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Lee Smolin

TIME REBORN

From the crisis of physics to the future of the universe

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In 1908 the Cambridge idealist J.M. McTaggart put forward a simple argument against the reality of time. For time to pass, McTaggart contended, any given event must successively be future, present and past. For example, my death lies in the future, yet sadly it is fated to become present, and in due course it will fade away into the past. However, *future*, *present* and *past* are incompatible properties, insisted McTaggart. So time cannot exist. Now, of course this is a very silly argument. There is no doubt that time is real. But, as with many other silly arguments, it has proved very fruitful trying to figure out exactly where the fault lies. Indeed modern philosophy of time is defined by a disagreement about exactly where McTaggart went wrong.

On one side stand the ‘detensers’, led by McTaggart’s colleague Bertrand Russell (or at least he was a colleague until McTaggart orchestrated his dismissal from Trinity College for his pacificism). In Russell’s view, tensed properties like *past*, *present* and *future* are not real properties of events at all, just as *north*, *here* and *south* are not real properties of places. They are simply terms that we use describe our relationship to the events or places in question. So there is no contradiction in my death being past, present and future relative to different times, any more than there is in my home being north, here and south relative to different places.

From Russell’s point of view, no substantial passage of events from the future to the past is involved in the change and corruption we observe around us. Change is nothing more than things having different properties at different times. In 1947 I am a little baby, and in 2013 I am tall man. We can account for my growth in this manner without making any reference to the past or the future. And, more generally, Russellian detensers hold that there is nothing more to reality than would be specified by a great big spatiotemporal map that details exactly what happens in every place, from the beginning of time to the end.

The opposition to Russell are the ‘tensers’, led by another of McTaggart’s Cambridge colleagues, C.D. Broad. The tensers think that the ‘block universe’ described by the Russellian mega-map leaves out a crucial feature of reality—which time is *now*. For the tensers, nothing could be more real than the difference between past, present and future. While the past is fixed, the future remains open, and the present marks the interface between them. The Broadian tensers thus agree with McTaggart that the passage of time requires events to shift substantially from the future into the past. However, they deny McTaggart’s further claim that this involves a contradiction. Of course, they allow, it would be incoherent for some event, like my death, to be *simultaneously* past, present and future. But there is nothing contradictory, urge the tensers, in my death being future when 2013 is *now*, becoming present when some hopefully distant year gets to be *now*, and dwindling into the past as yet subsequent years acquire this distinction.

Since these issues were first explored, the majority of philosophers and scientists have tended to side with Russell against Broad. The problem is not that the tensed view is inconsistent, in the way that McTaggart claimed. With some ingenuity, it is possible to construct a consistent story in which past, present and future are substantial properties that times possess in turn. The real trouble with this tensed story is that it seems to multiply complexity beyond necessity. You can consistently posit

a substantial *now* that highlights the present and casts the future and past into shadow, if you really want to. The only question is whether it does you any good.

It is not in dispute that time displays many puzzling features. Why does time have a preferred direction, always pointing from the past to the future? (After all, space doesn't similarly point in any particular direction.) And why does it seem to us as if we are travelling in that direction from our births to our deaths, carried effortlessly along by the progress of *now*? However the Russellians point out that these things can all be explained in scientific terms, without any appeal to a moving now. For instance, time has a direction because causes always lie on the same temporal side of their effects; we experience ourselves as moving through time because our causally constructed memories are more comprehensive at later times than earlier ones; and so on. What is more, the Russellians observe, their Broadian opponents will be hard-pressed to reject these explanations, on pain of finding themselves at variance with orthodox science. So the Broadians seem to be left without any evidence for adding a moving now to the scientific framework. Their theory may fit untutored intuition, but so did the theory that the earth is at the centre of the universe.

Nor do the scientific objections to Broadian tenses stop there. Modern relativity theory has placed a number of more specific obstacles in the way of a tensed metaphysics. For a start, special relativity intertwines space and time in a way that undermines the very idea of any absolute *now* that is the same for all observers across the universe. General relativity makes things even worse by allowing the possibility of your traveling along a 'timelike loop' to a point where you meet your younger self. (Should that point then count as in the future or the past?) And, to cap it all, the best current attempts to reconcile quantum mechanics with gravitational theory seem to eliminate time as a dimension altogether, leaving us with nothing even recognizable as normal change. In one way and another, modern physics seems determined to make life difficult for the friends of tensed properties.

Lee Smolin is a prominent theoretical physicist, and as such might be expected to side with the Russellians defenders against the Broadians. But his new book for the general reader, *Time Reborn*, is an emphatic polemic in favour of reintroducing a moving now to physical theory. Smolin's agenda is highly ambitious. He aims not only to show that a moving now can be made coherent even in the face of modern physics, but that modern physics positively needs such a *now*. Smolin refers to Einstein as hankering for 'something essential about the Now which is just outside the realm of science'. From Smolin's perspective, Einstein didn't have the courage of his convictions. He shouldn't have been looking for a moving now outside the realm of science, but rather have shown that we can't do without it inside science.

In the end, however, Smolin delivers far less than he promises. He does offer reasons for thinking that modern physics may be less hostile to many familiar features of time than it initially seems. But, despite his frequent protestations, none of these amounts to an argument for adding a moving now to reality, as opposed to simply preserving the familiar Russellian block universe.

One of Smolin's central theses relates to the explanation of basic physical laws. He worries that if these laws are timelessly true, applying in all places and times, then we will be unable to explain why they take the form they do. So he offers a theory on which these basic laws evolve. According to Smolin's model of 'cosmic natural selection', universes reproduce themselves, with small variations in their physical laws, whenever they form black holes. So just as Darwinian natural selection favours biological traits that help organisms to have offspring, cosmic natural selection will favour universes with physical laws that help them to form black holes.

As will be familiar to readers of Smolin's earlier *The Life of the Cosmos* (1997), this ingenious theory has a number of virtues, not least that it promises to explain why the laws in our universe are so friendly to human life, without any appeal to the presumed beneficence of some deity. But what this theory does not do is add to the case for a tensed metaphysics. Smolin's thought is that, once we turn away from timeless laws to laws that evolve, then we must have a time for them to evolve in. However, even if we put to one side quibbles about the timelessness of the laws that govern cosmic evolution itself, this is no argument for a Broadian as opposed to a Russellian time. After all, Russellians don't deny change, they just model it as involving nothing more than different things at different times. So Smolin's cosmic evolution poses no more of a problem for Russellians than ordinary biological evolution, or indeed my personal evolution from a baby to a grown man.

This problem runs through the book. Smolin ranges through many of the branches of modern physics, including quantum theory, cosmology and thermodynamics, and repeatedly argues, often against theoretical orthodoxy, that modern physics should be reconfigured so as to give us back the kind of time we thought we enjoyed before the advent of relativity theory. But it would be a yet further step to add a moving now to this time, and Smolin never gives us any reason to take it. In a way this is unsurprising. A serious argument for an extra Broadian *now* would require it to play some role that transcends any current understanding of scientific phenomena, and even Smolin's fertile mind does not offer any model for how this might work.

Perhaps it is unreasonable to break this book on the wheel of philosophical nicety. Although Smolin repeatedly uses the language of philosophical debate, it is not clear that he is really exercised by or even familiar with basic philosophical issues. Rather the talk of time serves as a peg on which to hang a series of chapters exploring different ways in which time matters to physics. Smolin adheres rigorously to the dictum that even the simplest equation will frighten the readers. But within this constraint he does as good a job as is possible of explaining how modern physics has rendered time problematic, and he adds a range of lively speculations about possible future directions for physical theory.