Review of: "Zeno and Einstein"

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This is an interesting paper and the author's thesis regarding the dangers of projecting abstractions onto the physical world is well-taken. I find some errors, however, in the author's interpretation of Einstein's theory(s) of relativity.

1. "Observers" versus frames of reference: It is commonplace to speak of "observers" when discussing the theory of relativity, but the concept of a reference frame in fact has nothing to do with observers. The special principle of relativity, for instance, states that the laws of nature are valid for all inertial *reference frames*. To refer to observers instead of reference frames, as the author does (introduction, for instance) is harmless in most cases, but in connection with paradoxes associated with the relativity of simultaneity it can be confusing. A reference frame is a physical system relative to which measurements in time and space are carried out. According to special relativity, all inertial reference frames are valid and any observer can use any frame he chooses. Observers are not "assigned" to their rest frames. It is better to leave off talk of "observers" altogether because it suggests that according to the special theory of relativity (STR), judgments of simultaneity are particular to an observer and therefore subjective. But relativity in the special theory is objective, not subjective (philosophically, the opposite of relative is absolute, not objective). Just like the wall may objectively to my left at the same time it is objectively to your right, measurements in time and space according to the special theory are objective but relative to inertial frames.

2. The author argues that relative simultaneity is not symmetrical in the STR. This is not true, as can be shown through a four inertial clock scenario: With clock A regarded as at rest, clock B intercepts A and synchronizes, subsequently intercepting clock C traveling in the other direction. Clock C synchronizes with B and then later meets A, registering time dilation of B relative to A. Now we regard B as at rest, with clock D intercepting A and synchronizing, subsequently to meet B and register the time dilation of A relative to B. It is true that the twin scenario is not symmetrical since the traveling twin must undergo acceleration to meet up again with the rest twin.

3. The author needs to distinguish, as does Einstein in his 1905 paper, between the conventionality of simultaneity and the relativity of simultaneity. Einstein first points out that no time measurements at different locations can be made unless we first "establish *by definition*" that the one-way transit times of light are equal. That stipulation yields what we call the conventionality of simultaneity *within a single inertial frame* in the STR. Having embraced Einstein's convention of equal transit times, the *relativity* of simultaneity then follows among different inertial frames.

4. The author is correct, I believe, that the relativity of simultaneity in the STR stems from mistakenly taking an abstraction as a physical reality (Whitehead's "fallacy of misplaced concreteness"). But the abstraction responsible for the fallacy is

not the one that the author cites, but rather that the special theory of relativity abstracts from gravity (i.e., from general relativity). According to general relativity, there can be no inertial frame in a gravitational field. Therefore, the relativity of simultaneity does not hold in a gravitational field. That leaves the conventionality of simultaneity. Einstein offered an essentially philosophical argument for the conventionality of simultaneity—that if we cannot empirically measure simultaneity at a distance then the concept is physically meaningless. If we decline to accept that philosophical argument, no conventionality of simultaneity follows from the theory of relativity.