"Time Without Change"

by Sydney Shoemaker

"In what follows I shall try to show that it is conceivable that people should have very good reasons for thinking that there are changeless intervals." (368)

"[The] claim is that something or other must change during any interval of time and not that everything must change during every interval..." (370)

"...what is in question here is not whether it is physically possible for there to be time without change but whether this is logically or conceptually possible." (368)

Two sorts of "change" must be ruled out of consideration if the thesis is not to be trivially false:

1. McTaggartian change = change of "A- properties"
2. Goodmanian change = change of "artificial" properties like 'grue' and 'bleen'.

Later on, SS says this: "McTaggartian properties are properties "something comes to exemplify or ceases to exemplify simply in virtue of the passage of time." (379) If events changing these McTaggartian properties (like being present or being 3 seconds future or 10 years past) is really change, then of course there cannot be (passing or lapsing) time (or "pure becoming" or "absolute becoming", as it is sometimes called) without change.

But it is perfectly reasonable to exclude this kind of "change" from consideration at the outset. As C. D. Broad pointed out, the existence of this sort of “change” might be a grammatical illusion. When an event becomes present, it doesn’t gain a peculiar property, it occurs or happens. Similar remarks should apply to all the other so-called A-properties or A-determinations.

The odd Goodmanian predicates ‘grue’, ‘bleen’, and the like arose during Goodman’s consideration of inductive inference. It looks as if admitting them would unfairly trivialize the argument, and so it seems reasonable to exclude them as providing counterexamples to Shoemaker’s **thesis** (“during every interval of time, no matter how short, something or other must change with respect to some such [genuine, non-McTaggartian, non-Goodmanian] property or other.” (364)).

SS notes that we measure time by noting changes in an instrument that we call a clock, illustrating the close connection between time and change. It would seem an unwelcome corollary of the view that there can be time without change that we can never know how much time has passed since the occurrence of any given past event. This is a form of skepticism with respect to the measurement of time.(It is rebutted at the end of the paper, since in our world we have none of the experiences that are required to support the hypothesis that there is time without change.)

I think that SS’s discussion of the sense of time adds little to the argument so far. Our sense of the passage of time reflects the fact that we are crude clocks. But we can infer from it that during a period when no change occurs (a frozen period), we can’t be aware that no change is occurring. What SS will try to do, then, is nevertheless “to try to show that it is conceivable that people should have very good reasons for thinking that there are changeless intervals.” (368). He does this by means of a very clever example.

The Example: A universe that consists of three parts, A, B, and C, that undergo “local freezes”, periods of time in which nothing (really: NOTHING) in that part or region changes. Could we not have good inductive evidence that the local freezes have periodic recurrence times that indicates a period when all three local freezes coincide? Could we not, that is, imagine having good grounds for believing in periodic <u>universal</u> freezes? Shoemaker’s question is: there is a “possible world” in which this can happen?

There are two sorts of objections to this scenario:

I. “The inhabitants of [this] imaginary world could not really have good reasons for believing that no changes whatever occur in a region during an ostensible local freeze in that region.” (371)

II. While admitting the possibility of local freezes, one questions the legitimacy of extrapolating from local to global freezes.

Type I arguments “have limited force even if correct.” (371) They are verificationist [Verificationism is the appealing but difficult to articulate view that the meaning of a proposition is its mode of verification, the ways of determining whether it is true or false. A proposition that cannot be verified or falsified is supposed to be meaningless.] and are “no more plausible than the argument from the fact (if it is one) that it is impossible to verify that two things are exactly equal in length to the conclusion that any two things necessarily differ in length." (372)

One type II argument involves an alternative hypothesis that the global freezes are skipped. This makes, according to SS, for a less simple hypothesis and so the simpler one (of global freezes) should be preferred. [This, in my view, is weak, since simplicity is not well understood and there are no grounds for supposing that nature is simple rather than complex.]

Note that it looks as if *only* simplicity, or some other such alleged methodological principle, can decide between the global freeze hypothesis and its alternative. There is no direct observation or measurement that can be made that can decide the issue. But the fact that there are alternative possible hypotheses, it seems to me, does not detract from the fact that the global freeze hypothesis <u>is</u> a hypothesis, and that's all that's needed to defend its conceptual possibility.

It is possible to modify the example in ways that make it look as if denying universal freezes is *ad hoc*. (374-5)

But *if* there are global freezes, the following fascinating question arises: How could a global freeze end? Suppose, for the sake of argument, that time is discrete. That moments of time follow one another the way the integers or natural numbers do. Then "it is clear that the cause of the change that ends a total freeze cannot be, and cannot be part of, the state of the world in the immediately preceding instant." (376)

The state of the world at one instant during a global freeze, after all, is *exactly* like the one before it--on the assumption we're making that time lapses with <u>no change whatsoever</u>. In fact, the state of the world at the end of the freeze is by this hypothesis exactly like its state at the beginning of the freeze. So <u>if</u> the last state could cause the freeze to end, so could the freeze's first state, and there would be no freeze at all.

This argument raises the further question: could it be that the cause of the change that ends a total freeze is not "in the immediately preceding instant" but exists earlier in time and exerts its causal "power" either across or through the frozen interval. Can there be causation across (or through) a temporal gap? [One might keep in mind a parallel question: Can there be causation across a spatial gap, a kind of causation that is called "action at a distance"?]

Now suppose (as is done in classical or non-quantum physics) that time is dense or continuous (like the fractions or real numbers). In a continuum, there is always a third element between any two distinct elements. One cannot speak so simply of the immediate successor or predecessor of a given state. In fact, freezes can come in four kinds, though SS does not spell this out:

1. A freeze has both a first and last moment. In this case, we can indicate a freeze this way: $[t_0, t_1]$. In this case, the freeze begins at t_0 and ends at t_1, but there is no last unfrozen moment before t_0 and no first unfrozen moment after t_1. We can say that such an interval is *closed* at each end and is itself a closed set.

2. A freeze has no first or last moment, but there is a last unfrozen moment before the freeze and a first unfrozen moment after the freeze. We can write this as (t_0, t_1), and we can say that the freeze is *open* at each end and that the set of instants (t_0, t_1) is an open set.

3 and 4. We obviously can have the two possible mixed cases as well: $(t_0, t_1]$ and $[t_0, t_1)$.

SS then argues (in the case that time is dense) from temporal locality—as stated in principle (P) just below--to the nonexistence of freezes in a way the mimics the argument in the discrete case but is inevitably a bit more complicated. (See p. 376)

Consider the following principle, P?

> **(P)** If an event occurs at time t and is caused, then, for any interval i, no matter how short, that begins at some time prior to t and includes all the instants between that time and t, the sequence of world states that exist during i contains a sufficient cause of E. (377)

Let's restate (P) our own way. Suppose that t_0 is a time (<u>any</u> time) prior to some time t at which a caused event E occurs. Let interval i be the interval $[t_0,t)$, which begins at t_0 and contains t_0 and all instants *between* t_0 and t. Then this sequence of world states i contains (is, constitutes) a sufficient cause of E.

Let t_0 be earlier than t by one second. Then all the world states in the interval $[t_0,t)$ contain a sufficient cause for the event E. But the initial one second interval $[t_i,t_f)$ of a freeze must be exactly like the interval $[t_0,t)$, and so E must occur immediately at t_f, rather than at t. The freeze cannot last more than one second.

But in fact we can make the interval i as short as we please, since we are allowed to choose any time at all as t_0 just as long as it is prior to t. It then follows that freezes cannot have any finite duration. Not matter how short a time you suppose that a freeze last, I can choose t_0 to be half that time prior to t and run the argument I just gave above. The upshit is that the occurrence of freezes as described in Shoemaker's example conflicts with principle P (and principle P is at least one way of expressing the temporal contiguity of causes and effects).

Should we, then, just accept the plausible principle P and give up the idea of freezes (and so give up on the Shoemaker's thesis that there can be time without change)?

Can we keep his thesis and give up principle (P)? That seems difficult. Abandoning principle (P) seems to permit causal action across a temporal gap. SS writes:

> I think that we are in fact unwilling to accept the existence of this sort of causality in our dealings with the actual world. If we found that a flash is always followed, after an interval of ten minutes, by a bang, we would never be willing to say that the flashes were the immediate causes of the bangs; we would look for some kind of spatiotemporally continuous causal chain

> connecting flashes and bangs, and would not be content until we had found one. And if we found that things always explode after having been red for an hour, we would never suppose that what causes the explosion is simply the thing's having been red for an hour… (377)

At this point SS makes some subtle distinctions. There are two kinds of ways to violate (P), he says.

The first is indeed causation across a temporal gap or, in Shoemaker's phrase, "delayed action" causality:

> X's happening at t is causally sufficient for Y's happening at a subsequent time t', but t and t' are separated by an interval during which nothing happens that is sufficient for the occurrence of Y at t'. (377-8)

"I think it is commonly believed that this sort of causality is logically impossible, and I am inclined to believe this myself." (378)

But SS claims that there is a second and more acceptable way in which principle (P) can be violated. All we need to assume, he says, is the weaker following possibility:

> X's happening at t is a necessary but not a sufficient part of an actually obtaining sufficient condition for Y's happening at t', and t and t' are separated by an interval during which nothing happens that is sufficient for Y's happening at t'. (378)

In this sort of violation of principle (P) causes may be temporally contiguous with their effects. X's happening at t is necessary for Y's happening at t', but it's the occurrence of the whole interval [t, t') that is a causally sufficient condition for the occurrence of Y at t'. There is no gap between [t, t') and t'.

But we must also note that, in fact, *nothing whatsoever* happens in the interval [t, t')–between, say, the beginning of a global freeze and its end. So clearly nothing could happen in that interval which would complete the set of conditions necessary for Y and make them sufficient for Y aside from the passage of time itself. It is just the passage of time itself that completes the set of conditions, in this case.

If that is so, then the passage of time itself <u>does</u> make a difference. The set of world states in any subinterval [t,t*), where t* is later than or equal to t but earlier than t', is not a sufficient condition for Y to occur but the whole set of world states in the interval [t, t') is sufficient. Something has changed when all the times in the interval have occurred, and it has changed merely as a result of (the passing or lapsing of) time.

Shoemaker evidently thinks (bottom of page 378) that he has described a possible world (one in which causation is not required to leap a temporal gap) in which there can be time without change. But the conditions needed to make this claim plausible seem to require that the passage of time itself be or produce a kind of change. It's not the straightforward qualitative change of a leaf's going from green to red. It's a temporal interval changing from merely being necessary to being causally sufficient when it achieves a certain heft (duration, that is), but I submit that this is a kind of change that it would be question-begging to rule out as a relevant kind of change.

Judging from footnote 10, Ruth Barcan Marcus raised a similar objection. Shoemaker seems to believe that he has answered it, but I believe that he has not.

A few final points. Could it be that freezes end spontaneously--that there is *no* cause for the resumption of change after some time T? This possibility avoids all the problems raised above, but Shoemaker thinks it cannot be.

> If that were so, it would apparently have to be sheer coincidence that observed freezes always last exactly one year,… and it is illegitimate to extrapolate from an observed uniformity that one admits to be coincidental. (375-6)

But the radioactive decay of a given element has a particular half-life, T, and this radioactive decay seems to be both uncaused and regular. That is, we can accurately extrapolate (predict) exactly how a sample will decay in a time period T.[1] On the other hand, the regularity of radioactive decay is (even in a "small" sample of a radioactive substance) a large-scale statistical regularity smoothing out the unpredictable intervals of decays of individual atoms. Nothing remotely like this seems to be relevant to the end of freezes, leaving us still with the initial

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[1] Which seems to run contrary to SS's assertion that "it is illegitimate to extrapolate from an observed uniformity that one admits to be coincidental." (375-6)

question: what causes them?

Second, suppose that freezes are marked by closed time intervals—that is, that a freeze starts at t_i and ends at t_f. That is, a freeze looks like $[t_i, t_f]$. Then in the period of the thaw after the freeze, (t_f, t_∞), every changing state has a changing predecessor within an arbitrarily small time interval. It seems as if there is no problem as to what causes the first changing state after the freeze, since there is no first changing state in the thaw.

But this idea looks at most as if it answers to the letter rather than the spirit of preserving contiguity. And it seems to leave one with the difficult question of what ends the freeze at t_f, since there is a last changeless state in the freeze. This last state is exactly like every state of the world that preceded it during the freeze.

Finally, in his explanation of the basic notions of mechanics Newton famously distinguished relative time(s) from absolute time. The latter, he said, "of itself and from its own nature, flows equably without anything external, and by another name is called 'duration'." Newton thought it possible for there to be absolute time in an empty universe, a kind of time without change. I think we have to concede that this is indeed a conceptual possibility.

In the same vein, John Earman has pointed out that there are solutions to the Einstein field equations that are empty spacetimes. Assuming that what is nomically possible is also conceptually possible, this too is conceptually possible time without change. It's not clear to me, however, that pointing to these two examples of time without change from physics settles the question that Shoemaker had in mind.

In a note called “Change and Time” which appeared in J. Phil., George Schlesinger made (amongst others) the following point. Newton had an opponent, Leibniz, who argued that space and time are not things that exist independently of objects but are orders of co-existence and succession of objects. This view is called *relationism*. If relationism is a necessary truth, then time without change, without events happening, is not a conceptual possibility, since events happening <u>is</u> the passage of time (on the relationist view).

While it is quite fashionable these days to maintain that philosophical positions, if true, are necessarily true, the arguments that Newton used to support his view (the rotating bucket of water and the pair of connected globes) have a disquietingly *a posteriori* quality.

Addendum: It is worth noting an interesting issue that is entangled with the one considered above. It is a feature of our reasoning that seems deep but it not often remarked that a past cause cannot act on the future except via its effects in the present. Put more generally, the idea is that in the causal evolution of a system from state X at t to state Y at t', whatever effect X has on Y is had by the state of the system at any intermediate time t* between t and t'.

This idea is called the <u>Markov</u> condition.

- I think (but I’m not sure) that Shoemaker’s condition (P) requires that the Markov condition hold for causation.

- Discontinuous time travel violates the Markov condition.
- Therefore, David Lewis’s theory of causation must not be be bound by the Markov condition.