’s parts exist in and exhaust $S$ at $t$. 
I now propose the following definition:

\((*St)\) An object \(O\) is wholly present in \(S\) at \(t\) if and only if \(O\) is wholly present at \(t\) and all of \(O\)’s parts exist in and exhaust \(S\) at \(t\).

\((*St)\) along with our existential claim just above imply that if an object \(O\) is wholly present at \(t\), then there exists a region of space \(S\) such that \(O\) is wholly present in \(S\) at \(t\). That is, if a material object is wholly present at a time, then it is necessarily wholly present in a space at that time. We now have a comprehensive and intuitive definition for ‘being wholly present in a space at a time’. Let us now turn back to the bilocation problem.

**VIII. A Formal Argument**

With \((*)\), \((*t)\), and \((*St)\) as machinery, we are now in the position to give an explicit and precise argument demonstrating how bilocation is a real problem for endurantist time-travel. Let us turn back to Tim. Remember that the endurantist claims that in the bar during \(T\) Tim is wholly present on one bar stool and also wholly present on the next barstool over. That is, he is wholly present in two disjoint places at the same time; Tim is *bilocated*.\(^{36}\) So we’ll assume that we have bilocation and show that contradiction results:

Let \(A\) and \(B\) be two nonempty, disjoint regions of space (one around each barstool) such that for some moment \(t\) in \(T\), Tim is wholly present in \(A\) at \(t\) and Tim is wholly present in \(B\) at \(t\).\(^{37}\) Finally, let \(P\) be a part (*simpliciter*) of Tim. Then we have the following valid argument:

\[
\text{(1) Tim is wholly present in } A \text{ at } t, \text{ and Tim is wholly present in } B \text{ at } t, \\
\text{ where } A \text{ and } B \text{ are disjoint [supposition of bilocation].}
\]
(2) $P$ is a part of Tim.

(3) Tim is wholly present at $t$ and all of Tim’s parts exist in and exhaust $A$
    at $t$ [from the first conjunct of 1, by (*$St$)].

(4) Tim is wholly present at $t$ and all of Tim’s parts exist in and exhaust $B$
    at $t$ [from the second conjunct of 1, by (*$St$)].

(5) $P$ is in $A$ [from 2 and 3].

(6) $P$ is in $B$ [from 2 and 4].

(7) $A$ and $B$ are not disjoint [from 5 and 6].

(8) $A$ and $B$ are not disjoint, and $A$ and $B$ are disjoint [from 1 and 7].

(8) is a clear contradiction; that is, the above argument uses (*$St$) to run a reductio on the
supposition of bilocation. Therefore, we must admit that if (*$St$) is an accurate definition
of what it is to be wholly present in a space at a time, then bilocation is a real problem; it
results in contradiction.

The endurantist who wants to maintain her belief in the possibility of time-travel
now has two options: She can either show that (*$St$) does not reflect the true meaning of
‘being wholly present in $S$ at $t’$, or she argue that, though bilocation is an impossibility,
time-travel does not involve genuine bilocation. We will take up the second of these
options in section X. For now, let me just say a few words in defense of (*$St$).

First, I think (*$St$) follows quite naturally from (*), as we have witnessed. If (*) is
to give way to any notion of being wholly present in a place at a time, then (*$St$) is it.
The reasoning, again, that we used to construct (*$St$) is simple: all of $O$’s parts are
material, and so all of $O$’s parts, if they exist, must exist somewhere; (*) says all of $O$’s
parts exist when $O$ is wholly present; so all of $O$’s parts exist in and exhaust some region
of space $S$ when $O$ is wholly present; (*St) then follows. Now, one might object that demanding that $O$ exhaust $S$ makes (*St) too strict. But notice that this feature of (*St) is not essential to the *reductio* above; our argument would follow just the same without it. Hence, ridding (*St) of this qualification will not help to solve the problem of bilocation.

Second, one might object that any definition at all for ‘being wholly present in $S$ at $t$’ is entirely unwarranted, since endurantists are not necessarily committed to any such notion. A thorough response to this objection would take us far outside the scope of this paper. Suffice it to say, however, that it is just as natural to talk of an object’s being wholly present in a place as it is to talk of that object’s being wholly present at a time, and I would highly doubt that any endurantist would want to flat out deny the strong intuition behind the former notion.

Finally, the legitimacy of (*St) clearly rests on that of (*), so (*) is in need of some defense here, too. For a full justification of (*), I direct the reader to Merricks (1994). For right now, I think we should be content simply noting the following two aspects of (*). First, our *desideratum*, that an object be wholly present only if all of its parts exist, seems to me to convey the essential intuition behind ‘being wholly present at $t$’, and indeed, this *desideratum* is fulfilled by (*). Second, any reasonable alternative to (*) must also fulfill this *desideratum*, and hence will entail a contradiction when applied to bilocation; that all of Tim’s parts exist in two disjoint places is what is essential to the bilocation problem. Despite what seems to be good reason to accept (*), there has been an attempt made to provide an alternative and unconventional definition of ‘being wholly present at $t$’ in order to save the endurantist from his troubles with the bilocation problem. And to this argument we now turn.
IX. A Proposed Solution

In a paper defending a presentist account of time-travel, Simon Keller and Michael Nelson have argued that when the phrase ‘being wholly present at \( t \)’ is understood in a particular way, bilocation, though odd, is not an impossibility for the endurantist.\(^{42}\) Their suggestion is to read ‘being wholly present at \( t \)’ as ‘not existing at \( t \) in virtue of having a [temporal] part at \( t \).’\(^{43}\) According to Keller and Nelson, the idea that objects are wholly present in this way at any moment that they exist, together with the claim that there are persisting objects, is all that should be built into the thesis of endurantism. This understanding of endurantism, they claim, is compatible with bilocation and the possibility of time-travel.\(^{44}\)

This solution, however, is unconvincing for a number of reasons. Notice, first, that Keller and Nelson’s definition of ‘being wholly present at \( t \)’ does not meet our desideratum for such a definition; it does not imply that if an object is wholly present at \( t \) then all of its parts exist at \( t \). Right off the bat, this makes for a rather counterintuitive notion of ‘being wholly present of \( t \).’ Further, their definition leaves open the possibility of an object’s consisting of temporal parts and also being wholly present at each moment of its existence. Such an object would consist of temporal parts, but would simply not exist at any time in virtue having a temporal part at that time; there seems nothing inconsistent with such an idea. But this is a problem, since the central claim of endurantism is that enduring objects don’t have temporal parts. In general, Keller and Nelson have offered only an ad hoc and wholly-negative definition of ‘being wholly present at \( t \),’ and though such a definition might be consistent with bilocation and time-
travel, it does not at all reflect the general claims that are essential to the endurantist thesis.

I think enough has been said at this point to have exposed the inadequacy of Keller and Nelson’s solution, but there remains one final objection that one might think to make to their proposal, depending on one’s views on existence and actuality. According to Keller and Nelson’s definition, and by assuming a possibilist view of existence, I can truthfully say that Sally, my pet unicorn, is wholly present at this very moment. Since Sally does not exist, in as much as she is a unicorn, it is vacuously true that she does not exist right now in virtue of having a part right now. Hence Sally, my unicorn, is wholly present at this very moment. Does she exist? No. Is she wholly present? Yes. This is an odd result, to say the least. Hence Keller and Nelson’s solution does not seem to make any sense from a possibilist’s point of view, unless one is willing to accept that unicorns and goblins are at all times wholly present. For this reason and for those already given, I think we would be wise to reject Keller and Nelson’s definition of ‘being wholly present at ‘ as a reasonable solution to the endurantist’s bilocation problem.

X. Temporary Intrinsic Properties
I’d like to take a small detour here to consider an issue closely related to, though distinct from what we have been discussing up to this point. Leaving aside for a moment the issue of being wholly present, let us turn back to Tim in the bar. Tim’s younger self, we may suppose, is youthful, with thick black hair. His older self, alas, is considerably aged; his once-black hair is now thin and grey. But as we know, these two men (or rather what
appear to be two men) are in fact one and the same person, namely Tim himself. So it turns out that Tim, at some time $t$ while in the bar, both has and does not have the property of having thick black hair. This is a clear violation of Leibniz’s law, and so it appears that the endurantist time-traveler might have more trouble on his hands than we first supposed.

In a sense, this problem—the problem of temporary intrinsics$^{46}$—is not particular to cases of time-travel or bilocation. Even if Tim were not a time-traveler, it would still be the case (for the endurantist, at any rate) that his older self and his younger self are strictly identical and yet have distinct properties; it would still be a violation of Leibniz’s law. There are two methods that endurantists generally employ to avoid this result. To avoid confusion let us look at Sam, who is similar to Tim though not a time-traveler. The first method (indexicalism) is to relativise properties to times.$^{47}$ On this account, Sam has the properties of having-black-hair-at-$t_1$ and having-grey-hair-at-$t_2$. Moreover, he has these properties at every moment that he exists; he has no temporary intrinsic properties. Hence it is never the case that Sam has an intrinsic property and then lacks it later, and there is no violation of Leibniz’s law. The second method (adverbialism) is to relativise the instantiation of properties to times.$^{48}$ On this account, Sam has the property of having black hair $t_1$ly and the property of having grey hair $t_2$ly. Hence it is never the case that Sam has an intrinsic property in one way and then lacks it later in the very same way, and so we avoid contradiction.

Despite perhaps being able to make sense of Sam’s story, as they stand, neither method provides a solution to the case of time-travel we are concerned with. Applying indexicalism, for example, it will remain the case that Tim both has and does not have the
property of having-black-hair-at-\( t \). But each method can be altered or generalized so as to provide a \textit{prima facie} solution to our problem. For simplicity’s sake, we’ll stick to looking at the indexicalist approach, keeping in mind that similar moves can be made for adverbialism.

One way to get around the problem of Tim’s temporary intrinsics would be to turn to personal time. Instead of relativising properties to moments in external time, we might think that properties should be indexed according to one’s personal time.\(^{49}\) If this is the case, then at every moment of his existence Tim will have the property of having-black-hair-at-\( t_1 \) and the property of having-grey-hair-at-\( t_2 \), where \( t_1 \) and \( t_2 \) are distinct moments in his personal time. More generally, since there is no moment in Tim’s personal time at which he is bilocated, there will be no (intrinsic) property \( P \) and (personal) time \( t \) such that he both has and does not have \( P \)-at-\( t \). There is no violation of Leibniz’s law.

To the extent that indexicalism as it is generally construed with respect to external time can alleviate the endurantist’s troubles regarding temporary intrinsic properties in standard cases of persistence, there seems to be at least good \textit{prima facie} reason for thinking that relativising properties to moments in one’s \textit{personal} time can provide a similar solution to the weird cases involving bilocation, while also continuing to make sense of the usual non-time-travel scenarios. So perhaps the problem at hand is nothing above and beyond the problems of persistence that already face the endurantist.

But there is a worry. Given that personal time is not really \textit{time} in any objective sense—it does not have the same positive ontological status that external time has—does it really make any sense to relativise properties to moments in personal time? If personal time is just an ordering of events lacking any intrinsic direction, if it is just something we
invent in order to retain the normal sequence of events in an object’s career, then it seems odd to give it such a fundamental status when it comes to properties, to regard *having a property at personal time* $t$ as being primitive to the concept of *having a property*.

Similarly, we must wonder what we are actually doing by relativising properties to moments in personal time. Actual *moments* in personal time do not really exist in the way we might think those in external time do. They are fictional entities that we use to make sense of time-travel stories, and we cannot reasonably *relativise* a property to any fictional entity.

A second solution would be to generalise indexicalism by relativising properties not to moments in time but to regions in space-time. Accordingly, Tim would have the properties *having-black-hair-at*-$R_1$ and *having-grey-hair-at*-$R_2$, where $R_1$ and $R_2$ are the space-time regions which Tim’s younger self and Tim’s older self occupy while in the bar, respectively. Again, it seems we escape contradiction.

Kristie Miller, who defends this solution, suggests that if we are willing to relativise properties to space-time *regions* then perhaps there is no reason to stop there: we should end up relativising properties to space-time *points*. Doing so then commits us to a view that Miller labels “mega-endurantism,” according to which an object is wholly present at each space-time point at which it exists, being extended in neither time nor space. Is mega-endurantism a tenable view of material objects? I’m not convinced it is, and indeed Miller seems to ultimately reject it. At any rate, acceptance of indexicalism with respect to space-time regions does not obviously seem to commit us to indexicalism with respect to space-time points.
So perhaps if we can relativise properties to space-time regions without committing ourselves to mega-endurantism, the problem of temporary intrinsics will turn out to be no more troubling for cases of time-travel than it already is for cases of ordinary persistence. But whether or not this is the case has no bearing on the main argument of this paper. The problem of temporary intrinsics in cases of time-travel is distinct from the problem of bilocation, and a possible solution to the former should not give us any hope regarding the latter. So much then for temporary intrinsics. Let us now return to the bilocation problem.

XI. No Bilocation, No Problem

We’ve said that if the endurantist is to maintain her belief in the possibility of time-travel, she must either deny the legitimacy of (*St), or else argue that time-travel does not involve genuine bilocation. I hope that by now the plausibility of (*St) has been made clear. In this penultimate section, therefore, I would like to present and reply to two ways that the endurantist might argue that Tim is not actually bilocated during T. Again, let t be some time in T.

Solution A: If we tell Tim’s story with respect to his personal time, then Tim is never bilocated at t. Instead, Tim is wholly present in A at t and wholly present in B at t*, where t* is some time much later than t in Tim’s personal time. This is essentially the same move the perdurantist makes to get out of his jam (section VI), so why can’t the endurantist do the same thing?
Reply: Recall that the perdurantist employs Tim’s personal time to make sense of the fact that Tim’s temporal part at \( t \) has two heads, four hands, etc. In doing so the perdurantist is able to tell a story about Tim that does not involve strange happenings like Tim’s hair growing backward or his temporal part’s having two heads. But this does not change the fact that in external time Tim’s temporal part at \( t \) does have two heads. And if we give any privilege to external time over personal time, if we think that external time has some intrinsic quality to it that cannot simply be reduced to the direction of causation or entropy or anything else, then we must admit that in some real sense the temporal part of Tim at \( t \) has two heads. This is not an impossibility, just a mere oddity like any other oddity that springs from time-travel.

But the endurantist’s predicament is different in a crucial way. The bilocation problem is no mere oddity. It results in a straightforward contradiction, as we have witnessed. So using personal time will not help the endurantist explain away bilocation. It might be the case that Tim is not bilocated in personal time, but this does not change the fact that he is bilocated in external time; it does not change the fact that in some deep metaphysical sense there is a contradiction present. Hence personal time cannot help the endurantist in this way.

Rebuttal: But what if we go further than merely retelling Tim’s story with respect to his personal time? What if we insist that an object is only wholly present with respect to its personal time, that there is no sense in which an object is wholly present in external time, no bilocation story to retell? Then \((^t)\) is left generally intact (it would merely change the
referent of ‘\(t\)’), and there will be no true sense in which Tim is bilocated in external time; there will be no contradiction.

Reply: Remember what endurantism really is: endurantism is a thesis about the way in which objects persist through time, the upshot of which is that objects are wholly present at every moment that they exist, and we have seen that (*\(t\)) gives a plausible definition of what it means to be wholly present at a time. But if we decide that the ‘\(t\)’ in (*\(t\)) refers to a moment in an object’s personal time, if we insist that when we talk about an object’s being wholly present we are only talking about its being wholly present in its personal time, then endurantism is reduced to a theory about the way in which objects persist through their personal times; it fails to say anything about persistence through external time. This, however, defeats the purpose of endurantism altogether, which is to explain persistence through external time. Accordingly, the proposed solution cannot reasonably work to rid Tim’s story of bilocation.

Solution B: We were wrong to ever think that Tim was bilocated at \(t\). It’s not that Tim is wholly present in \(A\) at \(t\) and wholly present in \(B\) at \(t\), it’s that Tim is wholly present in the union of \(A\) and \(B\) at \(t\). He is only wholly present in one set of space, and so there is no bilocation.

Reply: But if Tim is wholly present in the union of \(A\) and \(B\) at \(t\), then Tim is a disjoint material being; his parts are scattered between \(A\) and \(B\). What’s more, he has two heads,
four hands, twenty toes, and so on. This doesn’t seem like something the endurantist would be willing to accept.

**Rebuttal:** But isn’t this the exact same problem the perdurantist has? After all, (*) implies that the temporal part of Tim at \( t \) is wholly present at \( t \), since when \( t \) is present all of the parts of Tim’s temporal part at \( t \) exist at \( t \). For the perdurantist, Tim’s temporal part at \( t \) has scattered spatial parts, one head over here, the other over there. Hence, if we are satisfied with the perdurantist’s solution of using personal time, we should be just as satisfied doing the same for the endurantist.

**Reply:** Remember, again, that despite the use of personal time, the perdurantist must still be willing to accept that, in some sense, a temporal part of Tim has two heads and is scattered spatially and so on. So the endurantist must be equally willing to endorse these odd properties of Tim if her solution is to succeed. There are two reasons, however, why I think the perdurantist should be far more welcoming of these conclusions than the endurantist. First, in general it seems much less counterintuitive to think of a temporal part of Tim as having two heads than it does to think that Tim himself has two heads. I’m just not so sure how willing endurantists would be to accept Tim as having one head before the interval \( T \), but then, at the moment \( T \) beings, as instantaneously growing another one halfway across the room.

Second, time-travel aside, perdurantists are already, in fact, quite committed to the claim that at least some temporal parts of Tim have two heads and such. For instance, the temporal part of me at \( t \) has one head, the temporal part of me at \( t + 1 \) has another
head, but the temporal part of me at the interval \([t, t + 1]\) has multiple heads (one at \(t\), one at \(t + 1\), and an infinite amount in between, since time is presumably dense). Perdurantists seem not to be bothered by these results, so why would they fuss over an *instantaneous* temporal part of Tim having two heads?

In general, perdurantism seems to lend itself much more naturally to an egalitarian mereology. Lewis, for one, claims that “the simple principle of absolutely unrestricted composition should be accepted as true.”\(^{51}\) If perdurantists like Lewis can accept that the mereological summation of, say, an Eskimo’s whisker, my umbrella and the Taj Mahal constitute a real entity, then there is clearly no reason why they would be hesitant to agree that a temporal part of a person might consist of scattered spatial parts with two heads and so on.

Admittedly, there seems to be no glaring contradiction in an endurantist claiming that Tim is a disjoint material being with two heads and twenty toes. But I would highly doubt that endurantists would want to endorse this counterintuitive result for the mere sake of maintaining a belief in the possibility of time-travel. Consider Peter van Inwagen, for instance, who considers enduring objects (actually, all objects) to be either metaphysical simples or organic “unified wholes”.\(^{52}\) Is it reasonable to think that such unified wholes could be scattered spatially? Could an organic being, in van Inwagen’s sense, plausibly consist of two disconnected heads? I would tend to doubt it. If the endurantist wants to endorse such results, so be it; perhaps she’s found a way out of the bilocation problem. But she is giving up some basic ontological intuitions along the way, and this just doesn’t seem warranted. Conversely, perdurantists, as we have seen, can
and should willingly accept the possibility of a temporal part of a person as having two heads and being scattered spatially.

XII. Conclusions

Reflecting on the above considerations concerning endurantism and time-travel, I think we must conclude that the bilocation problem presents a serious difficulty for endurantist time-travel. But perhaps, we might think, this claim should be qualified. That is, perhaps we should say that the bilocation problem only presents a worry for special types of endurantist time-travel, namely those in which a person travels through time to visit his younger or older self. I think, however, that this qualification is unwarranted for two reasons. For one, the problem of bilocation is not specific to persons or agents. In fact, depending on how we view personhood, the bilocation problem might not apply at all to persons or agents per se. Instead, the bilocation problem applies to all material objects that endure through time, and this includes Tim’s body (if not his mind as well) and any other objects that might travel back in time, including the machine itself. Second, if we are assuming that causation must involve spacio-temporal continuity, then it seems the time-machine, and everything in it, cannot avoid the problem of bilocation when making its journey back in time, since the machine must pass through some block of time during which it has already existed. So bilocation will occur in every case of backward time-travel except those that admit of “distant” or “discontinuous” causation. Admittedly, if Tim were to travel forward in time and stay there without ever going back, then it does not seem that he would run into any problem of bilocation. But if he were to, say, travel into the future and eventually return to the present, then both journeys—into the future
and back to the present—would end up involving bilocation: both would necessitate his traveling through a block of time in which he already exists. Therefore the bilocation problem seems to rule out the vast majority of time-travel scenarios for the endurantist, and hence the “special types” are really those few for which endurantist time-travel might remain a possibility.

We have said that the bilocation problem presents a serious difficulty for endurantist time-travel. It does not, on the other hand, present any obvious difficulty for endurantism simpliciter. The endurantist might not be able to reasonably believe in the possibility of time-travel, but this does not mean that he should give up the thesis of endurantism itself. Thus, the endurantist’s problems with the possibility of time-travel should not be viewed as a weakness of the endurantist thesis, but rather should be thought of as marking a defining difference between endurantism and perdurantism.

Notes
1 I am indebted to Professor Glenn Ross for his helpful comments and suggestions on the many drafts of this paper.
2 I will assume here, for the sake of illustration, that my computer is a persisting material object, though I recognize that not all philosophers would be willing to grant this.
3 The names ‘perdurance’ and ‘endurance’ were coined by David Lewis in his (1986b), in which he uses ‘persist’ as a neutral term, and ‘endure’ and ‘perdure’ as denoting different ways of understanding an object to persist.
4 I do not mean to imply that perdurantism and endurantism are the only coherent, or even defensible views regarding the ontology or persistence of material objects.
5 By no means do these two theses exhaust the possible views one could take towards the ontology of time. For alternative views, see James (1968, chapter XI); Broad (1923, chapter II); and Tooley (1997). James is not explicit, but I do take him to be suggesting a “growing block” picture of time.
6 For an interesting discussion on the possibility of an eternalist view that is not reductionist about tense, see Sider (2001: 17-21).
7 (Ibid: 15).
8 For an account of endurantism that is not presentist, see van Inwagen (1990a); Haslanger (1989); and Johnston (1987). I know of no philosophers who maintain a view combining presentism and perdurantism.
10 See Merricks (1999).
11 This point is raised by Simon Keller and Michael Nelson in their (2001: 334-335).
13 This, again, is Merricks’s point (Merricks (1999)), which we will return to in section VII.
This is not to say that the bilocation problem itself is essentially what requires presentist language to describe, but rather the more general notion of ‘being wholly present’, on which the bilocation problem relies. This will be made clear in section VII.

Lewis (1986a: 67). The majority of ideas presented in this section are taken from this seminal work on the philosophy of time-travel.

This is my specific definition of personal time. It is not clear if Lewis would be willing to accept that personal time is necessarily related to causation. Sider has expressed that personal time might be best understood as relating to causation or entropy (see Sider (2005: 330)). I would be happy to define personal time as relating to entropy as well.

The term ‘personal time’ is perhaps a bit misleading. Persons are not the only things that have personal times; any persisting concrete particular has, in a sense, a “personal” time. The personal time of a penny, for instance, is simply the temporal ordering of events in the penny’s career that preserves the normal continuity and forward direction of causation. The penny is minted, it rusts, it chips, and finally it is melted down into molten copper. That one’s personal time coincides with the order in which one experiences the events of his life is not an essential characteristic of personal time per se; it is merely a consequence of the fact that our experiences are a result of causal processes which are then ordered in a specific way by our personal time. Hence objects that do not experience anything whatsoever can still be thought of as having personal times. This, however, is particular to my own interpretation of personal time, and is not necessarily something that Lewis would endorse.

Lewis (1986a: 69).

I do not mean to claim here that Tim as a person is a mere material object, nor that endurantists necessarily view persons as such. Throughout this paper, ‘Tim’ should be thought of as referring to the physical components of Tim, whatever they may be. Thus my argument will remain neutral with respect to physicalism, dualism, and any other such ontological thesis. The argument made about Tim presented herein could just as well be applied to an inanimate material object such as a penny, assuming such a thing endures. For illustrative purposes, however, I will stick to talking about Tim.

Identity here and elsewhere in the paper, of course, is taken in the strictest possible sense, i.e. numerically.

This name I have taken from Keller and Nelson (2001: 341), in which credit for its coinage is given to David Lewis.

A solution similar to the one to follow has been suggested in Keller and Nelson (Ibid: 341).

In fact, I think the only way we could reasonably say that there is no objective sense in which Tim’s temporal part at t has two heads and so on is if we thought that personal time had the same ontological status as external time. Endorsing such a view would be to say that there is nothing intrinsic about the direction of external time, that external time can be reduced to mere talk of causation or entropy or something else. For an interesting discussion on this conception of time and how it relates to time-travel see Sider (2005).

Lewis (1986b: 202).

See Merricks (1999: esp. 425); and Sider (2001: 63-68). It is important to note that Sider is not arguing that endurantism cannot be appropriately formulated on an eternalist picture; he seems to think it, or at least
a very similar theory to it, has potential. Instead, he is only claiming that ‘being wholly present at \( t \)’ cannot be reasonably defined on eternalist grounds.


31 Strictly speaking, \( O \) could be thought of as having exactly one temporal part at \( t \), namely the mereological sum of its spatial parts at \( t \). This does not contradict endurantism, nor does it suggest perdurantism. What (*) does not allow for is a wholly present object’s ever having more than one temporal part.

32 From here on I will use (*) and (+) interchangeably, depending on which is better suited to the given context. Remember that they are equivalent definitions.

33 For this notion of ‘parts simpliciter’, see Merricks (1999: 423).

34 It is important to note here that the analogy between the way a universal is instantiated and the way an enduring object is wholly present does not hold up in the case of being wholly present in a place. The reason is simple: Enduring objects have spatial parts, whereas universals do not, even in their instantiations. That is, enduring objects and universals do not exist in space in the same way at all, and this is where the analogy breaks down. Conversely, enduring objects and universals do exist in time in the same way, one might think: neither consists of temporal parts.

35 See note 31. If \( O \) does have a single temporal part, then that temporal part is a present (instantaneous) temporal part, and is merely an aggregate of space. As we’ll see, this is all we need to construct our definition.

36 Perhaps we might think that there are alternative ways for the endurantist to tell Tim’s story, ways that don’t involve bilocation. These will be discussed in section XI.

37 For the sake of argument, suppose that \( t \) is present.

38 I have dropped the qualification ‘at \( t \)’, but, again, we are assuming \( t \) to be present (see note 37).

39 The supposition of bilocation, as I am construing it, requires that Tim be wholly present in two disjoint regions of space at the same time. Indeed, this construal accurately reflects the events of the story we have told about Tim. But we might want to expand the notion of bilocation to include all cases where an object is wholly present in two distinct regions of space at the same time (say Tim travels back in time and finds himself, as a result of the time-travel process, conjoined with his younger self). With a little readjusting of the above argument, we can easily show that this broader understanding of bilocation leads to contradiction as well.

40 One might worry that our argument is not necessarily a reductio on the supposition of bilocation, but rather could be interpreted as a reductio on (2), the claim that \( P \) is a part of Tim. Surely, if (2) were not true (i.e. if Tim had no parts), then bilocation would not result in contradiction. But (2) is undeniably true. Even if we were to insist that Tim has no proper part (and this itself seems an awfully controversial view to endorse), there is no denying that Tim has an improper part, namely Tim himself. Hence Tim necessarily has a part, and our argument is a reductio on, and only on, the supposition of bilocation.

41 See also Merricks (1999).


43 Keller and Nelson do not include the modifier ‘temporal’, but it is clear from the context that by “part” they do in fact mean “temporal part”.

44 It should be stressed that Keller and Nelson take ‘not existing at \( t \) in virtue of having a part at \( t \)’ as a definition for ‘being wholly present at \( t \)’, not as a mere necessary condition: “We think that what it means to say that an object is wholly present at a time \( t \) is simply that it does not indirectly exist at \( t \); it does not exist at \( t \) in virtue of having a part at \( t \). This, plus the claim that there are persisting objects, is endurantism.” (Ibid: 342).

45 For actualists, who don’t believe that one can refer to a non-existent entity like Sally at all, this objection never even gets off the ground.

46 This name comes from Lewis (1986b: 203)

47 For a defense of this view, see van Inwagen (1990).

48 For a defense of this view, see Johnston (1987).

49 This solution is suggested in Keller and Nelson (2001: 343-345).

50 Miller (2006).

51 Lewis (1986b: 212).
See van Inwagen (1990b), especially sections 9 and 12. Here he states: “It seems plausible to say that what binds [the simples that compose an organism into a single being] together is that their activities constitute a life, a homeodynamic storm of simples, a self-maintaining, well-individuated, jealous event” (Ibid: 121).

References
van Inwagen, Peter (1990a) “Four Dimensional Objects”, *Noûs*.