

The Relativistic Approach to Causality Does Not Resolve the Question of Physical Existence — It Sidesteps It

Causality cannot be reduced to the ordering of an antecedent and a consequent. For such a relationship to be effective, the realities involved must exist and evolve in a determinate way. The question raised by the relativity of simultaneity is therefore more fundamental than that of causal order: it concerns what, at each instant, actually exists and undergoes becoming.

In relativity, the possibilities of causal connection are defined by the structure of spacetime and the limiting speed at which physical influences can propagate. Three types of interval between two events are distinguished:

1. A timelike interval

An influence can travel from the first event to the second at a speed below that of light. This is the case, for example, between the launch of a projectile and its impact. All inertial frames agree on the temporal order of these two events.

2. A lightlike interval

An influence can connect the two events by propagating at exactly the speed of light. This is the case between the emission of a light signal and its reception in a vacuum. Here too, all inertial frames agree on their temporal order: emission precedes reception.

3. A spacelike interval

For an influence to travel from one event to the other, it would have to exceed the speed of light. Relativity therefore rules out a direct causal influence between these two events. Their temporal order can vary with the reference frame: one event may precede the other in one frame, follow it in another, or the two may be simultaneous. They may nevertheless have a common cause.

This classification determines the possibilities of causal connection within the relativistic framework. It does not demonstrate that an influence has actually occurred merely because one is possible. Above all, it is not sufficient, on its own, to resolve the question of the existence and becoming of physical realities.

The fundamental question therefore remains: what does it physically mean for a plane of simultaneity to determine what exists “now” for a given reference frame?

The following scenario, in my view, reveals an internal contradiction in this interpretation.

Consider a space shuttle that accelerates, thus continuously changing its instantaneous inertial frame, while tracking the trajectory of a missile located behind it. At every instant during its acceleration, the shuttle redefines its plane of simultaneity — that is, what, for it, exists “now” in the universe.

If we take seriously the idea that this plane of simultaneity corresponds to a physical fact (rather than merely a synchronization convention), the following consequence arises: during this continuous acceleration, the same event — the launch of the missile — can shift from the status “already exists” to “does not yet exist” for one and the same physical system continuously tracking the trajectory of that object.

This is not simply a change in the relative descriptions given by two distinct observers, something special relativity handles without difficulty. It is a breakdown of internal consistency: a system continuously reasoning about the existence and motion of the same object sees that object shift between existence and non-existence, without any physical event having occurred on the object itself. The missile was already in motion; nothing physically justifies this shift.

Saying that the event under consideration is separated from the shuttle's event by a spacelike interval does not address this difficulty. It means only that no direct influence is possible between the two events at that instant — not that the question of the missile's physical existence has been resolved. Yet this is precisely the question my objection raises.

The logical conclusion that follows is this: if the hypothesis that the plane of simultaneity corresponds to a physical fact produces a contradiction in this scenario, then that hypothesis must be rejected. The relativity of simultaneity therefore cannot correspond to a physical difference in what presently exists. Since the physical invariance of the one-way speed of light in all inertial frames implies this physical relativity of simultaneity, that universal invariance must also be rejected.

Merely invoking the preservation of causal order does not avoid this conclusion: doing so presupposes the adequacy of the standard interpretation, whereas it is precisely that adequacy which my objection calls into question.

For more than ten years, I have observed in discussions of my objection that appealing to the relativistic conception of causality blocks examination of the question of physical existence that it raises. The classification of intervals and the preservation of causal order are invoked as though they were sufficient to answer this question. Yet their relevance to resolving this difficulty is precisely what must be demonstrated: these criteria determine the possibilities of causal connection within the relativistic framework, but they do not, on their own, settle the question of what physically exists.

When these criteria are assumed to be sufficient to conclude that the objection has been resolved, the reasoning becomes circular: the adequacy of the very interpretation challenged by the objection is taken for granted. Until this mechanism is identified, it becomes difficult to reopen discussion of the framework's philosophical and logical presuppositions. I fear that the same difficulty may arise when an article is reviewed by a scientific journal.

I develop this demonstration in full in Chapter 2 of my book *Conceptual Foundations of a Theory of the Universe*, as well as in the text devoted to this objection in my book *Paradox of the Invariance of the Speed of Light*.

- [The Space Shuttle and Missile Objection](#)
- [Chapter 2 — Conceptual Foundations of a Theory of the Universe](#)

Philippe de Bellescize