The Truly Paradoxical Case of the Symmetrically Accelerated Twins

(Paper II)

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Abstract. This is the second instalment in a four part series, the aim of the work being to introduce absolute motion into Einstein's Special Theory *of* Relativity (STR). Herein, we depart from the traditional case where one twin stays put while the other rockets into space, we consider the case of identically accelerated twins. Both twins depart at uniform relativistic speeds in opposite directions for a round trip from the Earth on their 21^{th} birthday destined into space to some distant constellation that is a distance L_0 in the rest frame of the Earth. A proper application of Einstein's STR tells us that the Earth bound observers will conclude that on the day of reunion, both twins must both have aged the same albeit their clocks (which where initially synchronized with that of the Earth bound observers) will have registered a duration less than that registered by the Earth bound observers. In the traditional twin paradox, it is argued that the stay at home twin will have aged more than the travelling twin and the asymmetry is attributed to the fact that the travelling twin's frame of reference is not an inertial reference frame during the periods of acceleration and deceleration making it "illegal" for the travelling twin to use the STR in their frame, thus "resolving" the paradox. This same argument does not hold in the case considered here as both twins will undergo identical experiences where each twin sees the other as the one that is in motion. This means, each twin must conclude that the other twin is the one that is younger. They will conclude that their ages must be numerically different, thus disagreeing with the Earth bound observers that their ages are the same. This leads us to a true paradox that throws Einstein's Philosophy *of* Relativity into complete disarray.

"*Our most trustworthy safeguard in making general statements . . . is imagination. If we can imagine the breaking of a Law of Physics – then, it is in some degree an Empirical Law. With a purely Rational Law we could not conceive an alternative. This ultimate criterion serves as an anchor to keep us from drifting unduly in a perilous sea of thought.*"

– **Herbert Dingle** (1890 – 1978)

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1 Introduction

As is well known, the Special Theory of Relativity (STR) has, for various reasons been criticized, with some sighting the lack of empirical evidence, some, the internal inconsistencies, some rejected it for mathematical physics *per se*, and some for philosophical reasons. At present, there still exist critics of STR outside the scientific mainstream and some in mainstream physics – like ourself. It is safe to say that the overwhelming majority of scientists agree that Einstein's STR has been verified in many different ways and there are no inconsistencies within the theory, hence, the reason for mainstream journals to banish and thwart forthwith any claim to refute the STR. What we provide here is something that cuts deep at the nimbus and very heart of Einstein's STR. Simple, the notion or idea that motion is only motion when measured to some material reference system is deeply flawed as we shall show here.

In Paper (I) [1], we provided a new and novel solution to the popular twin paradox of relativity due to Professor Albert Einstein and Professor Paul Langevin. This solution neglects the acceleration of the travelling twin which are used in the traditional solution to argue that the twin that experiences

the accelerations is the one that actually experiences time dilation. In Paper (I), we argue that without these accelerations, it is the stay at home twin that is older at reunion. This new and novel solution makes use of a third 'fixed' reference point. Einstein's STR requires only two points in-order to completely describe motion. According to Einstein, motion is completely described if a second reference point is specified.

Herein, we present the case of the symmetric twin paradox. If we are to try to find a solution to the symmetric twin paradox using Einstein's philosophy namely that motion is completely described if a second reference point is specified, then, we are lead to a true paradox because it is seen that symmetric nature of the set of twins's state of motion, leads to a situation were each of the travelling twins see the other as the younger one at reunion. By the use a third 'fixed' reference point as done in Paper (I) for the tradition twin paradox of Einstein and Langevin, we shall provide what we believe is a plausible solution and this solutions leads us to conclude that absolute motion must exist somehow.

2 Symmetrically Accelerated Twins

Suppose, Takunda – unlike in the previous version presented in Paper (I), decided to be adventurous too. That is, he decides to rocket into space and travels not with his twin brother but all by himself and instead of rocketing to α-Centauri he travels at the same constant relativistic speed as Tadiwa to an imaginary constellation (call it Constellation α-Christina) which is equidistant and directly opposite to α-Centauri along the line of site joining the Earth and α-Centauri – see figure (1) below.

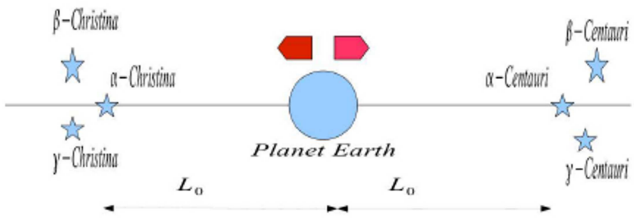

Fig. (1): The pictorial view of the symmetric twin paradox. Tadiwa rockets to α-Centauri at speed v relative to the Earth bound observers and Tadiwa rockets to the imaginary constellation α-Christina which is a replica of α-Centauri (but on the opposite end), at speed v relative to the Earth bound observers. According to the STR, the twins will each see the other move at a speed $V = |2v/(1 + v^2/c^2)|$.

On their day of departure, their family and friends bid them farewell and wish them safe travels. They travel the same distance to and from at the same speed v as measured relative to the Earth bound observers. Without much say; on the day of reunion, the family and friends [who – like Takunda and Tadiwa; (all) have studied physics at university and understand very well Einstein's STR] will have no doubt that they will all have aged the same.

The big question is, will the twins agree with their family and friends that they have aged the same? If one accepts Einstein's Philosophy *of* Relativity, which amongst others states that it is impossible for an inertial observer to measure their state of motion, verily, the "truth" according to this philosophy is that: each of the twins will see the other as having aged less than they, so they would not agree with their family and friends that they must be the same age. Actually, the twins will see the other as having aged less. Herein we have a paradox! We shall explain this more clearly.

3 Einstein's Solution

If v is the speed with which the Earth bound observers (family and friends) see the twins travel at in their respective spacecrafts, then, according to the twins in their own respective frames of references, the Earth is receding at a speed v and they each see the other twin as receding at a speed $V = |2v/(1+v^2/c^2)|$ (relativistic velocity addition). What does Einstein say about the age of the twins?

First things first is that we must acknowledge without fail that the scenario under consideration is perfectly symmetric. If anything, we can no longer seek refuge in the GTR by making use of the accelerations and decelerations because both twins undergo identical accelerations and decelerations, actually, their motion is exactly identical in every respect except that they move in opposite directions. So, we can forget about these accelerations and decelerations because they will not help us in our quest for understanding.

According to Einstein's Philosophy *of* Relativity, each of the twins has every right under the majestic heavens to say the other twin is the one that is younger and they will not agree that their ages are equal upon reuniting. Logically, one would expect that they must be the same age at reunion since every experience of the twins is identical.

We are here presented with a true paradox which the STR is unable to provide an answer because both twins undergo similar experiences which see them see the other as the one that is younger. Logically, this is unacceptable especially given that ageing is a physical process. To shade some light, suppose the twins move at a speed that sees each twin see themselves age $1\,yr$ and the other $60\,yrs$ (given the distance to α-Centauri, it means $v \simeq 0.99981c$), clearly, at reunion, the older twin will be seen by the wrinkles on their face and there will not be such an absurd statement from the twins as:

From an Einsteinian relativistic point of view,
it is you and not me that has wrinkles.

Their '*Einsteinian and Relativity*' pilgrimage is over, now they must face and dance to the music of physical and natural reality were something "is" or "is not".

We shall stress once again that the situation of the twins is symmetric and this symmetry is what brings about the true paradox. Can the STR solve this? Even when the GTR is brought to the rescue, is there a solution? *i.e.*: will the adventurous set of twins agree with their family and friends that they are the same age at reunion? Who between the two of them has wrinkles? Really? May the reader – here; be their own Judge.

4 Symmetry

We have said that the description of events by both observers must be the same if their experience are symmetric. Further, in Paper (I), we did say that the description of events by by the stay-at-home and the travelling twin are asymmetric. What do we mean by this? In Paper (I), we gave a succinct description of the twin's view. In the present case, a succinct description of the twins experiences goes as follows:

According to Takunda (α-Centauri bound twin): He is stationery and Tadiwa is receding from him at a speed V and the Earth is receding from him at a speed v. α-Centauri is receding at a speed v while α-Christina is approaching him at a speed v.

According to Tadiwa (α-Christina bound twin): He is stationery and Takunda is receding from him at a speed V and the Earth is receding from him at a speed v. α-Christina is receding at a speed v while α-Centauri is approaching him at a speed v.

The above descriptions are congruent. For example, we just have to swap the α-Christina with α-Centauri and Takunda with Tadiwa, that is, where there is α-Centauri $\longmapsto$ α-Christina and where there is α-Christina we make the replacement α-Christina α-Centauri and where there is Takunda! Tadiwa. It is not possible to do the same in the case of the asymmetric twin paradox of the previous section. This is what we meant when we said the traditional twin paradox is asymmetric even if we did neglect the accelerations and decelerations because the:

Description of events is and can never
be symmetric in the sense envisaged above.

We would like to emphasis that unlike the asymmetric twin paradox where one can seek refuge by invoking the GTR to deal with the accelerations and decelerations of one of the twins, here, this clearly won't work since both twins will all undergo the same experience. Their ages will be less than that recorded by the Earth observers and these observers will measure these ages (of the twins) to be exactly the same but according to the twins, their ages can not be the same, hence a dilemma arises! How do we solve this? We offer in the next section (NB: not subsection but section) what we believe is a plausible solution.

5 Solution by Use of a Third Reference Point

As in Paper (I) which makes use of a third reference point, if Δt_2 is the time lapse of the journey of the travelling twins, then, this time-lapse is related to the time lapse Δt_1 measured by the *stay-at-home* twin by the same relationship of relativistic time dilation *i.e.* $\Delta t_1 = \Delta t_2 / \sqrt{1 - v^2/c^2}$.

Something of interest here is that for the twins in their respective reference frames, they do not arrive on Earth from their journeys simultaneous while according to the Earth observers, their arrival is simultaneous. Logically, we expect them to. But as we know, in relativity, simultaneity is relative.

6 Discussion and Conclusion

6.1 Discussion

Against all which is known within the realm of the laws of binary logic, the twins must – against common sense; each conclude that the other must be younger, which is in-itself nonsensical. For example, if wrinkles are a sign of ageing, each twin must see themselves without any twinkles while they see the other twin to have wrinkles – this is silly if not absurd. To add onto the nonsense and absurdity, despite their identical physical experiences, the twins will not agree with the Earth bound observers that they are the same age! These illogical contradictions point to one thing, that, at the very least, the Philosophy *of* Relativity needs to be revised.

The STR's underpinning philosophy holds that two points are sufficient for the complete description of motion. In Paper (I), we saw the use of a third point and this use of the third point enabled us to concluded that indeed, the travelling twin is the one that really is younger at reunion. We feel that the resolution of absurdities as those we have just encountered in the twin paradox lay in incorporating a third point into the description of motion. This is what we shall do in the third instalment. This third point we shall choose to be an absolute and immovable reference point.

6.2 Conclusion

(1). The case of the symmetrically accelerated twins as presented herein exposes Einstein's Philosophy *of* Relativity that holds that moving is only motion when measured relative to some reference point.

(2). From within the domains of Einstein's STR, we believe there is no consistent answer to the case of the symmetrically accelerated twins as presented herein even when the GTR is taken into account to account for the moments the twins experience accelerations and decelerations.

References

1. Nyambuya G. G. On a New and Novel Solution to Einstein's Famous Twin Paradox Without Invoking Accelerations of the Travelling Twin. *Submitted to Progress in Physics*, 2013, http://vixra.org/abs/1309.0068, pp.1–6.