

The Twins Paradox (Twin Paradox, Clock Paradox),
Einstein's clock synchronization,
and the universal frame of reference.

Detailed in *Relativity Trail* (210 pages, 140 illustrations.)

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Abstract

One must begin by defining what the Paradox of the Twins is.

Einstein's treatment is not self-contradictory, strictly speaking. After all, he *did* use quotes around "stationary" and "moving", and he never offered an explanation of where the missing time in the Twins Paradox went. He merely called it "peculiar", and let that comment stand the rest of his life.

The paradox is one of opposing interpretations: When an examiner claims there is no "truth of the matter" regarding clock rates of different inertial frames, or when he claims clocks of different inertial frames keep time at the same rate from the God's eye view, he forces himself to claim that an inertial force creates the time differential of the Twins Paradox in a twinkling, even though nothing is involved but the simple transfer of local information.

When an examiner claims there is (typically) an actual difference in clock rates between two inertial frames, no surprise such as found in the Twins Paradox arises. Yet all the conclusions of Einstein's special relativity are preserved.

Relativity Trail is completely consistent with, and in fact subsumes, Einstein's relativity, with the effective equivalence of all inertial frames. *Relativity Trail* is not the relativity of Lorentz or of the aether or of variable light speed. This book is devoted primarily to two goals - presenting relativity in absolute terms, devoid of any mystery or ambiguity; and, corollary to this, refuting the common explanations of the Twins Paradox.

Einstein's clock synchronization is a convenient pseudo reality of simultaneity for each inertial frame which predicts, but does not explain, the time differential present in the Twins Paradox. When Einstein's clock synchronization (identically spacetime) is allowed a say in the matter, a "jump in time" is claimed, which amounts to a disagreement between two pseudo realities.

In *Relativity Trail*, we incorporate no such convenience of clock synchronization, and are thus not locked into a mode of thinking which will bring us any surprise upon the change of an inertial frame. We fully expect the time differential upon reuniting, seeing plainly that an actual difference of clock rates is what is bringing it about, and incrementally so.

Begin:

At every step in Einstein's derivation, as well as in any experiment designed to test the theory, information must be exchanged across inertial frames.

Party A cannot learn anything of Party B's clock rate or length without some sort of signal jumping from one frame to the other. This applies to optical perception as well as to a radio pulse. It is information alone that jumps from one inertial frame to the other, to be used in one frame for the purposes of taking measure of the party of the other frame.

No inertial force stemming from a change of inertial frame can affect the information which jumps frames.

Physicists take the mutual effects of relativity as confirmation that uniform motion is purely relative, and that there is therefore no meaning to be attached to absolute uniform motion, and therefore of course, to actual differences in clock rates, etc. But the time differential present in the Twins Paradox, showing up at the same place-moment, does not fit with that interpretation. Therein only, lies the true paradox - one interpretation must be chosen over the other. How has this been dealt with?

Without exception, it seems, examiners of relativity fail to realize that the very transfer of information which is involved in mutual assessments across inertial frames is also all that is involved in the turn-around associated with the Twins Paradox; for without exception, they appeal to an inertial force associated with the turn-around, which somehow suddenly creates the entire time differential, as though some force could actually affect the transfer of information, which involves nothing more than the simple act of starting a watch.

Do a search on this topic, and you will find the most famous physicists signed on to such explanations, such sudden shifts of "lines of simultaneity".

People seem to forget that Michelson's and Morley's slab was real, with real separations and real place-moments. Such experiments dictated Einstein's postulates, *but they did not dictate his clock synchronization*. With Einstein's clock synchronization, each party calls simultaneous whatever appears simultaneous, with light serving as the messenger of moments. *Einstein's postulates demand a time differential, but his clock synchronization obscures the cause of that differential*. It does this by obscuring the reality behind Einstein's assignments of "stationary" and "moving" to two inertial frames. As we state on page 88, it nullifies the notion of a universal (albeit undetectable) frame of reference. On page 82 we note that it proves to be a means to disregard physical absolutes in favor of absolutes of measure.

At the conclusion of Einstein's kinematical section, where he noticed the "peculiar" result of a time differential between reunited clocks, he should have realized that his assignments of "stationary" and "moving" had meaning beyond their characteristics of certain mutual effects.

The clock synchronization is where the reality gets obscured. The mutual effects between two frames, *which we can derive with or without employing this clock synchronization*, unfortunately reinforces the incorrect notion that there is no "truth of the matter". That there *is* a truth of the matter stares us right in the face when we look at the disparity between two reunited clocks at the same place-moment.

Again, the experiments of the day drove Einstein's postulates. The application of the *absolute* version of these postulates dictates our conclusion of the time differential *independent* of Einstein's clock synchronization.

The fatal mistake made by examiners of the Twins Paradox is to apply Einstein's clock synchronization to the analysis. It forces them to purport a perceived "jump in time" for the suddenly returning astronaut.

Einstein's clock synchronization is a convenient pseudo reality of simultaneity for each frame which predicts, but does not explain, the time differential present in the Twins Paradox. When Einstein's clock synchronization (identically spacetime) is allowed a say in the matter, a "jump in time" is claimed, which amounts to a disagreement between two pseudo realities. Spacetime hinges on Einstein's clock synchronization. It is in spacetime diagrams that we find the infamous sudden shift of a line of simultaneity. The further down the line of simultaneity a transfer of clock information occurs between the two pseudo realities, the greater the magnitude of the ultimate surprise, a surprise noted by Einstein at the conclusion of his kinematical derivation, and which he called "peculiar".

The clock synchronization had been obscuring the reality behind his assignments of "stationary" and "moving". The God's eye view reveals an asymmetry, the particulars of which, can never be detected by the participants themselves.

The only correct time-checking paradigm to apply to the Twins Paradox is the regular sending of radio pulses forth and back between the two parties. That obvious paradigm shows plainly that there is no perceived jump in time, rather an observed incremental build up of time-keeping asymmetry, beginning at turn around. (See next page, as well as pages 12, 13 and diagram 7 on page 12 of *Relativity Trail*.)

In *Relativity Trail*, we incorporate no such convenience of clock synchronization, and are thus not locked into a mode of thinking which will bring any surprise upon the change of an inertial frame. We fully expect the time differential upon reuniting, seeing plainly that an actual difference of clock rates is what is bringing it about, and incrementally so. Furthermore, our absolute approach subsumes Einstein's treatment.

If you wish to understand what is actually creating the effects of relativity, you must let go of the clock synchronization. And you must utilize the absolute speed of light in an absolute frame of reference.

For a more detailed discussion, including an explanation of the absolute versions of Einstein's postulates, see:

relativitytrail.com/relativitytrail_abstract.pdf

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Next page: Table of data from a Twins Paradox adventure.

Twins paradox analyses typically fail to incorporate a transfer of clock reading from an outbound traveler to an inbound traveler. Such transfer is requisite for any study involving special relativity, otherwise acceleration is involved.

Einstein's clock synchronization (identically spacetime), is the wrong observation paradigm to apply to the Twins Paradox. You'll get nothing more than a disagreement between two pseudo realities. One must employ the regular sending of radio pulses forth and back between the two gents in relative motion. This paradigm can be understood only in the context of the universal frame of reference.

We can recreate diagram 7 of page 13, but with gent B traveling outbound until his clock reads 10 seconds, at which point he hands off his clock information to B' coming from the opposite direction at the same speed, and have gent A and gent B (and ultimately B') send radio pulses to each other every one second as registered on their respective clocks. We obtain the following table:

The columns "B sends", "A rec's", "A sends", "B rec's" contain the times shown on the respective clocks of A and B.

The column under the left hand "d" shows the differences between "B sends" and "A rec's".

The column under the right hand "d" shows the differences between "A sends" and "B rec's".

The column under "dd" shows the differences between the differences.

Note the incremental change in all columns, beginning at turn-around.

With pulses sent at ever shorter intervals, these increments are of course as smooth as you care to make them. There is no "jump in time" to be found in the perceptions of either A or B.

This same strategy can be repeated, but with gent A changing frames. The results are identical, as we have checked.

| B sends | d | A rec's | dd | A sends | d | B rec's |
|---|-----|---------|-----|---------|------|---------|
| ----- | - | ----- | -- | ----- | - | ----- |
| 1 | 1 | 2 | 0 | 1 | 1 | 2 |
| 2 | 2 | 4 | 0 | 2 | 2 | 4 |
| 3 | 3 | 6 | 0 | 3 | 3 | 6 |
| 4 | 4 | 8 | 0 | 4 | 4 | 8 |
| 5 | 5 | 10 | 0 | 5 | 5 | 10 |
| ----- Last transmission rec'd by B before turn-around ----- | | | | | | |
| 6 | 6 | 12 | 1.5 | 6 | 4.5 | 10.5 |
| 7 | 7 | 14 | 3 | 7 | 4 | 11 |
| 8 | 8 | 16 | 4.5 | 8 | 3.5 | 11.5 |
| 9 | 9 | 18 | 6.0 | 9 | 3 | 12 |
| 10 | 10 | 20 | 7.5 | 10 | 2.5 | 12.5 |
| ----- Last transmission sent by B before turn-around ----- | | | | | | |
| 11 | 9.5 | 20.5 | 7.5 | 11 | 2 | 13 |
| 12 | 9 | 21 | 7.5 | 12 | 1.5 | 13.5 |
| 13 | 8.5 | 21.5 | 7.5 | 13 | 1 | 14 |
| 14 | 8 | 22 | 7.5 | 14 | 0.5 | 14.5 |
| 15 | 7.5 | 22.5 | 7.5 | 15 | 0 | 15 |
| 16 | 7 | 23 | 7.5 | 16 | -0.5 | 15.5 |
| 17 | 6.5 | 23.5 | 7.5 | 17 | -1 | 16 |
| 18 | 6 | 24 | 7.5 | 18 | -1.5 | 16.5 |
| 19 | 5.5 | 24.5 | 7.5 | 19 | -2 | 17 |
| 20 | 5 | 25 | 7.5 | 20 | -2.5 | 17.5 |
| | | | | 21 | | 18 |
| | | | | 22 | | 18.5 |
| | | | | 23 | | 19 |
| | | | | 24 | | 19.5 |
| | | | | 25 | | 20 |

A synopsis of *Relativity Trail*, which includes a brief discussion of the postulates can be found at:

relativitytrail.com/relativitytrail_abstract.pdf

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