LOGICAL INVALIDITY OF EINSTEIN'S "TRAIN" THOUGHT-EXPERIMENT

by

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EINSTEIN'S TRAIN: A THOUGHT-EXPERIMENT

This is the way Einstein thought up his "Train" thought-experiment (cf. the Web Page of Concordia College, Maine, USA at <http://www.cord.edu/dept/physics/credo/etrain_2000.html>):

Imagine an extremely high speed train moving in a straight line at an enormous speed with respect to the ground. Inside the train a lady stands in the centre of the train. Outside the train a lone man stands on a station platform, watching the train speed by.

As the train passes the man, two lightning bolts strike either end of the train, leaving burn marks on the track and on the train's caboose and engine, and sending flashes of light into the train and along the platform.

Let's assume that the man sees the lightning bolts strike the two ends of the train, and the tracks under them, simultaneously. Let's also assume that later the man measures the distance from where he was standing to each of the two burn marks on the track, and finds that the distances of each of two marks from where he was standing are exactly the same.

The man, therefore, must conclude that the two flashes of lightning struck the track simultaneously. Since we are assuming that the speed of light in all directions is the same, and independent of the source or observer, the two flashes must take the exact same amount of time to travel the identical distances from each of the burn marks to where the man happened to be standing.

The passenger, however, must see things differently — or so argues Einstein. She is standing in the middle of the *moving* train. (Let's assume that afterwards she, too, measures the distance from where she was standing to the burn marks on the engine and caboose, and also finds them to be exactly equidistant from where she was standing.) The train however was moving *towards* the front flash of lighting and *away* from the rear flash. So after the lightning strikes, she *first* sees a flash of light from the front of the train then *a bit later* a flash of light from the back of the train.

She must thereupon conclude that the engine was stuck by lightning *before* the caboose.

This, in a nutshell, is Einstein's brilliant argument.

EINSTEIN'S MISTAKE: THINK ABOUT IT!

Hel-lo! Mr Genius! Aren't we forgetting something? If the speed of light has got to be the *same* for the *lady* as for the man, then she has got to see the flashes simultaneously *as well!*

Note that if the speed of light has got to be the same for the lady as for the man, light should take just as long to go from the rear of the train to the front of the train, as it does to go from the front of the train to the rear of the train.

And that means that it should take exactly the same mount of time to travel *halfway* along the train as well, regardless of whether it is coming from the front or the rear!

Now the passenger is standing smack bang dead-centre in the middle of the train, right? The burn mark on the caboose is just as far away from her as the one on the engine, right? In *her* frame of reference they are both the *exact* same distance away from her, right? She measures speed just like everyone else, namely by dividing distance by time ... *right?*

If she were to see the flashes at *different* times, she would have to conclude that it took one of the flashes a *longer* time to travel to her inside the train, than it took for the other! But in *her* frame of reference — namely the train — both flashes travelled the *same* distance, right?

And if that's the case, the flash that took the *longer* time to travel the exact same distance must have been travelling *slower!*

Note that it doesn't matter how much the train "shrank" due to so-called "length contraction" or how much her watch slowed down due to so-called "time dilation". In fact it doesn't matter whether the so-called "Relativistic Lorentz transformations" occurred or did not! No matter *what* the length of the train, the caboose will *still* be as far from the lady as the engine; and no matter *how* much slower her watch ticked, it *still* would tick the same for the purposes of measuring the duration of light travel from the caboose to her, as for measuring the duration of light travel from the engine to her!

Note also that she and the man can always meet later, and compare notes. He will, if he is honest, tell her that he saw the flashes simultaneously — and (hopefully) she will believe him. If she saw the flashes at different times, then she would have to conclude that the speed of light in the *train's* frame of reference was *not* constant: that light moved *faster* in one direction than in the opposite direction!

Either she has to give up the notion of the constancy of the speed of light for all reference frames, or she has to give up the notion that there can be no simultaneity between frames of reference that are in movement compared to one another — because the two notions are mutually incompatible.

Of course if she gives up the notion of the constancy of the speed of light, she would have to give up Relativity too — because that is one of the basic postulates from which all of Einsteinian Relativity is derived.

But even if she gives up the notion of "no simultaneity between frames of reference that are in rectilinear motion compared to one another" she would have to give up Relativity — because if there *can* be such simultaneity, it would be possible to synchronise clocks *all over the universe,* regardless of the speed of movement of the clocks! Which means that a concept of "universal time" or "absolute time" *would* have meaning.

One way or another, she would have to give up Relativity — and that is but natural, because Relativity contradicts itself!

A LOGICAL ANALYSIS IN SUPPORT OF THE ABOVE CONCLUSION

We take as a hypothesis the following:

- a train of "proper" length ***l***, moving rectilinearly along the tracks at a relative velocity ***v***,
- a passenger on the train,
- a flash of light occurring at the front end of the train and another at the rear end. (See diagram on next page).

Now:

(1) If the first postulate of relativity — the postulate of the constancy of the speed of light for all inertial observers — is correct, according to the passenger's calculations, the light from the flash at the front end of the train ought to take the *same* amount of time to reach the rear end of the train, as the light from the flash at the rear end of the train takes to reach the front end of the train.

(2) By the argument given by Einstein in his "Train" thought-experiment, if the train is moving at a velocity ***v*** along the tracks, according to the passenger's calculations, the light from the flash at the rear end of the train should take *more* time to travel to the front of the train, than the light from the flash at the front end of the train takes to travel to the rear end of the train.

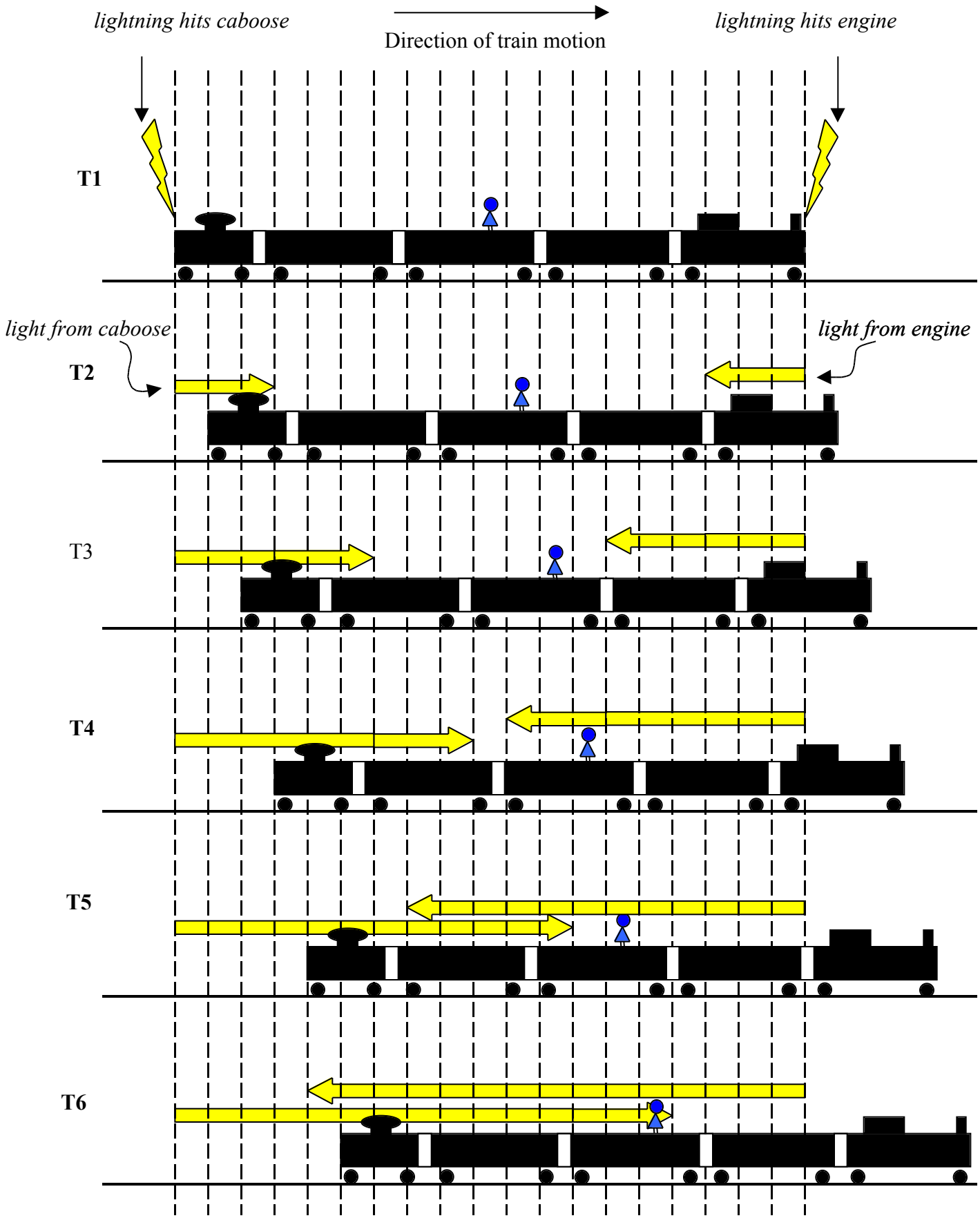
(3) Statements (1) and (2) above contradict one another, so both cannot be correct.

(4) If statement (1) above is not correct, the postulate of the constancy of the speed of light cannot be correct. And if this postulate is not correct the Theory of Relativity cannot be correct.

(5) If statement (2) above is not correct, the logical incompatibility between the first postulate of Relativity and the "Principle of Relativity" cannot be removed (see Einstein's own words at <http://www.bartleby.com/173/7>, paragraphs 4 and 5.) Thus if statement (2) above not correct, the Theory of Relativity must be based on a logical incompatibility, and thus cannot be correct either.

Q.E.D.

Comments? *Email me.*


lightning hits caboose
Direction of train motion
lightning hits engine
T1
light from caboose
light from engine
T2
T3
T4
T5
T6