Operational definition of absolute space and time

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First I shall demonstrate how sloppy and circular is the way we talk about the empirical meanings of such fundamental physical quantities as time and distance. It is an old suggestion that these difficulties can be avoided by applying the "one standard clock and light signals" method for the coordination of space-time. The suggestion is as old as the widespread belief that the task is trivial and that the resulted spatiotemporal structure is necessarily identical with the usual space-time geometry of special relativity. I shall show that the consequent performance of this task—without operational circularities—is highly non-trivial; and the analysis of the spatiotemporal conceptions so obtained leads to the following surprising conclusions:

1. Although the space and time tags so obtained are, "relative" to the trivial semantic convention by which we define the meaning of the terms—this kind of "relativism" is common to all physical quantities having empirical meaning—they are absolute in the sense that they are not relative to a reference frame but prior to any reference frame.

2. No objective meaning can be assigned to the concept of "proper" time. "Time" is what the *etalon* clock reads, by definition.

3. It is meaningless to talk about "non-inertial reference frame", "space-time coordinates (tags) defined/measured by an accelerating or rotating observer", and the likes.

4. Whether the standard clock used in the contemporary physical laboratories is appropriate for the definition of space and time tags is still an open empirical question. (A realistic experiment will be suggested by which the question could be decided within the Solar System.)

5. There is no additional conventionality attached to simultaneity over and above the original choice of the value of Reichenbach's ε in the trivial semantic convention. Moreover, this freedom merely consists in the choice of a single real number between 0 and 1; it cannot depend on "space

coordinates" and/or "direction"; simply because there are no such things as "space coordinates" and "direction" prior to fixing the value of ε.

6. Assuming that the future experiments mentioned in point 4 will confirm what our present physical theories suggest, there seems no way to build up the spatial concepts operationally, if $\varepsilon \neq \frac{1}{2}$. And, given that our aim is to define not only the temporal but also the spatial concepts, this is a strong experimentally testable argument against the $\varepsilon \neq \frac{1}{2}$-synchronization.