Relativistic Challenges to Presentism

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Presentism is the metaphysical view that "only presently existing things exist" (Hinchliff, 2000, p.S576). This view is really only coherent if we assume that space and time are Newtonian in character. As soon as we adopt Einstein's Theory of Special Relativity and move to a relativistic spacetime, presentism faces some serious challenges. In this paper, I will briefly outline the special theory and its important consequence for presentist metaphysics. From there, I will address some of the specific problems that this consequence creates for presentism, as well as some of the proposed solutions to these problems. Ultimately, though, I believe it will be impossible for us to coherently adopt both the physical theory of special relativity and the metaphysical theory of presentism; and of these two, I believe that it is presentism that we should give up.

1 The Special Theory of Relativity

Einstein's Special Theory of Relativity rests on two postulates. These are:

Principle of Relativity Physical laws are the same in all inertial reference frames.

Constancy of the Speed of Light The speed of light in a vacuum is a constant[1] in all inertial reference frames.

People often think of Einstein's theory as completely overturning Newtonian mechanics. Not only is this not the case, it turns out that Newton himself noted (a form of) the principle of relativity: "The motions of bodies included in a space are the same among themselves, whether that space is at rest or moves uniformly forward in a straight line" (Feynman, 1997, p.50). And

[1] $c \approx 3.0 \times 10^8$ m/s

indeed, this principle can be traced back even further to the works of Galileo (Einstien, 1961). So the important addition of Einstein's theory is not the principle of relativity, but the principle of the constancy of the speed of light.

1.1 Consequences

While the special theory of relativity itself is only a minor change to Newtonian physics, it has some far-reaching consequences. One of the most important, at least from the perspective of philosophers working on theories of time, is that space and time can no longer be thought of as separate entities. This is in stark contrast to the Newtonian "stage" way of thinking of the physical geometry of the universe. There, space and time are separate, but here, in a relativistic setting, they are inextricably linked. For instance, what is measured as space from one observer's perspective may be measured as time from a different observer's perspective.

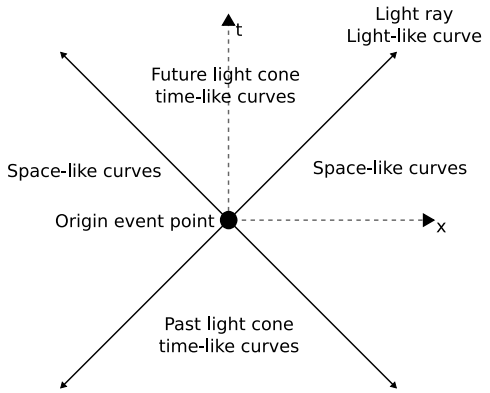
Though this result is startling, it will not directly concern us here. Instead, the result that is the most troubling to presentism is that there is no longer a relation of absolute simultaneity. Whether two events are simultaneous depends on one's choice of inertial reference frame. So any presentist theory will have to either give up simultaneity as the definition of the present, or else will have to account for the relative nature of the present. We shall examine a number of attempts to reconcile presentism with special relativity. Ultimately, though, I believe that all of these attempts fail, either because they are open to independent objections, or they move too far afield from the basic presentist intuition: the intuition that there is a universal present moment that is special in some way.

But first, we should examine some of the notions of the physical geometry of relativistic spacetime. This four-dimensional mathematical space is known as a Minkowski space, named for Hermann Minkowski, the mathematician who gave the first formal treatment of spacetime following Einstein's work on special relativity. By plotting the path of rays of light to and from a single spacetime point[2], we can divide the areas surrounding that point into three distinct regions. These

[2]In the mathematics dealing with Minkowski spacetime, these four-dimensional points are referred to simply as "events". I will be avoiding this usage, since it is easily confused with philosophers' usage of "event", which can often refer to a spatiotemporally extended thing. When speaking specifically of the four-dimensional spacetime points, I will call them "points" or "event points".

three regions are the time-like region, the space-like region, and the light-like region. The light-like region forms the boundary between the space-like and time-like regions.

Figure 1: Regions of spacetime around a given event point



We can also separate the time-like region (and the light-like region, along with it) into two pieces. These are often called the affective past and the affective future. A particle starting at any point in the affective past can, by traveling at some velocity less than the speed of light, reach the origin point. Likewise, a particle starting at the origin point can reach any point in the affective future by traveling at some velocity less than the speed of light. Thus, things in the affective past can cause things at the origin point, and likewise, things at the origin point can cause things in the effective future.

Of course, there are some particles than can travel at the speed of light; namely, photons. This brings us to the second region, the light-like region. This region contains all the points that can reach or be reached from the origin by particles traveling at the speed of light (i.e., light rays). As mentioned above, this region forms the boundary between the time-like and the space-like regions. It also lends another common name to the affective past and future: past- and future-directed light cones.

So, events in the past light cone can cause things at the origin point, and things at the origin point can cause events in its future light cone. However, points in the space-like regions cannot affect or be affected by the origin point. That is, there is no known particle that can travel fast

enough from one of these points to the origin, or from the origin to one of these points[3].

1.2 Simultaneity

One way of thinking about the present on this picture is to consider the present to be every point that shares a time coordinate with a given point. Call this the plane of simultaneity with respect to that point. Certainly this is how the present is defined in pre-relativistic Newtonian space-time. More importantly for the purposes of this paper, it is the notion of the present that lies behind the metaphysical theory of presentism.

Consider two observers, one of whom is stationary and one of whom is moving at a constant velocity along the x-axis. Each of these observers is at the origin of their own coordinate system, but to talk about the relations between these two observers, we need to translate values in one observer's coordinate system to the other's coordinate system.

In a pre-relativistic setting, the only value that we need to worry about translating is the x value, the direction of motion. The other two spatial axes, and most importantly for the current discussion, the temporal axis, are the same for both observers. And since both observers have the same temporal axis, they will be in complete agreement about which events are simultaneous, since while they may disagree about the x-coordinate for an event, they will agree about its t-coordinate.

However, when we move to a relativistic setting, what we notice is that this plane of simultaneity is not shared between observers in two reference frames. When translating[4] the coordinate system of a moving frame to the coordinate system of a stationary frame, what happens is that the space and time axes of the the moving frame get "compressed" with respect to the space and time axes of the stationary frame, while the speed of light remains a constant[5].

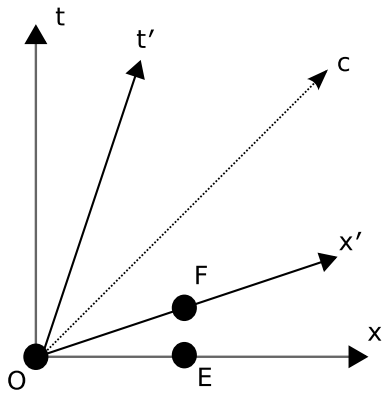
Since the moving frame's x-axis (here labeled as x') is no longer identical with the stationary frame's x-axis (here labeled as x), that means that there will be events that an observer in the moving frame will report as simultaneous, but will not be simultaneous for the stationary observer.

[3] I'm ignoring for the purposes of this paper the tachyon, which is a theoretical particle that must travel faster than the speed of light. To the best of my knowledge, though, these particles remain purely speculative at this point.

[4] By means of a Lorentz transformation.

[5] It is common practice to normalize the units for Minkowski diagrams so that the speed of light is equal to 1, thus giving light-like curves a 45° slope. I am also, of course, ignoring two of the three spatial dimensions.

Figure 2: Minkowski diagram of two overlaid coordinate systems



For example, in Figure 2, events O and E will be simultaneous for the stationary observer but not for the moving observer, and events O and F will be simultaneous for the moving observer but not the stationary observer.

It is tempting to say that all that needs to be done is to determine which inertial frame is actually at rest, and then use that frame's plane of simultaneity as the measure of simultaneity in all frames. That is, to determine if two events are actually simultaneous, all we would have to do is translate the frame we observed them in into this hypothesized "absolute rest frame". If the two events in question lie along the absolute rest frame's plane of simultaneity, then they are simultaneous; if not, they aren't, end of story.

It is an unfortunate fact[6] that, according to the special theory of relativity, there *is no* absolute rest frame. As we shall see, however, defenders of presentism such as Prior (1996) and Markosian (2004) take issue with the philosophical conclusions that are drawn from this. In particular, they argue for there being a gap between what we can determine and the way the world actually is.

2 Putnam and the Plane of Simultaneity

Putnam (1967) argues against presentism by showing that using simultaneity to define the present is an untenable notion within the framework of special relativity. In his paper, Putnam puts forward

[6]Unfortunate for presentists, that is. I don't think eternalists need to worry just yet.

two requirements for the relation R, which he sees as roughly the relation of "present-for". These requirements are:

1. R must be transitive (Putnam, 1967, p.242; this is a simplification of the "No Privileged Observers" thesis given on p.241)

2. "R must be restricted to physical relations that are supposed to be independent of the choice of a coordinate system" (Putnam, 1967, p.241)

Of course, in a pre-relativistic setting, simultaneity fits both of these requirements perfectly. However, when we adopt a relativistic framework, simultaneity ceases to satisfy either (1) or (2). It is easiest to see how simultaneity violates (2), the invariance requirement, by examining the Minkowski diagram that overlays two coordinate systems that are moving relative to one another (see Figure 2 above). The coordinate axes come apart, and in particular we should notice that the x and x' axes, which define the planes of simultaneity for the observers at their respective origin points, are no longer the same.

One place where Putnam is inexact in his argument is where he addresses the concern that under special relativity, "there are events which lie in the 'future' according to *my* coordinate system and which lie in the 'present' of you-now according to *your* coordinate system" (Putnam, 1967, p.242). The problem with stating this worry in this way is that it is inexact in its usage of the terms "future" and "events".

Although two observers moving at a relative velocity with respect to one another will have different planes of simultaneity, at the moment they are coincident, they will share an affective past and future. Remember that the affective past and future for a given spacetime event-point is defined by the light-cones for that point. And by the principle of the constancy of the speed of light, these light-cones *are* independent of the choice of inertial frame. If what Putnam means in (2) by "independent of the choice of coordinate system" can be read as "independent of the choice of inertial frame", then it turns out that the light-cones may be a candidate relation for the R (i.e. "present-for") relation. And in fact, we will see that Hinchliff (2000) does make use of this when defining what he calls "cone presentism".

But to return to Putnam: It is technically incorrect to say that an event F that is on your plane of simultaneity but not mine is "in my future"[7]. It is outside of my *affective* future; that is, I cannot bear any causal relation to F. But since F is also outside of my affective past, F cannot cause anything where I am now. F is on a space-like curve with respect to my position, and is thus causally inert with respect to me now.

This brings up an interesting fact regarding the plane of simultaneity. Since all the points on event's plane of simultaneity are space-like separated from it, that event can neither cause nor be caused by anything simultaneous with it. So, two simultaneous events cannot cause or be caused by one another, though they of course can share a single cause somewhere in a shared past.

Putnam's solution is to give up presentism. In fact, his ultimate conclusion is much stronger than just giving up one particular philosophical, metaphysical theory of time. "I do not believe that there are any longer any *philosophical* problems about Time; there is only the physical problem of determining the exact geometry of the four-dimensional continuum that we inhabit" (Putnam, 1967, p.247).

Of course, there are those who disagree with this dismissal of the relevance of the philosophy of time. In the next section, I will examine several ways in which Hinchliff (2000) attempts to make some room for the metaphysics of presentism within the physical framework of four-dimensional spacetime. Although he provides responses to some of the challenges facing these proposals, I believe that problems remain for each proposal.

3 Hinchliff's solutions

Hinchliff (2000) presents three ways of integrating presentism with the special theory of relativity. Two of these involve redefining the concept of the present in order to fit presentism to special relativity, while the third retains the classical definition of the present and instead proposes an alternate theory to special relativity that is amenable to presentism.

[7] Assuming we are coincident, that is.

3.1 Point presentism

Hinchliff's first redefinition of the present is to restrict the present to simply the single point of "here-now". He calls this version of presentism "point presentism". Hinchliff quickly dismisses the objection that this view makes the present "lonely". While he admits some sympathy to that position, he notes that all that this objection accomplishes is to restate the view, and it should not really count as a full objection.

A second objection that Hinchliff raises is one he attributes to Putnam (1967). At the heart of this objection is the intuition that for something to be in the past, it must first pass through the present. But for point presentism, there is a way for things to appear in the past without ever being in the present. Let E be a point that is space-like separated from the here-now O (see Figure 3). Under point presentism, E is not in the present. Now extend the world-line from O to some point O' such that E is contained in the past light cone of O'. Now E is in the past with respect to O', but as long as the world-line from O to O' does not contain E, E was never in the present for the observer represented by that world-line.

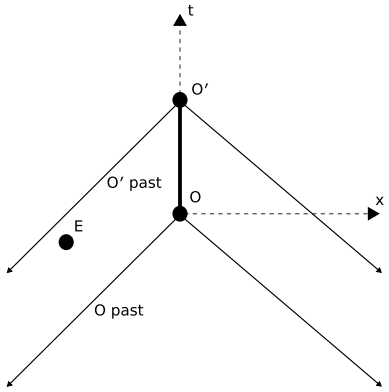


Figure 3: "Past but never present"

Notice that a view that equates the present with the plane of simultaneity with the here-now is not open to this objection, since any point will have to first pass through the plane of simultaneity (and thus be present) before it appears in the past (i.e., in the past light cone). This appears to be because in the plane-of-simultaneity version of presentism, the present is spatially extended,

whereas in point presentism, the present is not spatially extended. On this count, I think intuition[8] favors the plane-of-simultaneity version of presentism, since we tend to think of the present as the now that is everywhere, and not just the here-now.

Hinchliff has little interest in defending point presentism, especially since he claims that no actual presentists hold this view. Hinchliff himself is more concerned with explaining cone presentism, his second attempt to fit presentism into a relativistic setting. He thinks that this view fares much better than point presentism. I admit that there is some intuitive appeal to cone presentism, but I am skeptical whether it is enough to preserve presentism in the face of a relativistic conception of spacetime.

3.2 Cone presentism

Cone presentism includes both the point of here-now and every point on the surface of that point's past light cone. In other words, any point that is light-like separated from the here-now in one direction is in the present. (Points that are time-like separated form the here-now—the "body" of the past light cone—are still regarded as being in the past.)

Hinchliff notes several objections to cone presentism, the first three of which he attributes to Savitt (2000). The first objection is that by declaring that the surface of the past light cone is the present, cone presentism is claiming that some past events are present. The objection uses the example of the cosmic microwave background radiation. Astronomers are currently observing this radiation, which is just a form of light. So by cone presentism, what the astronomers are observing is something that is happening in the present. But in the same breath, the objection goes, these astronomers are talking about the cosmic microwave background radiation occurring 15 billion years ago. Surely both of these cannot be correct.

That is indeed the case, but Hinchliff rightly observes that such an objection is actually conflating two horns of a dilemma. If one clearly articulates the dilemma, then it becomes evident that there is in fact no problem for presentism. If we accept that there is some absolute metric by which

[8] Of course, we must remember that intuition is *not* a reliable guide to what the actual physical nature of the world is. For an even more startling reminder of this, consider the "bizarre" quantum effects such as tunneling that go on at a microscopic scale.

we can claim that the cosmic microwave background radiation originated 15 billion years ago, then we obviously have some metric by which we can establish invariant temporal intervals. From this, we will be able to define a notion of absolute simultaneity. And with this relation, we can revert to being classical, pre-relativistic presentists.

On the other hand, if we accept that there is no such relation of absolute simultaneity, then we will be unable to come up with an absolute metric for the measuring of absolute time. So in this case, it is an illegitimate comparison to claim that what cone presentism says is in the present is actually in the past; there is no independent determinant of age or past-ness. So this form of the objection turns out to not be a good argument against cone presentism.

There is something deeper at work here, too. If we take relativity seriously, then we have to accept that *anything* we see is "in the past", in the sense that it took a non-zero interval of time for the light from that event to reach our eyes[9]. In the case of our everyday experience, we ignore this, and we commonly think of everything we see as being in the present. In other words, we are actually cone presentists (at least in regards to the way we define the present) in our everyday lives. It is only when we turn our gaze to the heavens that we start to factor in the fact that light takes some time to cover a finite distance. It is in this context that we feel uneasy about cone presentism[10].

The second objection to cone presentism claims that the choice of the past-directed light cone is (at least somewhat) arbitrary. After all, there is another light cone, the future-directed one, so why exclude points on the surface of that light cone from the present? After all, the spacetime interval[11] for a point on the future-directed light cone is the same as the one for a point on the past-directed light cone: they are both zero.

Hinchliff is correct when he responds that there is a principled reason to distinguish the past- and future-directed light cones. However, I believe he gets the reason wrong. Hinchliff claims that since there is something directed about the nature of light itself, there is a direction to the light

[9]Hence Feynman's comment that "there is actually no fortune teller who can even tell us the *present*!" (Feynman, 1997, p.101).

[10]Which explains, I think, why the example used in the objection has to do with a distant astronomical event.

[11]Spacetime intervals are the invariant "distance" metric between points in spacetime; in many respects, they are the replacements of temporal intervals in non-relativistic settings.

cones. A better explanation for there being a difference between past and future lies in the fact that while at the very small scale, physical processes are symmetric with respect to time, at a large scale, there are physical processes that are *asymmetric* with respect to time (Feynman, 1997, pp.28-29). This gives us a principled way of defining a past and future, on which we can then base our definitions of which light cone is past-directed and which one is future-directed.

I admit that there is still something troubling about this. What we have here is a notion of the present that is defined not purely in terms of spatiotemporal interval, but must take into account facts from a quite different branch of physics (namely, thermodynamics). Even if we grant that when moving to working in a relativistic framework, we are no longer dealing with time by itself, but unified spacetime, it is important to note that to successfully restrict cone presentism in the way Hinchliff wants to, we cannot make a simple translation from "temporal interval of zero" to "spatiotemporal interval of zero". We need the above mentioned facts about irreversible macroscopic physical processes to actually accomplish the intended restriction. This by itself is not a grievous charge, though. However, it is one more way in which cone presentism differs from classical presentism. As such, it may also be one more reason for abandoning the presentist framework altogether in the face of relativistic concerns.

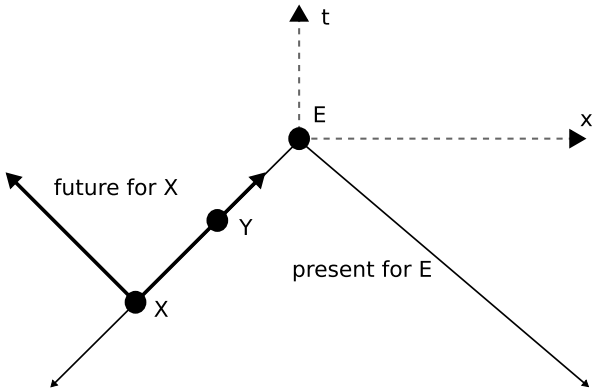


Figure 4: Achronality

The third objection to cone presentism that Hinchliff addresses is what he and Savitt term *achronality*. This is the principle that "if two events, X and Y, are present for E, then neither should be in the absolute past or future of the other" (Hinchliff, 2000, p.S582). But under cone

presentism, all events on the past light cone of E are part of the present for E. So it would be possible to place two events X and Y at different points along the past light cone of E such that they have different t coordinates, and thus (from E's point of view, at the very least) cause Y to actually be in X's future, while they are both in E's present.

There is a further objection to cone presentism that I would like to raise. While cone presentism succeeds in providing us with an invariant notion of the present for observers in different inertial frames, it is only invariant as long as the two observers are at the same spatial location. Two observers who are at different spatial locations, even if they share an inertial reference frame, will not have identical light cones (see Figure 5). And thus, by cone presentism, they will have different presents, even though they may lie along the plane of simultaneity for that reference frame.

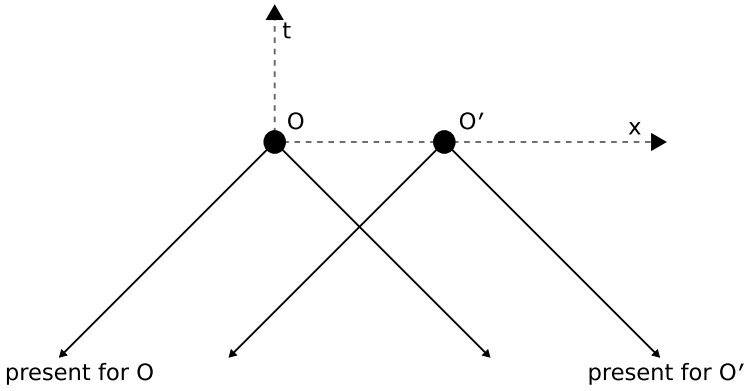


Figure 5: Different presents (under cone presentism) in the same reference frame

This highlights a choice that we must make when it comes to defining the present in a relativistic spacetime. If we maintain that being simultaneous with the here-now is what defines the present, then we must accept that coincident observers traveling at different velocities will have different presents. If on the other hand, we want to ensure that all coincident observers, regardless of their relative velocities, share a present, then we are forced to the conclusion that non-coincident observers traveling at the same velocity have different presents by virtue of their spatial separation.

Both point and cone presentism redefine the present in a way that is still ultimately unsatisfactory for the purposes of presentism. Presentism is a metaphysical theory that makes claims

about what things exist. And existence certainly seems like the sort of property that we absolutely do not want to relativize. Yet under cone presentism, the property of *being present for* (and, by extension, the property of *existing for*) becomes both asymmetric and non-transitive. That is, even if y is present for x, there is no *a priori* guarantee that x is present for y. And likewise, even if y is present for x, and z is present for y, there is no guarantee that z is present for x.

Hinchliff is prepared to accept these consequences of his redefinition, stating "that henceforth presentism will no longer be a view [...] about time but about spacetime" (Hinchliff, 2000, p.S583). This statement echoes a similar statement made by Hermann Minkowski about the unification of space and time within the special theory of relativity. Hinchliff's point is that we should not find it surprising that we will have to adjust our philosophical theories in light of new physical theories. Since the special theory did away with time as a truly independent entity, we should adjust our metaphysical theories that formerly dealt with time to the next closest thing: spacetime. However, in saying this, Hinchliff is oddly silent about the problem of relativized existence, which is the position that accepting the presentism part of cone presentism forces us into.

While in general I agree that it is a good idea to guide our philosophical thinking by the best empirical science we have available, I think in this case the philosophical theory is one not much worth salvaging.

3.3 Surface Presentism

Unlike the previous two revisions of presentism discussed above, the third reconciliation of presentism and special relativity that Hinchliff considers preserves classical presentism and proposes revisions to the theory of relativity. Hinchliff calls this view surface presentism.

The argument for this view appears to turn on a rejection of verificationist principles. Proponents of surface presentism—and Hinchliff counts Prior among these—may accept that according to the special theory of relativity, we can never determine which inertial frame is at absolute rest. But, they say, it does not follow directly from this that there *is no* absolute rest frame. Perhaps there is one, but it is permanently hidden from the view of science exactly which one it is.

Markosian (2004) presents a similar view with an eye to integrating presentism and relativity.

His stance on the issue, however, is somewhat stronger than Hinchliff's, since Markosian accuses scientists of loading the special theory of relativity with unwarranted "philosophical baggage". Markosian envisions two version of the special theory of relativity, which he terms STR^+ and STR^-. The former contains the aforementioned philosophical baggage (I can only assume he means some sort of verificationist principle), whereas the latter makes no philosophical claims. These two theories, by hypothesis, each make the same empirical predictions. On the grounds of "good *a priori* evidence", Markosian favors STR^- over STR^+ (Markosian, 2004, p.75). He does not explicitly state what he thinks that evidence to be, so I am forced to assume he means some sort of anti-verificationist principle is what moves him to this stance.

There is a crude version of verificationism which holds that the only truths are those that we can in principle verify. If this is the sort of verificationism that Markosian is opposed to, then he is being overly hasty in dismissing STR^+. This version of verificationism seems to suffer from an implicit anthropocentrism, in the sense that it implies that *we* have some important role in determining what things can have a truth value and what things cannot. For instance, there may be some claim about some portion of the universe that is too remote for us to ever observe, given the lifetime of the universe. On the crude verificationist view, this claim has no truth value, because the region of space in question is too far away for *us* to observe (Glanzberg, 2006).

This seems too narrow and arbitrary a restriction of the notion of "in principle verifiable". Compare this with certain "in principle" unverifiable claims in quantum physics. The uncertainty principle states that if we know a particle's momentum to a certain precision, we cannot know its position beyond a certain precision. This has nothing to do with any peculiar feature of us as observers; it is a mathematical fact that governs the features of certain phenomena. Likewise, in relativistic physics, it is a mathematical fact that we cannot determine which reference frame is at absolute rest. Or, to put it more clearly, there is no reason to privilege any reference frame over another.

There seem to be two different sorts of verificationist principles that people like Prior and Markosian might be rejecting. On the one hand, we have a strong verificationist principle that rules out the existence of anything that we cannot (even in principle) verify. On the other hand,

we have a weaker principle, which would merely remain agnostic about anything which we cannot (again, in principle) verify.

Note that the weak verificationist principle is actually compatible with there being an undiscoverable absolute rest frame. So this would be at least one possible position that Markosian is calling for when he advocates STR^- (the unencumbered theory of special relativity) over STR^+ (the one weighed down with "philosophical baggage").

One suggestion that could come up in regards to solving the problem of determining absolute simultaneity between events involves getting a perspective not from within but from without; "stepping outside the universe", as it were. From this perspective, perhaps it would become clear to us which events are actually simultaneous. In some ways, this echoes Feynman's example of being able to walk around a three-dimensional object, and seeing that the apparent width and apparent depth of that object are actually "not *fundamental* properties of the object, because if we step aside and look at the same thing from a different angle, we get a different width and a different depth" (Feynman, 1997, p.94).

Yet there is an important difference, which makes the "stepping outside the universe" solution an untenable one for determining absolute simultaneity. For it is not that being able to walk around the object all of a sudden gives us some special coordinate system that gives us the "real" width and depth of the object. Rather, as Feynman says, it gives us an appreciation "that depth and width are, somehow or other, just two different aspects of the same thing" (Feynman, 1997, p.95).

There will be an invariant quantity between two spacetime event points (the spatiotemporal interval), and stepping outside the universe might allow us to see this quantity clearly, the same way that walking around a three-dimensional object can give a sense of its overall invariant shape, and not just the particular apparent depths and widths from different angles. But this ability does not, in and of itself, provide us with any reason to think that there is a particular coordinate system that is "more real" than any other. Why should we think that the short side of a table, say, is the table's real depth and the long side is its real width, and not vice versa? There is no principled reason to pick one coordinate system over another, it seems. And the choice of coordinate system matters, since that is what affects the simultaneity relation in relativistic spacetime.

One response to this might be that while yes, stepping outside the universe would not directly tell us which reference frame we should use as our frame when determining absolute simultaneity, we might be able to determine it indirectly. That is, by being outside rather than within, we could somehow observe which frame is at absolute rest. In other words, maybe outside the universe, we could run a successful Michelson-Morely experiment.

4 Conclusions

So far we have seen some of the challenges that the theory of special relativity presents to the theory of presentism. These challenges all hinge on the consequence of the special theory that says that there is no relation of absolute simultaneity. That is, whether two events are simultaneous depends on your inertial reference frame. To be clear, this is not supposed to be a theory that merely says that there is no way to determine whose measurements of simultaneity are correct. Rather, there is no fact of the matter whether two events are simultaneous. In a relativistic setting, simultaneity as we conceive of it is not a fundamental notion, but one that is derived from facts about the speed of light and our inertial reference frame.

As with other earlier theories about the nature of the universe, presentism is guided by an intuition that, while roughly applicable in the scale and scope of common human experience, does not come close to capturing the whole truth of things. As noted above, under special relativity, simultaneity is no longer a primitive or invariant notion. Yet simultaneity is the intuitive underpinning of the primitive and invariant notion in presentism: i.e., the present.

Because of the scale we live at, the sorts of distances and speeds at which relativistic effects become readily evident are completely outside of our experience. And, by and large, for the vast majority of our endeavors, we can get by with the approximation of pre-relativistic, Newtonian physical theory. Yet we philosophers, like physicists, should not be content with theories that only approximate reality for our immediate surroundings. And given that relativity is one of the most well-confirmed physical theories around today, it seems imperative that we take its conclusions and consequences as a starting point for our metaphysical constructions.

Presentists such as Hinchliff have attempted to give a redefinition of the present that moves

away from the notion of simultaneity, and embraces invariant features of relativistic spacetime. The best attempt so far is Hinchliff's cone presentism, which replaces the varying planes of simultaneity with the invariant light-cones. Yet this is merely a trade-off, since even the light-cones around a given event point are not completely invariant. As we have seen, for coincident points they are the same, but for spatially separated points, they are not. Thus, a choice: we can have the same present for coincident observers moving at different velocities, or we can have the same present for spatially separated observers moving at the same velocity, but we cannot have the same present for all of them.

So much for redefining the present to produce a coherent theory of presentism under special relativity. The other family of presentist responses to the problems created by special relativity argues against the consequence that there *is no* absolute simultaneity or absolute rest frame. Philosophers like Prior and Markosian instead lobby for an interpretation of special relativity that does not rule out the (metaphysical) existence of an absolute rest frame or (more importantly) a relation of absolute simultaneity. I admit here, there may be some ground for the presentist to hold to, but it is *extremely* shaky ground at best. If we were able to step outside the universe, and if there were some experiment that we could perform there that would allow us to determine the absolute rest frame of our universe, then we might be able to reconcile presentism with special relativity. That is an awful lot of "ifs" and "mights", though. And if this relation of absolute simultaneity is only knowable if we were to "step outside", then I fail to see how it can be of any use to us inside the universe.

In the end, I think the better option is to give up the metaphysics of presentism. Attempting to preserve or refine the definition of "the present" leads to worrisome problems with relativizing existence. With special relativity in the mix, presentism is no longer a simpler alternative to eternalism. In fact, it seems a good deal more complicated, and thus we would be justified in abandoning it on grounds of theoretical parsimony.

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