Special Relativity: the Clock Absurdity

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Abstract

Special Relativity's clock absurdity is a simpler version of its 'twin paradox'. It provides the most direct refutation of SR.

Introduction

Special Relativity's *Clock Absurdity* is a simpler version of its so-called 'twin paradox'. 'So-called', because a paradox is defined in the dictionary as "a *seemingly* self-contradictory or absurd statement"[a]. The classic example is Zeno of Elea's 'Achilles and the tortoise'. The clock case is not, however, a *seeming* contradiction. It is a *real* one. Not conforming to the definition of a paradox, it should be called the 'clock absurdity'.

In his 1905 *On the Electrodynamics of Moving Bodies*[1] Einstein wrote :

> "The unsuccessful attempts to discover any motion of the Earth relative to the 'light medium' suggest that the phenomena of electrodynamics, as well as those of mechanics, possess no properties corresponding to an absolute rest. But rather that the same laws of electrodynamics are valid for all frames of reference for which the equations of mechanics hold good[b][2]. We will raise this conjecture to the status of a 'relativity postulate'. And will introduce another, only apparently irreconcilable with the former. Namely that light is always propagated in empty space with a definite velocity *c*, independent of the state of motion of the emitting body."[3]

In his 1916 Relativity article he added:

> "According to the theory of relativity there is no such thing as a 'unique' (lit. 'specially favoured' or 'marked out') co-ordinate system."[4]

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[a] Italics ours.

[b] All inertial frames.

The "unsuccessful attempts" he refers to are presumably the alleged 'null' result of the 1887 Michelson-Morley aether-wind experiment[a][5].

These two assumptions form the *Einstein postulates*. He provided no substantiation for them apart from the oblique, and in fact invalid[b], reference to Michelson-Morley. They were things Einstein wanted to be true. So he simply postulated that they were.

The first 'relativity' postulate is resumed by saying that *all the laws of physics* – and not just those of mechanics – are the same for all inertial observers:

– 1) the laws of physics are the same for all inertial observers

In contemporary relativistic jargon: no inertial observer is "privileged" or "preferred"[c] – effectively that all inertial observers' viewpoints are correct:

all inertial viewpoints are correct

The second 'speed-of-light' postulate says that the speed of light *c* in a vacuum is constant:

– 2) the speed of light c in vacuo is invariant

Clock slowing (1)

The second postulate of a constant speed of light for all inertial observers might at first sight seem contradictory. A physical wave is not itself a material object. It is a *time-dependent event*, a *disturbance* propagating through a *medium* at a characteristic speed *c* given by the properties of that medium:

wave = disturbance propagating through a medium at a characteristic speed c given by its properties

To say that the speed of light *c* is constant for all inertial observers[d], is thus like saying that the speed of sea waves relative to a boat is always the same, regardless of whether it is sailing upwind or downwind, and is apparently nonsensical.

"Aha!" said Einstein, the difference is that at 'relativistic' speeds, comparable to that of light, firstly *clocks run slow* – so-called *time dilation.* And secondly, *lengths contract* proportionally in the direction of motion[e]. The speed of light that an obser-

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[a] In fact positive, discussed in detail in the companion 'Aether' article.

[b] Its result wasn't 'null'.

[c] Einstein's "unique" or "specially favoured" (p.1).

[d] Rather than through its medium.

[e] The Fitzgerald-Lorentz length contraction.

ver measures, the ratio of the two[a], is then always the same. He described his *eureka* moment:

> "I had discussed every aspect of the problem with a friend of mine, the Italian Michele Besso[b]. Returning home I suddenly I saw where the key lay. *Time* cannot be absolutely defined. Next day I said to him: 'Thank you, I've completely solved the problem'. With this new concept I resolved all the difficulties; and within five weeks the Special Theory of Relativity was completed."[6]

Einstein's reasoning was the following. Imagine a *photon clock*, a single photon of light[c] reflected vertically between two mirrors that emit a "tick" every time the photon hits them, Fig. 0-1. If the mirrors were 1 m apart, for instance, and the speed of light was 1 m/s, the photon clock would tick once a second[d].

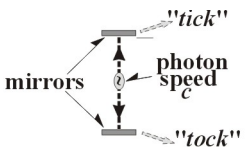

Fig. 0-1. Photon clock.

Consider an observer A standing at a railroad station with such a clock, Fig. 2a, and a second individual B with a similar clock on a railroad truck moving at a steady speed *v*, Fig. 2b.

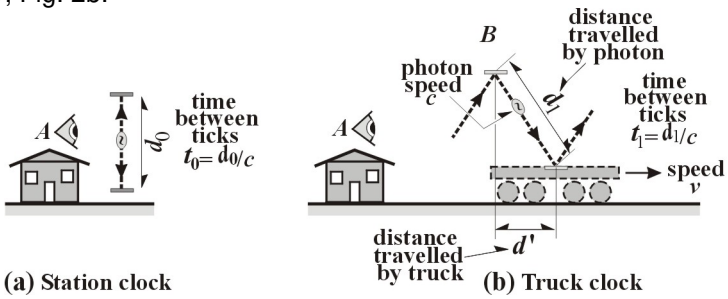

Fig. 2. Clock-slowing (1).

During the time the truck photon takes to travel between the mirrors, the truck itself moves foreward a distance *d'* proportional to its speed. Pythagoras' theorem

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[a] Speed being distance divided by time.

[b] His long-term university friend.

[c] Here, exceptionally, in terms of the 'particle' nature of light.

[d] A photon clock enables the 2nd 'constant speed of light' postulate to be used.

and a little simple algebra show that the distance d_1 the truck photon has to travel is *greater* than its stationary value d_0 by a factor γ:

$$\gamma = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}} \qquad \text{(eq.1)}$$

called the *Lorentz factor* in honour of the Dutch physicist Hendrik Lorentz[a]. Fig. 3 shows the overall path of the truck B photon through space.

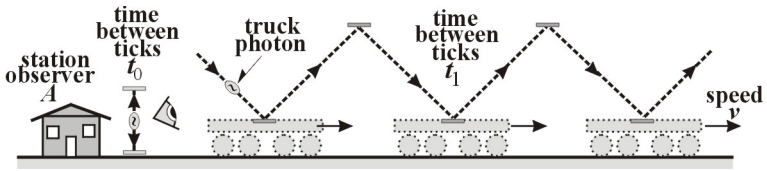

Fig. 3. Clock slowing (2).

The speed of light *c* being constant[b], the truck clock B *ticks more slowly* than the station clock A by the Lorentz factor γ. Meaning that *times* measured on it are *shorter* than those on the station clock by the same amount.

At low truck speeds *v*, the Lorentz factor γ is approximately unity and can be ignored. But at relativistic speeds it increases rapidly, becoming infinite at the speed of light *c*[c], Fig. 4.

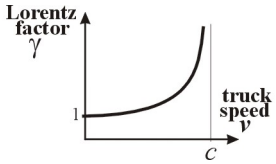

Fig. 4. Lorentz factor.

Clock absurdity (1)

If a travelling observer's clock runs more slowly, so also do by implication for him physical events in general. Meaning that he *ages less* than when at rest. Einstein wrote in 1911:

> "A living organism placed in a box, after a lengthy flight at approximately the speed of light, could return in a scarcely altered condition, while

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[a] Hendrik Lorentz (1853-1928), Dutch physicist.

[b] The 1st 'relativity' postulate (p.2).

[c] Where *v*=*c* and the bottom line of the Lorentz factor (eq.1) becomes zero.

corresponding organisms on Earth had long since given way to new generations."[7]

In the same year Paul Langevin[a] put this into its better known *twin form*. Twin A is an earthbound homebody, and twin B is an astronaut. Twin B undertakes a spaceship journey at near to the speed of light, returning to find himself younger than his brother, Fig. 5.

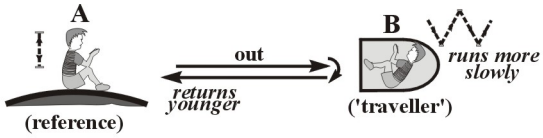

Fig. 5. Twins.

The same applies to two twins in spaceships free-floating in outer space, Fig. 6. The reference twin A sees the travelling twin B's clock running slowler than his own.

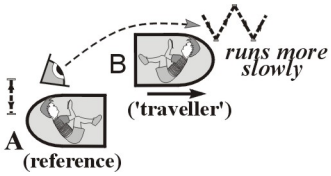

Fig. 6. Twin A's view.

Relative to twin B, however, *twin A* is the 'traveller'. Meaning that *his* clock runs slower, Fig. 7. Because both twins are moving inertially, according to Einstein's first 'relativity' postulate both their viewpoints are equally valid, effectively correct[b].

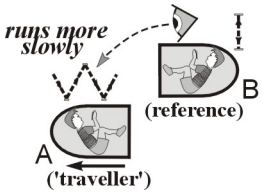

Fig. 7. Twin B's view.

Special Relativity thus predicts that *two clocks can each run slower than the other*:

SR predicts that two clocks can each run slower than the other

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[a] Paul Langevin (1872–1946), French physicist.

[b] p.2.

This is the essence of the clock absurdity. Being rationally contradictory, so also on the philosophical *reductio ad absurdum* principle are the Einstein postulates, and by extension Special Relativity itself. It is resumed in Fig. 0-8[a].

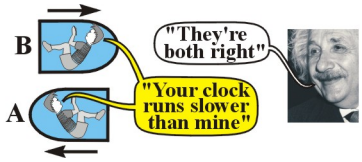

Fig. 0-8. Clock absurdity (1).

The clock absurdity alone is sufficient to falsify Special Relativity. Experimental refutations, of which there are many[b], are interesting but superfluous. A logical contradiction cannot correspond to physical reality. One doesn't need experiment to show that there are no square circles. Special Relativity is its own *reductio ad absurdum*:

Special Relativity is its own reductio ad absurdum

To maintain that Special Relativity is correct is like saying that there can be square circles[c][8].

To conclude, a quote from the Nobel prize judge Harald Nordenson:

> "People express astonishment that Einstein was not awarded the Nobel prize for Relativity, considered by many to be one of the most outstanding achievements of this century. I do not hesitate to declare that it is not only among the most sensational fancies, but is also one of the most serious logical incoherencies in the history of Science."[9]

Bibliography

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[a] Remembering that these are imaginary *thought exercise* twins, unrestricted by practical considerations, who even at relativistc speeds can pass each other within a hairswidth without risking scratching their spaceships' paint. And their pilots can carry out complex scientific measurements in the twinkling of an eye. In one's imagination one can imagine anything one cares to imagine.

[b] Starting with the 1887 Michelson-Morley experiment (p.2).

[c] The historical and social background to all this is discussed in a companion article.

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[1] Einstein 1905.
[2] Einstein 1919.
[3] Einstein 1905.
[4] Einstein 1916.
[5] Fiennes 2019a, p.11.
[6] Einstein 1922.
[7] en.wikipedia.
[8] Fiennes 2019b.
[9] wbabin.