

Time without Change and without Persistence

The old debate about time without change has focused on whether it is possible for every thing to persist for some time unchanged.¹ If it were possible, this would be one way for time to elapse without change. I want to consider another way. Let's say that time passes if and only if (iff) a time interval elapses, and that a time interval elapses iff one thing—temporal location, event, or object—is before another. The question whether there can be time without change is the question whether it is metaphysically possible for one thing to succeed another without any change in anything. Because change requires persistence, if a time interval without persistence is possible, then so is a time interval without change. I argue that it is possible for there to be a time interval without any persisting things, at least if persistence is endurance. I begin by defending the claim that change requires persistence and explaining the concept of endurance.

1. Persistence and Change

If changes are events, and events require subjects (see Simons 2003a: 371-372), then change happens only when things change. There are two elements in change. First, if something changes it must last for some time. Nothing changes if it does not persist. But, even if duration requires change, having some duration is not the same as changing. So second, something changes only if it has some property² F at one time when it exists and some incompatible property G at another time when it exists (Lewis 1986).³ The first

1 See Shoemaker (1969), Newton-Smith (1980), LePoidevin (2003), and Warmbröd (2004), among others.

2 Unless otherwise noted, "property" is used to include both non-relational and relational characteristics, as well as relations. A relation is a connection between two or more things: *being taller than*, for example. A relational property is exemplified in virtue of a relation between two or more things: *being taller than Steve*, for example. A non-relational property only involves the one object: *being positively charged*, for example.

3 I assimilate the acquisition or loss of parts to the acquisition or loss of properties: if something gains a part P, it acquires the property *having P as a part*.

condition requires that things that change also persist. The second condition requires that changing things vary qualitatively during the time when they persist. Change is persistence *plus* variation in properties. Therefore, change requires persistence.

If there can be a time interval without persistence there can also be a time interval without change. (I henceforth consider only what is required for a time interval without persistence; I leave the implication implicit.) Whether a time interval without persistence is possible depends on what persistence is. Standardly, the two main views about persistence—endurantism and perdurantism⁴—are distinguished by whether they hold that a persisting object is “wholly present” or only “partly present” at the times when it exists.⁵ On perdurantism, an object is supposed to have extension in time in much the way it is widely held to have extension in space: as spatially extended objects have non-overlapping spatial parts in non-overlapping places so temporally extended objects have non-overlapping temporal parts⁶ at non-overlapping times.⁷ To perdure is to be composed of more than one temporal part. An enduring object is supposed to not have temporal parts, but to be present as a “whole” at each time when it exists.⁸ If O endures from T1 to T2 then “all” of it exists at both times. I assume that things persist by enduring.⁹

2. Substantial and Relational Time without Persistence

4 See Sider (1996 and 2001) for a third view, sometimes called “exdurantism.” Perdurantism and endurantism are also sometimes called “four-dimensionalism” and “three-dimensionalism.”

5 See Lewis (1986), Sider (1997), and Merricks (1994) *inter alia*.

6 Unless otherwise noted, by “part” I mean “proper part.”

7 See Sider (2001) for an influential account of temporal parts: Y is an instantaneous temporal part of X at T iff (i) Y exists only at T, (ii) Y is a part of X at T, and (iii) for all Z, Z is a part of X at T iff Z is a part of Y at T.

8 On whole presence, see Crisp and Smith (2005).

9 There are also a number of different endurantist accounts: see van Inwagen (1990), Merricks (1994), and Zimmerman (1998). The main difference among these views—whether they accommodate change by relativising properties to times or by treating the present as privileged—does not affect my argument except in section 3.1.

A traditional dividing line on our question involves the dispute about whether temporal locations¹⁰ should be understood substantivally or relationally. A relational temporal location is a collection of simultaneous events. A substantival time is something in addition to, and independent of, all of the events located at it (Nerlich 2003). The question whether there can be time intervals without persistence may be divided into two: whether there can be substantival time intervals without persistence and whether there can be relational time intervals without persistence. To say that a substantival time interval obtains is to say that there is a substantival time T1 that is immediately before¹¹ another such time T2.

Setting “empty” temporal locations aside, suppose there are some objects existing at T1 and objects existing at T2. It is possible that none of these objects exist (are wholly present¹²) at both times. These objects may be tables and chairs, human beings and tigers, photons and neutrons, or mere simple objects. According to endurantism, something persists from T1 to T2 only if it is wholly present at both T1 and T2. By hypothesis, none of the objects in the situation is wholly present at both T1 and T2. So none of the objects persists from T1 to T2. So, if persistence is endurance, the situation involves a time interval without persistence. Let’s call this situation a complete replacement of objects (CRO).

The least complicated case of a CRO involves simple objects that exist at T1 and simple objects that exist at T2, where none of them exist at both times. It is possible that material objects O1 and O2 are contiguous. It is possible that a simple object O1* is

¹⁰ My talk, here and below, of temporal locations can be put in the vocabulary of spacetime: temporal locations are timelike separated spatiotemporal regions. Events or regions are successive when they are timelike separated.

¹¹ I consider the possibility that times are densely ordered in section 3.3.

¹² It is to be understood, even where it is not explicitly stated below, that to exist at a time is to be “wholly present” at it.

simultaneous with O1, and contiguous with O2*, which is simultaneous with O2. These possibilities may be iterated indefinitely, and nothing prevents the possibilities' being combined. It is only slightly more complicated to suppose that some of the objects that exist at T1 or T2 are composite. This requires that a composite object may cease or begin to exist along with all its parts. But there is nothing absurd in these requirements. God is traditionally supposed to have created composite objects *ex nihilo*. And since a composite object can cease to exist at a certain time, there is no reason why all of its parts might not also happen to cease to exist at that time. (I consider this issue in more detail in section 3.2.)

According to relationism, a temporal location is a collection of simultaneous events. Rather than ask the much more complicated question of whether it is possible for two relational temporal locations to be successive without any persisting objects, I will consider the more direct question whether the same is possible with two successive events.¹³ This is the more important question in any case, since, from the relationist perspective, facts about the succession of relational locations surely supervene on facts about the succession of events.

The reason it seems a taller order to prove there could be a relational time interval without persistence is because relational time is built up out of events, which seem to be intimately connected with change. If events just are changes, and change requires persistence, then perhaps there could not be a relational time interval involving events without persistence or change. To examine this line of reasoning I consider the

¹³ A relational time interval also takes place if an event takes place (Warmbröd 2004: 285). As I explain below, if the obtaining of a time interval just is the obtaining of an event, then, given the account of events I assume, there cannot be a time interval without persistence. But it is evident that a time interval also takes place when one event is before another. To deny this is to deny that succession is at least a sufficient condition for the passage of time.

most developed view on which events are changes. On Brian Lombard's view, events are structures involving objects and properties. According to Lombard, an (atomic) event is a structure involving an object O1's being F before it is G, where F and G are incompatible properties (1979; 1986). The event of a poker's getting warmer involves the poker's having a certain temperature before it has another, hotter, one. Could there be successive events without persistence on Lombard's account of events? It is true that on this view the existence of a single event implies the existence of some persisting object. An event E involves an object O1 that is first F and then G. If O1 is F before O1 is G, O1 persists. But even if the occurrence of each event requires persisting objects, it does not follow that there must be persisting objects in the time interval between two successive events E1 and E2. In order for this time interval to involve persistence there must be some object that exists simultaneously with both E1 and E2.

Given Lombard's conception of events, a relational time interval without persistence is one in which some events—E1a, E1b, E1c, etc.—are all simultaneous with each other and immediately before some other events—E2a, E2b, E2c, etc. (Any event simultaneous both with an E1 and an E2 would involve a constituent object that persists during the time interval.) The interval occurs without persistence if all of the objects that exist earlier cease and all new objects begin. It is possible for the constituent objects of the events simultaneous with E1 to cease to exist with it and for the constituent objects of the events simultaneous with E2 to begin to exist with it. In other words, a CRO is possible even in relational time.

Assuming perdurantism is combined, as it usually is, with universalism, the possibility of a CRO requires that persistence is endurance rather than perdurance. Universalism is the view that for any objects at all there is something that is their sum

(van Inwagen 1987). Since some object O1 exists at T1 and an object O2 exists at T2, there must be some object, O*, that is the sum of O1 and O2. O1 is a temporal part of O*: it overlaps every part of O* that exists at T1. The same is true of O2. Since an object perdures by having different temporal parts at different times, O* perdures from T1 to T2. So, if persistence is perdurance, a CRO is not possible (at least not in the way I have outlined).

3. Objections and Replies

I now answer several objections to the scenario sketched. For ease of exposition, I formulate the objections and responses in a substantival framework.

3.1 The Universe

Monism, let's say, is the view that the universe is the sum of all (the other) material objects (see Lewis 1986). It may seem that even if no ordinary object exists at both T1 and T2, if there is an object that is the sum of all the objects that exist at T1, and an object that is the sum of all the objects that exist at T2, then at least this object—the universe—persists from T1 to T2.

There are two ways of thinking of the monistic universe. If presentism¹⁴ is true and only present things exist, then the universe is the sum of all the present things. If eternalism is true and past and future objects exist as much as present ones, then the universe is the sum not only of present but of all past and future things.¹⁵

The eternalist universe is of no help to the objector. The objector claims that something persists in the scenario sketched because the universe exists at both T1 and T2. But this requires that the universe persist through this interval, which the eternalist

14 See Markosian (2004), and Bigelow (1996), among others.

15 See Sider (2001) and Smart (1963), among others.

universe cannot. The eternalist universe U is the sum of all objects that exist at all times. Persistence, again, is understood as endurance.¹⁶ Either U changes during the time interval or it does not. If U does not change, then the time interval involves persistence but no change. In addition to being independently implausible, the possibility is inconsistent with the view that time intervals necessarily involve change. So suppose U changes during the time interval. There are two main ways endurantists accommodate change. Tensors claim that things change because the properties they have (now) need not be the properties they had. Relativists hold that an enduring thing can be, say, both red and green over time because red and green are really relations to times. The enduring changing thing has the different relations to different times. Neither conception allows the eternalist universe to endure. For the tensor, the only properties things have are those they have presently. Suppose T1 is present and consider what parts U has. In the same way that X cannot have a property at T unless X exists at T, so if X (now) has Y as a part then Y (now) exists. Since past and future things do not exist at present, the universe cannot (now) have them as parts. Therefore, the eternalist universe's change cannot be understood in terms of tense. Nor can it be understood by relativising changing properties. On this view, *being a part of* is at least a three term relation: Is a part of (X, Y, T). Analogously, the composition relation must be relativized to times—Compose (the Xs, Y, T)—to allow that the Xs compose Y at T1, but the Zs (\neq the Xs) compose Y at T2. But the eternalist universe is supposed to be composed of everything, period. In order to articulate that, we need a sense of composition that is not a three term but only a two term relation: the composition base and the object composed.

¹⁶ It is likely that the eternalist universe may be conceived to perdure by having different temporal slices at different times. A slice, in the case of the universe, is the sum of all the material objects that exist at a certain time.

At best, the advocate of the eternalist universe is left with the inelegant consequence that there are distinct primitive composition relations.

Only the presentist universe can endure through the interval. But even presentist monism is only as plausible as monism. As Peter Simons argues (2003b), the universe is best thought of not as a single object, but as all the objects. (Simons is concerned with objects from various categories, such as properties and events. I restrict myself to material objects.) To put the point linguistically, the singular form of “the universe” is misleading. “The universe” is really a plural expression that picks out each material object. On this view—call it pluralism—one may allow the existence of the universe, and that “it” (they) “exists” (exist) at both T1 and T2, but without conceding that there is any object that exists at both times. Suppose T1 is present. Then the objects that exist—the universe—exist at T1. Some time elapses and T2 is present. Then the objects that exist—the universe—exist at T2. All this is consistent with there being no single object that exists at both times.

3.2 Causation, Creation, and Destruction

What is the causal relationship between the old and new objects in a complete replacement of objects? Could some or all of the old objects be causally related to some or all of the new objects? It is possible that all the new objects begin to exist without a cause. But a CRO is compatible with the objects’ being causally connected. Nothing prevents there being the causally significant counterfactual connection or constant conjunction between the various properties of the old objects and the various properties of the new objects. Still, this overlooks the most peculiar feature of a CRO. What, if anything, accounts for the old objects’ ceasing to exist and for the new objects’ beginning to exist? Can a CRO involve an account of the destruction of the old objects and the

creation of the new objects?

The natural causal conception of a CRO involves all the old objects' being destroyed and all the new objects' being created. The problem is that ordinary creation and destruction do not work this way. Ordinary creation involves causing some existing things to have some relation they did not have before. Ordinary destruction involves causing certain things that are parts of something to cease being parts of that thing. Let's distinguish creation from creation *ex nihilo*¹⁷ and destruction from destruction *in nihilo*. O is created *ex nihilo* iff O is created and O is not composed of objects that existed prior to the beginning of O's existence. O is destroyed *in nihilo* iff O is destroyed and none of O's parts outlast O. Notice that a simple object can only be created *ex nihilo* and destroyed *in nihilo*. Therefore, if simple objects can be created or destroyed, then it's possible for some things to be created *ex nihilo* and destroyed *in nihilo*. Science reveals that apparently simple objects, such as photons, are created and destroyed (Kuhlman 2000: 384). Since simple objects are actually created and destroyed, it is possible for them to be created and destroyed.

The possibility of creating *ex nihilo* and destroying *in nihilo* composite objects is a natural consequence of the possibility of creating and destroying simple objects. Creating a composite object O *ex nihilo* involves creating various simple objects and causing them to compose O. Destroying a composite object O *in nihilo* involves destroying the simple parts that compose O.¹⁸ Since it is possible to create several simple objects, it is also possible to cause those simple objects to stand in whatever relations suffice for their composing something. And since it is possible to destroy several simple

¹⁷ This is not the traditional conception of creation *ex nihilo*, since in my sense an object can be created *ex nihilo* even if various things existed before it did.

¹⁸ I assume a composite object cannot undergo a complete change of parts from one moment to the next.

objects, it is also possible to destroy all of those simple objects that happen to compose something.

3.3 Further Details about a CRO in Substantival Time

The series of instants that make up a time interval may be supposed to have either a dense or discrete order. The series of instants is discrete iff for every instant there is a unique previous or later instant. The series is dense iff for any two successive instants there is a third after one and before the other. If time is discrete, then it may be supposed that there is no instant between T1 and T2 in our time interval. A CRO occurs when various objects exist at T1, various objects exist at the next time T2, but no object exists at both.

By considering non-overlapping contiguous times, I have been assuming that time is discrete. The natural way to extend the discrete time scenario to a dense context is to suppose there is a time interval from T1 to T2 such that there are objects at those times and at every time in between, but where there is no object that exists at more than one of these instants. There are two noteworthy consequences of this suggestion. First, in order for there to be a dense interval without persistence there must be some objects that exist instantaneously.¹⁹ Second, the number of objects required for the dense scenario is the same cardinality as the set of rational numbers. Thus a dense time interval without persistence requires that an infinite number of objects exist during a certain finite interval of time. I consider these consequences in that order.

Given a time interval understood as a series of instantaneous points, it is easy to explain what is involved in an object's existing instantaneously. An object exists

¹⁹ This is not required in either the relational or discrete substantival scenario. Even if nothing persists from T1 to T2, it may be that everything that exists at T1 persists (by also existing before then), and everything that exists at T2 persists (by also existing after then).

instantaneously if it exists at exactly one instant. What sort of object can exist instantaneously? The better question is: what properties can an object have that exists instantaneously? A strong case can be made, first, that some familiar properties may be exemplified instantaneously. Something may be positively charged, exactly 3 meters in length, or spherical for just an instant. But, second, even if familiar properties necessarily involve temporally extended exemplification, there is nothing incoherent in the bare concept of an instantaneously exemplified property. The concept of a property is just the concept of a way something can be. Nothing in this concept precludes something's being a certain way for just an instant.

With regard to the possibility of an infinite collection of concrete objects, I note that the standard complaints about Hilbert's Hotel,²⁰ for example, threaten the possibility of dense time no less than the possibility of an infinite number of objects occupying such time. If dense time is impossible, then dense time is no objection to the possibility of a complete replacement of objects.

²⁰ See Craig (1993), Morrison (2002), and Moreland (2003). Imagine a hotel with an infinite number of rooms each of which is occupied. It is still possible, surprisingly, to add a guest. One way to accomplish this is to move each current guest as follows: from Room 1 to Room 2, from Room 2 to Room 4, from Room 3 to Room 6, and so forth.

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