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Clive Tickner B.A. BSC;

clivetickner@aol.com

A rethink of the Twin's Paradox; build your own light-clock; and a proper look at reciprocal events and the errors of time dilation

ABSTRACT

In physics, the Twin's Paradox is a thought experiment in special relativity, involving identical twins, one of whom makes a journey into space in a high-speed rocket, to return home to find that the twin who remained on Earth has reached a greater age.
Many explanations of this hypothesis have been offered since it was originally posited, (1911 Paul Langevin) with almost as many rationalisations as there are physicists addressing the issue. As this conundrum relies upon the protagonists' *impressions* of events and how things *appear* to them, concerning the passage of time, I build a light-clock, diagnose reciprocity errors and offer new points of view and an unequivocal answer to the riddle.

KEY WORDS

Gravitational forces, Ladder in Barn Paradox, Twins' Paradox, speed of light, space-time diagrams, Einstein's train, Light-clock, simultaneity, reciprocity, time dilation, GPS, satellites.

CONTENTS

The TWINS' PARADOX as CURRENTLY EXPLAINED

Both “simultaneity” and “relativity” are the common sources for resolutions to the Twin's Paradox, but both fail to make a distinction between clock rhythms (their tick rates) and clock time readings, (time co-ordinates), nor do they recognise the indeterminacy of special relativity. The various versions of their application of mathematical formulae are completely chaotic.

A variety of explanations employ an assortment of phenomena;

1) Gravitational time dilation.

2) Acceleration and deceleration; the importance of the *change* in the astronaut's acceleration (whilst others claim that acceleration is irrelevant).

3) The Doppler shift; affecting the frequencies of signals sent from earth to the craft and back.

4) Understanding speed; the difference between “synchronized speed” and "Einstein speed".

5) Minkowski's "world lines"; thought to result in the differing experiences of the two protagonists.

6) Speed of information; inconsistencies in information sent, received or perceived.

7) Symmetry; two reference frames and a broken symmetry between the astronaut and the home-based twin.

8) *Three* reference frames; momentary 'co-moving' reference frames at the “turning around” point, the astronaut switches from one inertial frame (having an outbound velocity) to a second inertial frame (with an inbound velocity). With the third reference frame being with the twin on earth.

9) A distance disagreement; two *opinions* affecting the time taken.

10) The Lorentz factor; most resolutions *already* accept that moving clocks run slow.

In these examples of this paradox, the actual difference in the twin's ages varies considerably. From 200 years passing on earth, against the 20-year aging of the traveller (Langevin), to many *thousands* of years passing on earth whilst the astronaut ages by just 40 years. (Brian Cox). (see Note 2)

All have a solid mathematical 'proof' for their conclusions, thus bringing into question the reliability of mathematics in solving this conundrum.

The astronaut twin's narrative involves far distant stars being reached, and these locations also act as turn-around points, for an equally long return journey. Obviously, it's not the *particular galaxy,* that is alluded to, that explains this disagreement in the opinions about the resulting age discrepancy, as there is no 'special direction' in space.

Therefore, I wish to offer a hypothesis of my own which will circumnavigate all the issues above, thus providing a simple proof that there will be *no difference* in the ages of these twins, after a similarly considerable journey, at a vast speed.

I deal in detail with a breakdown of errors in these professed resolutions later in this essay, but first I offer concomitant examples of space adventures, the results of which have not been addresses by physics.

To this end I ask that you remember that particle accelerators, such as the Relativistic Heavy Ion Collider at the Brookhaven National Laboratory, New York, and the Large Hadron Collider at Cern, rely on a circular ring construction for their experiments, as this offers a path of infinite length in which their speeding particles may traverse enormous distances. A curved path is accepted as being exactly as relevant as would be a straight-line path. (see NOTE 1)

<u>NEW POINT OF VIEW</u> first example

Therefore, let us imagine that the astronaut twin does *not* travel directly away from earth towards some far distant planet, star or galaxy, but accelerates upwards, past the Kármán line at 100 kilometers, past the International Space Station, at its altitude of just over 400 kilometers, and on to reach a height from the earth of approximately 400,000 kilometers, where any affect from Gravitational time dilation (if such a phenomenon does actually exist), is negligible.

On achieving this height, we see her craft establish a fixed orbit, passing close to our moon, and, henceforth, she continues to complete full revolutions, around the earth, at a speed of 97% of the speed of light.

Diagram 1; A journey around the earth.

The length (circumference) of such an orbit will be based upon the radius of the earth at 6,378 kilometers, plus the 400,000 kilometers height the craft has reached; giving an orbital path of 2,553,348 kilometers per each circumnavigation of the earth.

Light itself passes around the circumference of the earth at 7.5 complete revolutions a second, but, at this *outer* orbit, light itself would take 8.5 seconds to complete *just one* revolution.

If the speed of light is taken as 18,000,000 kilometers a minute, then light will travel around this *outer* orbit 7.049 times in that minute, and, with the spaceship travelling at 97% the speed of light, the craft will complete the lesser total of 6**.**838 (*six point eight, three, eight*) revolutions in a minute.

With the twin on earth focusing a telescope towards the moon, as an 'in space' marker, and keeping it set at that same inclination, he could easily observe his astronaut sister passing that particular point in space, those 6**.**838 times a minute.

That is, in the opinion of the earth-bound observer, in *24 hours*, the astronaut's space ship will pass by the 'moon marker' 9,846.72 times, when the moon itself will occupy that same position only once in a 24 hour day.

Now the prediction of the dramatic effect that time dilation has for an astronaut travelling at this speed, as proposed by Brian Cox, for example, is that a 40-year trip for a near-light-speed craft would see 59,000 years pass on earth. (Therefore, a 1-year trip for the craft would correspond to 1,475 years for the earthbound twin- and his offspring).

So, we have current physics comparing the difference in the time experience between our two protagonists as being 1 equating with 1,475.

As space has no left nor right; no up nor down, no backwards or forwards, we can consider that such a circular path for my trip *in no way* differs from a straight-line journey to Alpha Centauri, or the Andromeda Galaxy, (as are often quoted when explaining the accepted paradox between the differing time experiences of the two twins).

Through his telescope, the sibling on earth *must see* his astronaut sister make **9,846** rotations of the earth in *his* single day, given that we have a definite, positive, starting and finishing post, established by the earth-bound twin's telescope's focus, (the moon's initial position) for every earth-encircling revolution made by the spacecraft.

But physics will have it that, when a full 24 hours has passed for the earthbound observer, only a 'one thousand four hundred and seventy fifth' *part of a day* has 'apparently' passed for the astronaut, <u>in the 'opinion' of the earth-bound twin</u>!

The astronaut, should also expect, *at her speed*, and height, to pass the moon 9,846 times an earth day, *but* if we look at the *tiny fraction* of '*her*' day, accomplished <u>in the earthbound twin's *understanding*</u> (i.e. not viewing) she can only have passed the moon **6.67 times**. (9846 divided by 1475) So how will the astronaut's 'view' of how many earth revolutions she has achieved fit in with those hugely conflicting figures? How can the true number of the astronaut's revolutions be based upon the mathematical calculations of a person elsewhere?

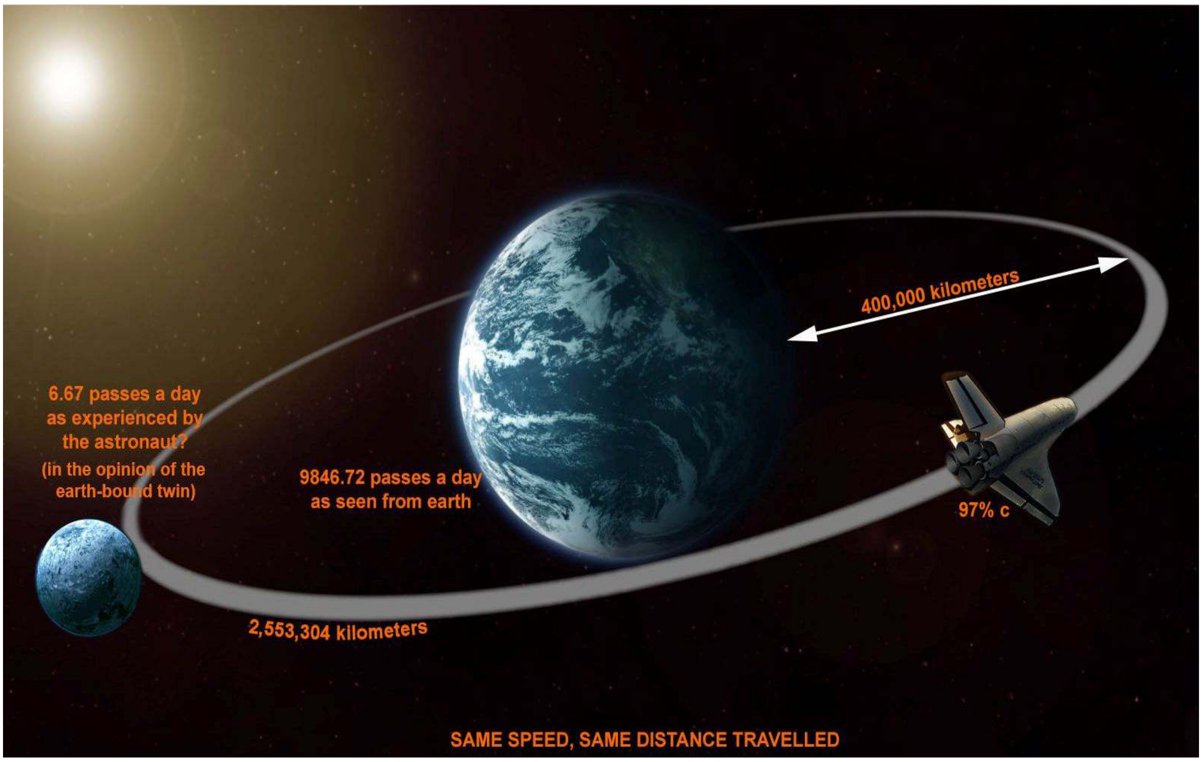


Diagram 2; the conflicting results of such a trip.

Clearly to base any time differences between two protagonists on the ‘opinion’ of the one who is *not* moving, is more than just counter intuitive. It just doesn’t work.

This is no paradox, it's a clumsy, but widely believed, mistake!

There is no possible explanation for the rocket to pass the moon 6.67 times for the astronaut and 9,846 times for the earth-bound observer. At a given speed and distance (however quickly the craft is travelling), the experience of both observers just *has* to match.

After 24 earth hours, should the stay-at-home twin signal to the astronaut that she should return to earth forthwith; on landing, there *cannot* be any disagreement about the number of times the craft has circumnavigated the globe, as predicted by physics, in its erroneous calculations of the twin's paradox.

Should our astronaut ignore the ‘call home’ and decide to continue her journey, however, to the extent of *her* 24-hour day (the 1,475 earth days of physics) then for her, that experience of one single day travelling will have seen her craft (by our earth-bound observer) having orbited our planet over fourteen and a half million times, which, again, clearly does not agree with the straightforward physics of 9,846 revolutions.

Now, if you are concerned about the local gravitational effects on a craft travelling in such a low orbit, let us examine our astronaut taking her trip at a much higher altitude; at a much greater distance from the earth than is our moon. (I will, later, compare the gravitational influences between my *second* suggested orbit and the conventional claim of a direct journey to the Andromeda Galaxy).

<u>NEW POINT OF VIEW </u>second example

Let us take our travelling twin to a distance of 20 million kilometers from earth, (almost half way to the nearest point of the orbit of Venus relative to our world), before she begins a circular path around the earth.

At this ‘height’ the circumference of such a path will be approximately 125,663,706 kilometers in length; where a craft, travelling at 97% the speed of light, will take 7**.**19 minutes to circumnavigate the earth completely, keeping to that orbit.

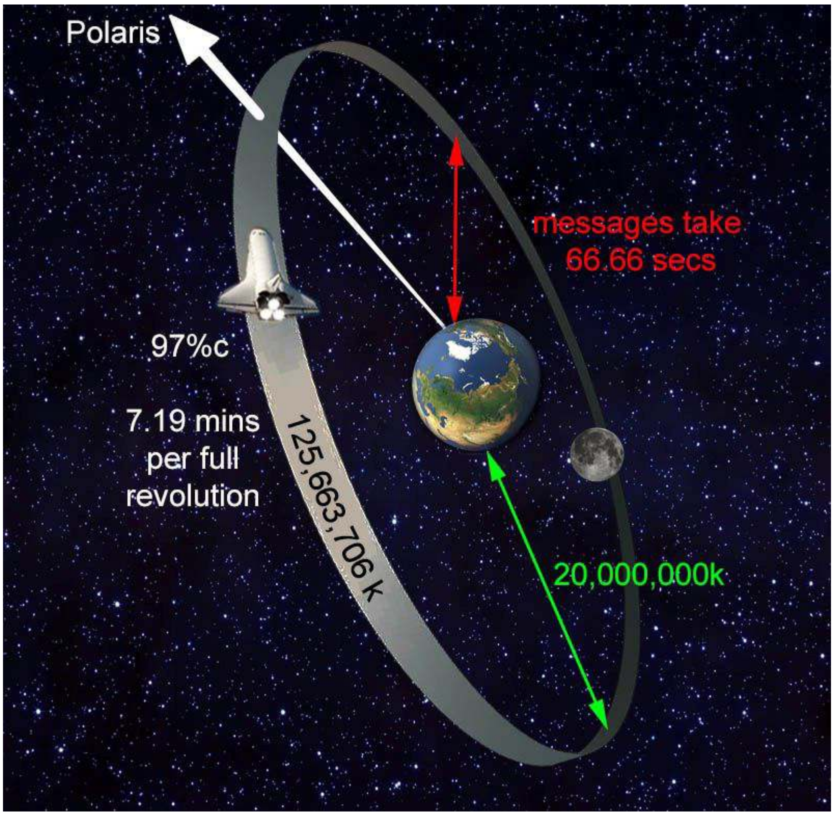


Diagram 3; A more distant orbit

How shall we judge timings now? With a wristwatch, with an atomic clock, with a calendar?

No! In this instance it will be a sensible choice to utilize the properties of 'Sidereal Time' to judge and compare both the astronaut's and the home-bound twin's timing of the spacecraft's number of revolutions of the earth per day, as sidereal time is measured *relative to fixed stars,* rather than to the Sun.

Sidereal time is a system that astronomers use to locate celestial objects, thus it is perfectly suitable for enabling our home-bound twin to point his telescope to pertinent coordinates in the night sky to judge his sister's performance.

In her new quest, our astronaut arranges her much higher orbit to coincide with a 'line of sight' to the North Star. (see NOTE 1) Then, from the home-bound twin's given observation point on earth, the North Star will act as the starting and finishing post, (no matter how many revolutions of the earth the astronaut makes) to be found at the same location each night, at the same sidereal time.

(Actually, a mean sidereal day is only 23 hours, 56 minutes, 4.0916 seconds, this being the time it takes Earth to make one rotation relative to the vernal equinox. However, this tiny discrepancy will make no difference to our calculations here.)

Thus, the home-bound twin, with his telescope aimed towards the North Star, will see his sister pass-by approximately 200 times in his 24-hour day.

Whatever way the astronaut may appear to experience her time differently from her brother on earth, whilst being on the move, she *has* to note the number of times that she passes a line between the earth and the North star. She just cannot pass by this marker, more, or less, times than is noted by her home-bound brother.

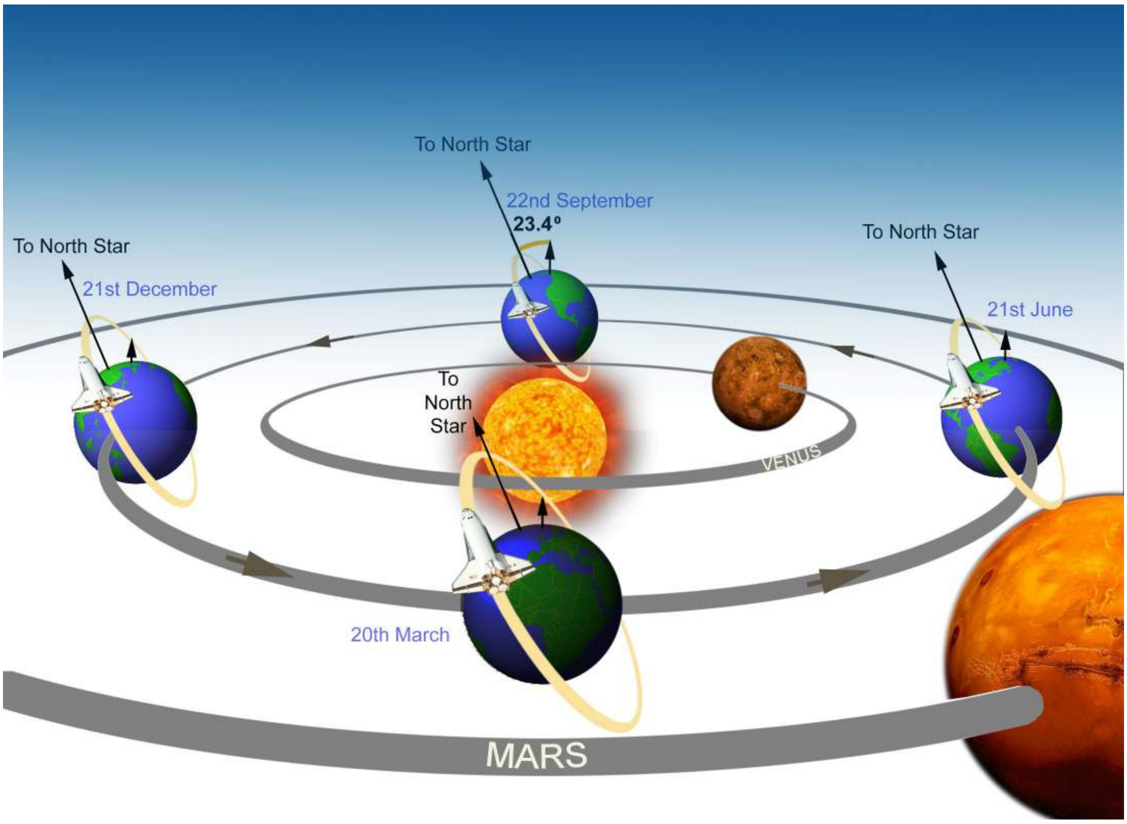


Diagram 4; a second journey, distance-matching an Andromeda trip.

Our astronaut may circumnavigate the globe as many times as is required to equate to a distance of travel to Andromeda, and she may then turn her craft around, having accomplished that similar spatial distance, and complete the same number of revolutions in the opposite direction; if we wish to make exact comparisons with an Andromeda journey.

But will her time experience differ from her home-bound brother? It cannot. There is no way the twins will disagree about the number of passes the craft has made across an Earth / Polaris, start / finish line.

And don't forget, it is the *outside observer's 'view' of a travelling clock that leads him to believe her time runs slow.* There is *no way* he will believe her clock is running slow when he can *see* her pass the start / finish line at times that coincide with his own clock on earth.

It will take a desperate and time-dilation-committed physicist to find fault with this comparative trip.

So, I ask, how could ‘time’ be different between our protagonists? Why is it considered that at a speed close to 'c' an astronaut would experience far *less* time passing than the ‘proper’ time passing on earth? How can the actual time passing for this astronaut be influenced, at all, by the *opinion*, or by the mathematics, of her brother on earth?

GRAVITATION FORCES

Now I return to the issue of any affecting influential forces; comparing the predictable gravitational experience of a twin circumnavigating the earth at a radius of 20 million kilometers, (Sun, moon, Venus, Mars, etc) with the much more dramatic gravitational influences she would meet on her return flight to the Andromeda galaxy.

Let’s look at this Andromeda trip and the ‘Local' group of galaxies through which she will have to navigate, along with the inevitable, “dark matter”, gas and dust that pervades most of the Universe.

NEW POINT OF VIEW the Andromeda Route

No current interpretations of the Twins' Paradox address the impact of gravitational fields through which the astronaut must travel; an odd discovery as massive objects within the Universe are bound to impede or influence her journey greatly.

Firstly she would inevitably come under the gravitational influence of the 400 billion stars in our own Milky Way, especially those of the Canis Major Dwarf galaxy, and latterly the Leo II and I Dwarfs (Leo B,DDO93 and DDO 74, UGC 5470) plus the Leo T Dwarf.

Then, much later, she will reach the Sagittarius Dwarf star cluster, (which spans about fifteen hundred light years) possibly also being influenced by the celestial bodies of Ursa Major II, before encountering the vast star collection of the Large Megallenic Cloud.

The obstacle, after Boötes I, will be the small, Megallenic Cloud, (SMC,NGC 292), then the Ursa Minor Dwarf and the Draco Dwarf (DDO 208) plus the inevitable influence of NGC 2419.

Next, she will have, possibly, to navigate close enough to the Sextans Dwarf (which may not be gravitationally bound to the Local Group) to be affected by their gravitational influence, and later encounter the Sculptor Dwarf (E351-G30), followed by the Ursa Major I Dwarf (Uma1 dSph) and the Carina Dwarf (E206-G20).

With still a tremendous distance ahead, our astronaut will be tackling the distant impact of the Fornax Dwarf (E356-G04)

These precede the Phoenix Dwarf Galaxy (P 6830) and Barnard's Galaxy (NGC 6822) and also MGCl (10) and NGC 185. (The star with the largest known proper motion is Barnard's Star.)

Her next hurdles will be in passing the outlying Andromeda II and IC 10 (UGC 192) at 5000 light years in width, and NGC 147 (DDO3), then Leo A (Leo III, DDO 69).

Before Andromeda I and III, she'll have to pass IC 1613 (UGC 668) then the Cetus Dwarf, before M32 (NGC 221), which is about halfway between our galaxy and that of actual Andromeda star cluster.

Getting closer to her goal she will encounter the Cassiopeia Dwarf system, (Cas dSph, Andromeda VII) and LGS 3 before Andromeda V.

The Pegasus Dwarf Sph (and V1) and Andromeda VIII mark the ending of her journey, finally to arrive at her turn around point; the trillion or so stars of the Andromeda Galaxy itself (M31).

So, I think we can negate any criticism of my suggested *circular* trip, around our world, arising from the gravitational influence of our local planets or stars, as clearly, she will experience many more of such problems whilst on her alternative but corresponding journey to Andromeda!

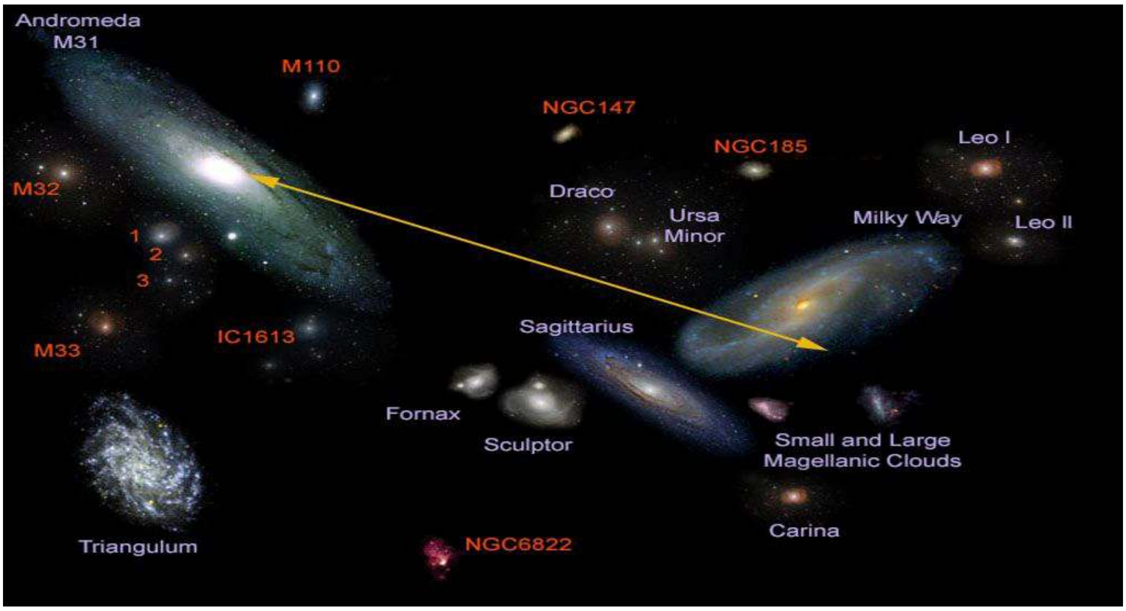


Diagram 5; The route to Andromeda.

I think this way of looking at the 'so-called' 'Twin's Paradox' clears up any ideas that considerable speed is able to provide an expanding of time and a shrinking of distance, as there obviously can be no difference in the time experiences of these two protagonists, in my two examples above, when sidereal time measures matching 'passes' of a fixed-star-marker, for both observers.

Also, we will see that the word "*appears*" actually 'appears' throughout every explanation of the Paradox, and it seems to me to flag a major question. It is a non-sequitur exploited in the explanations of the Twin's disconnected time frames, as it links a *presumption* of events from which *facts* are concluded, (which don't necessarily follow logically from previous statements).

EXAMPLES OF VAGUE CLAIMS

As examples, here are quotes from many published answers to the Twin's Paradox;

"Special relativity tells us that an observed clock, travelling at a high speed past an observer, *appears* to run more slowly".
Does an *appearance* necessarily constitute a concrete occurrence? What is the value of a single opinion?

"A star, six light-years away to the home-bound twin, *appears* to be only 4.8 light-years away to the traveller at a speed of 0.6c".
It *appears* to be, but is it really? Has a 'proper' physical distance, provable by measuring the passage of light from that star, been bodily contracted by a perception?

"Therefore, to the traveller, the trip to the star takes only eight years, whereas the homebody *calculates* it taking 10 years."
But this calculation is questionable, for to complete a trip 20% faster than expected by a home-bound observer, the *measured speed* of the craft must be *more* than calculated by the astronaut; or the distance shorter. Also, a 20% increase in speed would require the craft to travel at the speed of light.

"So, to the earthbound twin, the traveller's clock *appears* to be running at half the speed of his clock."
Again, it only *appears* to run at half speed. These authors are not committing to 'the clock actually, really and truly running at half speed' as alleged by this traveller.

"So, the traveller also *views* the homebody's clock as running half the speed of his clock".
Well- from where the traveller is, he cannot actually *view* the homebody's clock, so this is only an assumption.

"So, back on earth, the stay-at-home twin, now *sees* the traveller's clock advance eight years in four years of his time; it is now twice as fast as his clock."
Again, the earth bound twin cannot actually *see* the travelling clock, so this is another assumption.

"We find the outbound traveller *thinks* he arrives at Alpha Centauri earlier than the Earth observer *thinks* the outbound traveller arrives there".
No empirical evidence; just two characters' *thinking* about what might have occurred.

"The outbound traveller *might say* it took him twenty years to get there when the Earth observer *thinks* the outbound traveller arrives there after thirty years.
More vague assumptions, now considered to be fact.

I 'think' we can agree that the above claims are worthless, as semantics are never a good explanation of facts or reality.

THE FLASH OF LIGHT

So.....Let us examine and criticise such a circumstance whereby two observers *appear* to disagree on the timings of a 'flash of light' in a famous explanation of the phenomena.

Consider a travelling train carriage, in which there is a travelling passenger/ observer, and, outside, watching the train pass, is a second observer.

A flash of light occurs in the middle of the carriage just as the two observers pass one another.

The travelling observer's understanding of the event

For the observer on board the train the front and back of the carriage *are at fixed distances* from the source of the initial flash, and according to this observer, the light will reach the front and back of the carriage *at the same time*.

Do you see the error? The carriage ends *were* at a fixed distance from the flash *when it occurred*; yes. But the flash occurred at a position relative to the earth, *not* relative to a moving carriage, no matter how it *appeared* to the traveller.

The carriage end walls were *coincidentally* equidistant to the initial flash, but the true *position* of the flash *source* cannot be relative to, and tied to, a moving carriage. It is relative to a point on the earth over which the train was travelling.

The flash *source position* must be located by the particular railway sleeper over which the flash source, (in the carriage), was travelling *when it flashed*.

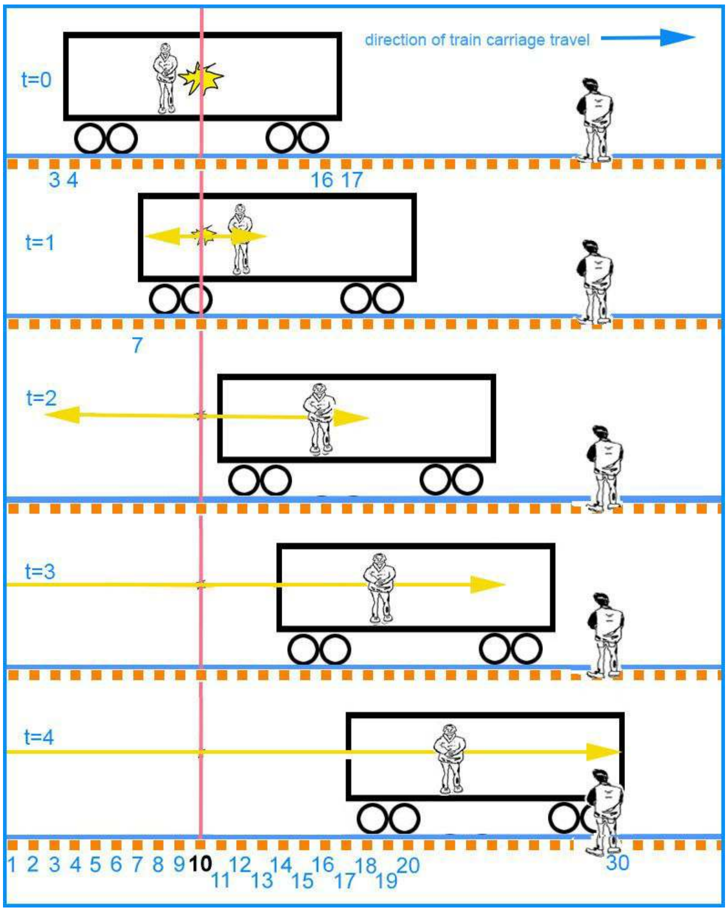


Diagram 6: A correct interpretation of the flash in carriage hypothesis.

In diagram 6, the flash occurs whilst the carriage crosses railway sleeper 10. At that moment the carriage walls *were* equidistant from the flash and the light from the flash did extend in all directions.

But once the light has flashed, the travelling source is NOT a *continuing* location point from which the flash originated. As the rear end of the carriage approaches the expanding light from the initial flash, its *originating point*, in the train, is no longer relevant. The travelling observer *cannot* see the flash hit both ends of the carriage at the same time.

The pink line above STAYS as the *flash source*, therefore the propagation of light performs equally, wherever one stands to view it.

The exterior observer's understanding of the event

For the exterior observer this situation is perfectly clear. He sees the rear of the carriage is moving *toward* the point at which the flash was given off. He sees that the flash occurred as the source was passing over railway sleeper 10, and he sees the no-longer-relevant, *originating-point* moving away (relative to the carriage) from its initial position.

The light from the flash heading for the back of the carriage will certainly have less distance to cover than the light headed for the front wall, so the flashes of light *will* strike the ends of the carriage at different times. But the light from the flash which *does* hit the rear end of the carriage will be seen *at the same moment* by both observers.

The light striking the front end of the carriage will, again, be seen at *exactly the same time* by both observers. Their experiences will *exactly* match. There is no time lag, between them both, in the simultaneity of their perception of this event.

A very far distant observer may 'see' the flash at a later moment, but being sensible, he will realise that this is a factor of the speed of light over distance.

With the speed of light being finite and the same in all directions for all observers, this only serves to underline the identical experiences between these two protagonists in this commonly misunderstood example.

It is totally bizarre that physics refuses to acknowledge that, *of course* the rear of the train is approaching the flash point, BUT in *exactly the same way* for both protagonists. This does not happen solely in the domain of the outside onlooker. The fact that the train's forward movement is more obvious for an exterior observer than for the travelling observer, is completely irrelevant; leading to the false conclusions so widely, and naively, held.
We will see later yet another naive explanation of what happens to light emanating from a contained flash.

Now this leads us to the crux of the matter, the misunderstanding of 'simultaneity'; with this being the basis for the misrepresentation of the time experiences of our twins.

SIMULTANEITY

According to the Special Theory of Relativity, 'relativity of simultaneity' is the concept that one cannot determine whether two distinct, but *spatially* separated, events occur at the same time, or not, as it depends upon each observer's reference frame. It is maintained that two separate and distant events which are recorded as being at the same time *on earth*, will *appear* to have occurred at a *different* time by an aircraft passenger flying overhead.

This hypothesis serves to endorse the possibility of time being different between the Twins.

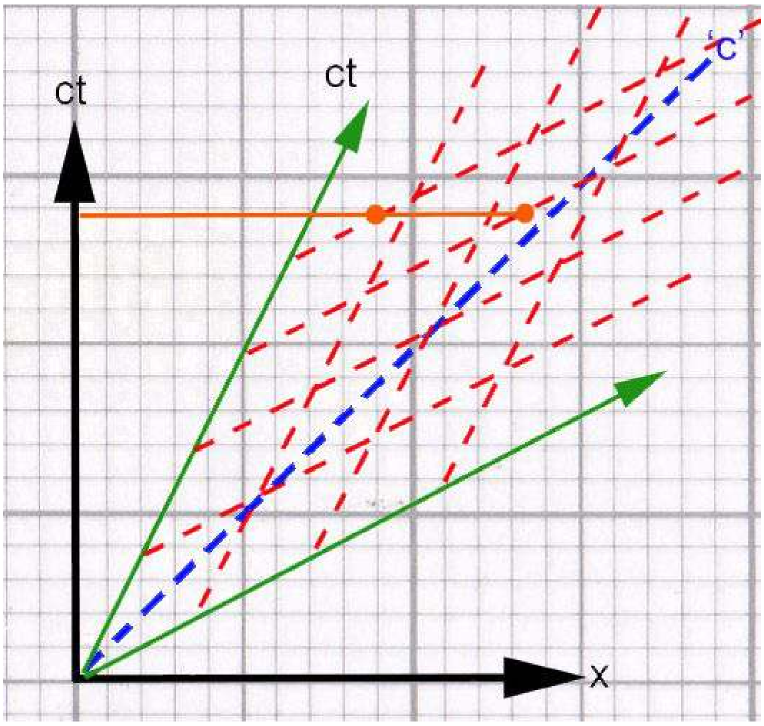


Diagram 7: 'simultaneous' events.

This is the kind of diagram that seeks to explain the 'perception' of the different timings of a singular event.
The particular incident that occurs here in the 'stay-at-home' observer's time, is where the orange horizontal line coincides with his upright, black, time-line.
It is horizontal because he is only moving (up) in time, but not to the right, as he is stationary. (such is the current reasoning).
Because the second observer is in motion, that speed is recorded by the lower green line, set at an angle to reflect the fraction of the speed of light; (the blue dotted line) at which she is moving.
All events experienced by the traveller are recorded (red dotted lines) at an angle to match her speed, established by the lower green line.
In consequence, instead of what should be a perfectly synchronous experience of an event (one orange circle only on the orange line) for both protagonists, we read that the moving observer's orange circle is in a different position from that of the stationary observer. The incident, thus, is considered to be simultaneous, but not coincident.

Taking this hypothesis further we can see how mathematics predicts further discontinuous 'simultaneous' episodes in the lives of our twins.

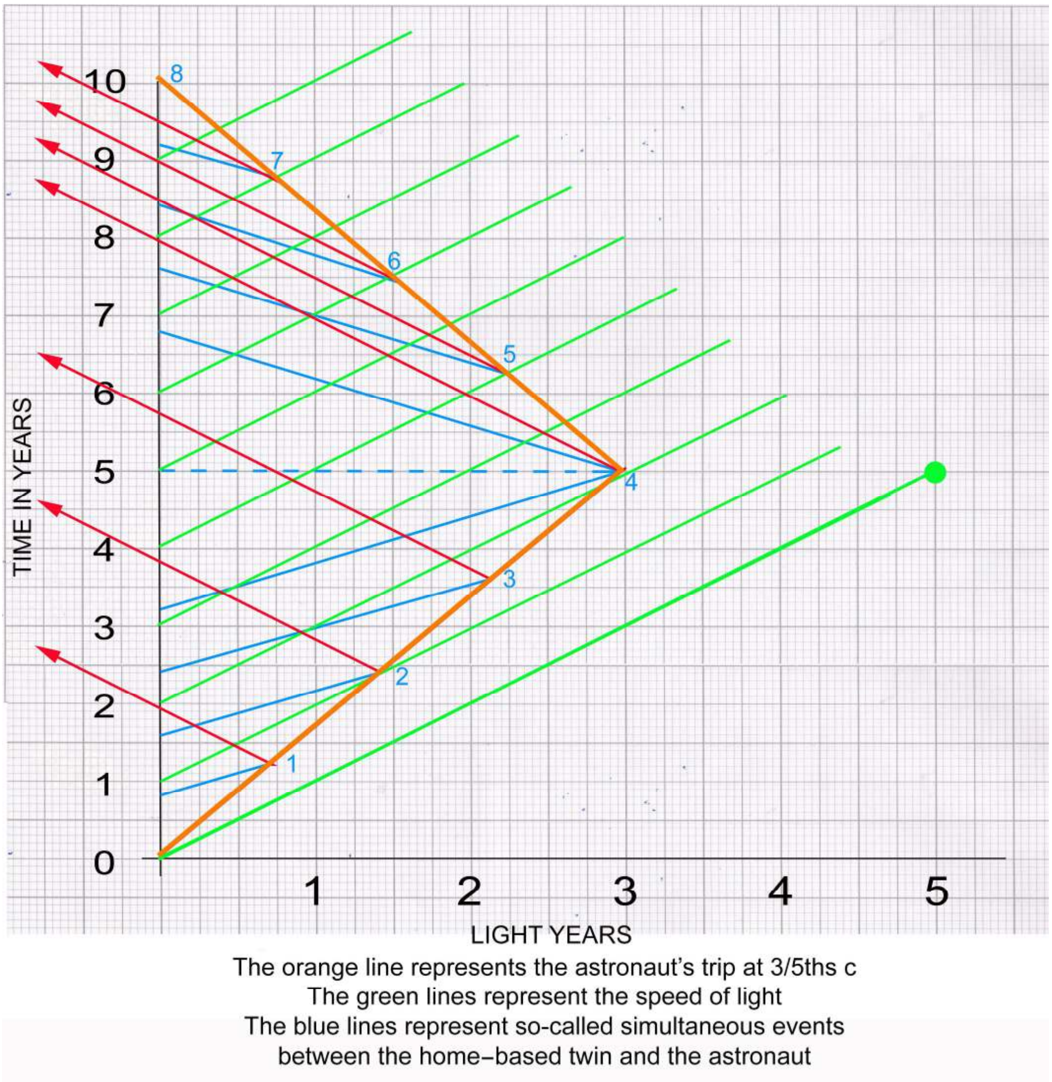


Diagram 8; the misleading depiction of an astronaut's time frame.

As the figures for the Andromeda trip are inevitably huge, after all it is 2.5 million light years from us, and one light year is approximately 9.5 trillion kilometers, this diagram shows only a 5-light year graph, with the astronaut travelling for 3 years on the outward journey, and the same on her return. All principles remain unchanged.

The upright 'x' axis is the time-frame of the stay-at-home twin.
The orange line is that of the astronaut.
Current physics tells us that the blue lines demonstrate the passing years for each twin, revealing the changing values of spacetime's relative simultaneity.

According to this representation of the Twin's experience, 8 months passing for the stay-at-home twin equates to 1.2 years for the traveller.

1.6 years equates to 2.5 years etc.
So, at the heart of the twin's conundrum is the hypothesis of time dilation and the idea that a simultaneity of events in a spacetime diagram *appear* not to correspond with 'simultaneous' events on earth.

The relativity of 'simultaneity' is calculated using the Lorentz transformation, which relates the coordinates used by one observer to coordinates used by a second observer (in uniform relative motion with respect to the first observer).

It is the Lorentzian interpretation of coincident events that has mislead mathematics, allowing distorting graphs to explain how an event (A) can be both before or after event (C) as experienced by an observer (the red line) moving up the (warped) spacetime scale, as shown below.

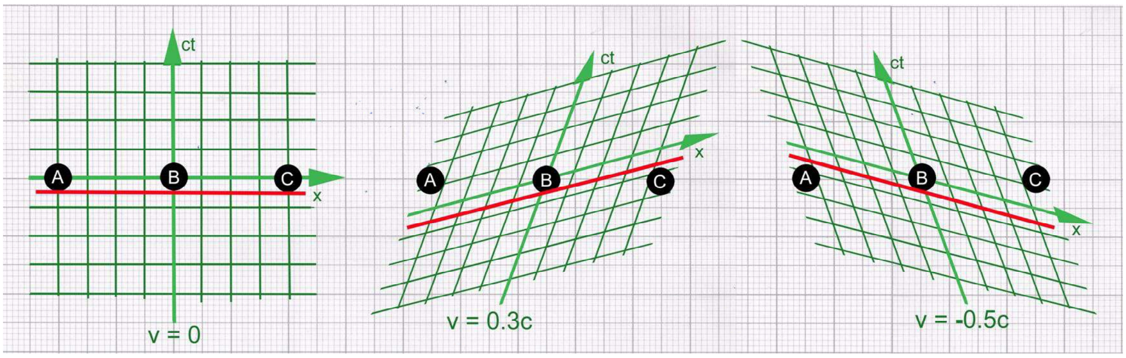


Diagram 9: The bending of time.

This hypothesis, allows for a graph to represent two, so-called, simultaneous events, (but spatially separated) with 'Relativity' endorsing them, as happening at different times. It is this muddled thinking that has led to the 'paradox' of the twins, when, of course, as we have seen, there *is* no paradox- as there is no difference in their experience of time passing.

THE SPACETIME GRAPH FAILS (1)

Let's look at my astronaut's orbiting, (but equivalent), journey described above and *attempt* to create a spacetime diagram to match an Andromeda trip. Again, I am selecting only 5 of those 2.5 million light years to discuss.

We know that she is circling the earth at an altitude of 20 million kilometers, and she is travelling at 97%c. So first we plot the speed of light. The green line reaches 5 light years along the y axis and that corresponds to the 5 year marker on the time axis.

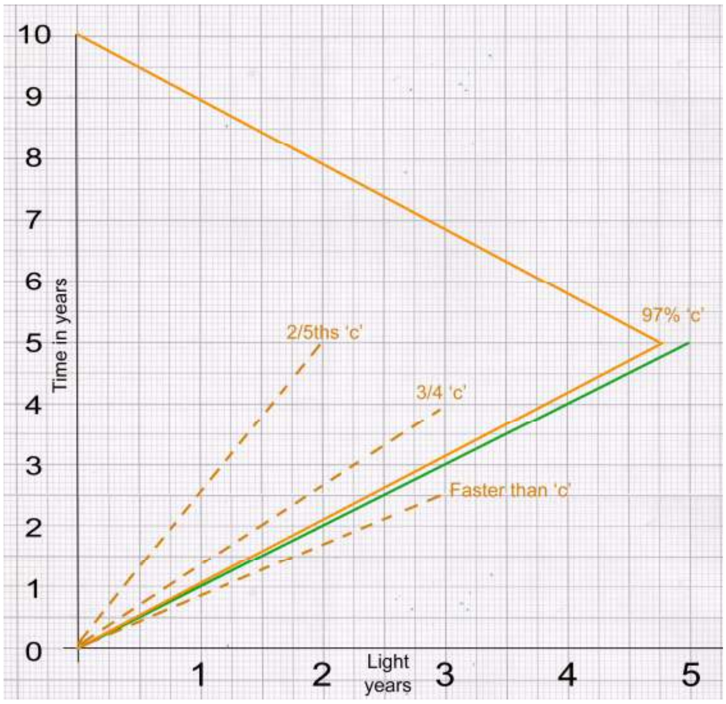


Diagram 10; a spacetime diagram for an orbiting astronaut?

For this example, we know that during her flight she has crossed a Polaris/Earth line as many times as has been recorded on Earth. Therefore, our astronaut (the orange line) *has* to be where the 5-year time marker coincides with the 4.85 light-year marker. Those are dictated by her having travelled at 97% c, whereby she has unavoidably covered the lesser figure of 4.85 light years against light's 5 years.

However, she is *not* 4.85 light-years from earth. At her speed she is 68.66 seconds away from earth, although, incontestably, still having travelled for 4.85 light-years.

We cannot move her orange line to the 4-year marker, for example, without slowing her speed down to 75%c
We cannot allow her to travel 2 light years in 5 years as the more we move her orange dotted line to the left, the slower we are making her craft.

If we place her orange dotted line anywhere *below* the green line of 'c' she is exceeding 'c'.

Our astronaut is in her reference frame, and her brother occupies his, in exactly the same way as they would, should the astronaut be on a straight-line journey to a distant star. This layout 'appears' to represent her speed, distance and spacetime as, again, it reflects, for her, the same distance and spacetime, as she would be spending, in a five-year segment of her journey to Andromeda.

But what *doesn't* work is the possibility of applying to the graph a representation of our astronaut sending signals home. At 20,000,000 k above our world, a message will only take 66.66 seconds to reach her earth-bound, twin brother, and that message-time cannot alter throughout her trip. Therefore, this apparently crucial piece of spacetime information *cannot* be plotted on a spacetime graph, which, by their very design, imply an *expanding communication* distance.

A SPACE-TIME DIAGRAM PRESUPPOSES EVENTS

Any diagram designed to simplify the understanding of a physical event should allow for possible changes and variations, within the parameters of what it seeks to explain.

However, *implicit* in a space-time diagram is the assumption that the astronaut travels *away* from the earth-bound observer. Inherent in its layout, is the predetermined and inflexible notion that an *increasing spatial gap* is the *inevitable* product of her journey. (until she turns around).

I cannot emphasise enough the totally erroneous and unacceptable conclusions that this entails.

A space-time graph *dictates* how, and where, her journey progresses, rather than her journey dictating the *construction* of a graph. This is not right.

As shown in all the diagrams above, the astronaut's time-line extends *at an angle* (to indicate speed relative to 'c') from the upright timeline of the earth-bound observer. Thus, there becomes the inescapable assumption of a growing *distance* gap between our two protagonists.
The space-time graph lay-out also, inevitably, demands an automatic acceptance of a growing *time-gap* between the twins, and the concomitant implications of that are, that any *messages* being sent between them *must* occur over longer and longer time periods. And the most damning implication of this is, that the further and further apart the twins grow, the more incongruent are their time frames.

We cannot plot an *orbiting* astronaut, with an upright line, as this indicates that she is not progressing through space-time distance. A horizontal graph-line of her path would indicate that she is not travelling, at all, in time.

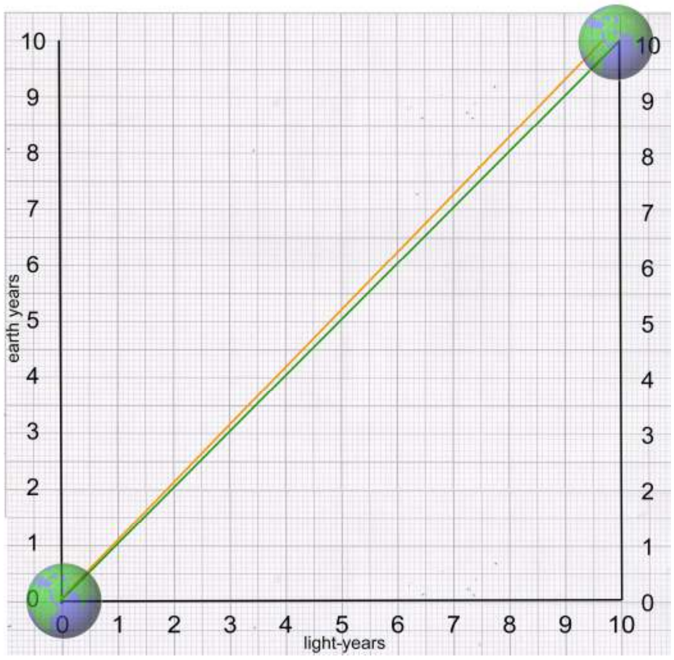


Diagram 11; a simple interpretation of a ten-year trip.

Perhaps this graph is the only way to represent an orbital trip, but as you can see the astronaut has to meet the earth-bound twin's time-line where their ages inevitably correspond.
Light (the green line) has travelled 10 light-years in ten years. The astronaut (orange line) has travelled 9.7 light-years in ten years. The earth has travelled through time for ten years.
Everything and everyone is ten years older.

If a spacetime graph fails in any one example, it is completely inadmissible to physics.
All we are left with, to discuss, concerning the Twin's Paradox, is it being the *opinion* of the earthbound twin- that the astronaut is taking a particular time for her journey. And he is probably wrong.
And it is the *opinion* of the astronaut that -she has taken less time than was previously predicted. And she too is probably wrong.

Yet, in current physics, so much is predicated on these erroneous judgements of *two*, yes, only two, observers.

Later we will be examining additional faults with the space-time concept, but for now let's consider possible conditions *for* simultaneity.

THEORETICAL EXPERIMENT in simultaneity

I would like to offer a mental experiment, in order to examine further the whole notion of 'simultaneous' events;

If you were to call out the word 'NOW', and at that *exact moment* the whole universe froze, what might we see if we could be the only moving object, and to cruise about, checking just what did freeze, at that particular moment?

1) Your neighbour is locked solid at his fridge door, about to take out the butter.
2) On the other side of the country, a delivery boy is totally still, knuckles poised, about to knock on a door.
3) In Spain an elderly lady is unmoving, as she stoops to feed her cat.
4) In Melbourne, Australia, a young girl is caught rigid, as if petrified, whilst awakened by an odd noise outside her house. She half sits up, frozen at an awkward angle. Slipping bed sheets are as if starched; rigid in space, locked off whilst falling off the bed.
5) In an aircraft overflying the pole, a stewardess is like a statue, about to offer a passenger some duty-free items. The plane itself is motionless, locked to the coordinates over the earth.
6) An astronaut in the International Space Station is motionless too; a drop of liquid from his dispenser hovers immobile above his cup
7) On Mars, something that was moving is now completely stationary.

And all this has happened at your call of 'NOW'. All those events *coincided* with your call of 'NOW', because you chose that!

No information has passed from you to them. They do not have any idea who has immobilised them or why.
No matter whether these characters were still at the time of your call, or whether their circumstances were in speedy motion; the Universe is, at present, full of totally inert states, all representing what was occurring when you called, NOW.

These correspondingly static proceedings were not triggered by a real, physical signal, nor were they affected by the speed of information, or the speed of light. They were not causally linked, nor were the events *related* to each other in any way.
Everything that 'is', could be described as being in its own reference frame. And *everything* just locked up solid at your NOW instant.

Everything just froze, for you, at that exact moment, for your perusal.

Those events are *unquestionably* concurrent, they are and were, *simultaneous* actions, absolutely everywhere, and it was *you* who dictated that frozen moment.

So, it wouldn't require signals to pass from an astronaut to earth to compare their timings, when you called NOW, as they, as part of everything, also froze up *simultaneously.*
That was exciting, so now you call "GO"; releasing the freeze.

8) Your neighbour resumes movement, takes the butter and closes the fridge door.
9) A customer, hears a knock, and opens their door, to take goods from the delivery boy.
10) In Spain the cat is fed.
11) In Australia sheets fall from the girl's bed. Her father is disturbed by her cry, heard from his own bedroom.
12) The aircraft resumes its flight and the passenger buys a watch.
14) The momentarily immobilised object on Mars moves again.

You must agree that all these circumstances, now returned to action, were synchronous.
Also, you must agree that, in no way, and in no-one's opinion, events 1 through 7 could come *after* events 8 through 14. Occasions 1 - 7, unquestionably, did come before occasions 8 - 14.
Events 1 - 7 all *had to be* coincident, as did 8 - 14, *because* you deemed it so!

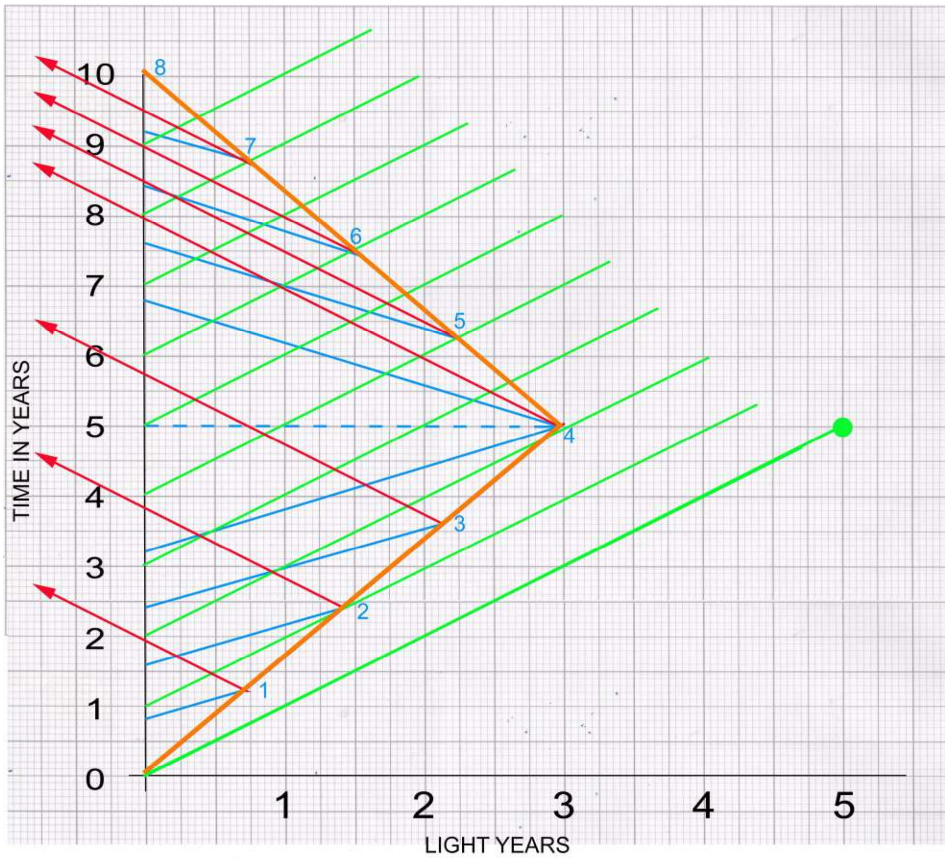
<u>The length of the pause you created would *have* to have been a matching time-gap for our astronaut, and for the earth-bound twin- had they been part of your experiment.</u>
However, if there was *ever* a discrepancy between the twin's experience of their own time-frames, then, at your calls of NOW and GO such an incongruity would *have* to be *exactly replicated* in your pause. Their experience of the length of the time of the pause you created would *only* have to be *different*, if we continue to believe that a difference *did exist* between them already.

Why, then, would it be only in this single case that the Twin's time-lines coincided with one another?
And if there is no time differential in the lives of these twins at your NOW and GO moments, how can we believe that time, either side of your pause, is inconsistent? Understanding this is crucial!

<u>THE SPACETIME GRAPH FAILS (2)</u>

So contrary to the claims of the ‘relativity of simultaneity’ we can see from above that, however far apart observers are from one another, no matter their speed, height, or location, it is possible to find truly concurrent and synchronised activity throughout the Universe.

With this in mind, let's see if we can find further faults in the construction of space-time graphs, apart from being unable to represent orbital journeys.



The orange line represents the astronaut's trip at 3/5ths c
The green lines represent the speed of light
The blue lines represent so-called simultaneous events
between the home=based twin and the astronaut

Diagram 12; As diagram 8.

Returning to the popular, fixed idea of the astronaut journeying *away* from earth, here we examine in more detail an astronaut's *5-year* trip (orange line) travelling at 3/5th the speed of light, over the 'space-time implicit' *growing* distance from her twin. It should now be obvious that the 'simultaneous' blue lines, professing a period of *four* years in the life of the astronaut (1 to 4 blue numbers) coinciding with the *fifth* year (black numbers) of the home-based twin, needs additional questioning.

The continuing green lines (messages emitted annually from the time location of the stay-at-home twin), travel at c, and are received by the astronaut where each of those lines cross her orange path. At graph year 5 she has received only three messages, whilst on her return trip she receives 8, more frequent, messages. (reason demonstrated).

Now, the purpose of a graph is to relate, visually, common or connected events. Clearly, a graph allowing both 4 and 5 years to be aligned on the 5-year marker is mathematically disingenuous. The conclusion thus achieved being that the astronaut has experienced only 8 years, when meeting her sibling at the top 10-year marker. Again, how can this make any sense of the ten-year marker if that figure doesn't apply to the astronaut as well, now she has reached it? She has returned after 10 earth years! And her twin is at that point also.

All journeys in space-time are considered equal. If more 'distance' than time is used up by the astronaut, she ages slowly. When more time than distance is consumed by the earth-bound twin, he ages more quickly.
That is the hypothesis.

But a space-time diagram shows that the returning astronaut has used both a great deal of 'distance', but she still arrives back home, to meet her twin, at the top of the x axis.

The graph therefore shows that she has consumed the *same* amount of time on the x axis as has her twin, *plus* she has managed to travel great distances as well. The Twin's events do not appear to be equal.

The graph also shows *another* piece of *seriously* conflicting information.

On one hand, by the angle of her journey, relative to the angle of 'c', she is shown to travel at 3/5ths the speed of light. (diagram 12)
Should she have actually only travelled for 4 years, then the speed of her ship must have been 3/4 c. Which results in an increase in speed of over 10,000,000 miles per hour.

Again, conflicting information does not a useful graph make!

SIGNALS HOME

Still staying with the idea of a straight-line journey for the astronaut, and, again, adhering to the conventional system of assembling a graph, then the diagram below shows the yearly signals sent from the home-based twin to his astronaut sister during her flight. This image describes an astronaut travelling at 0.8 of the speed of light, over a 20-year period.

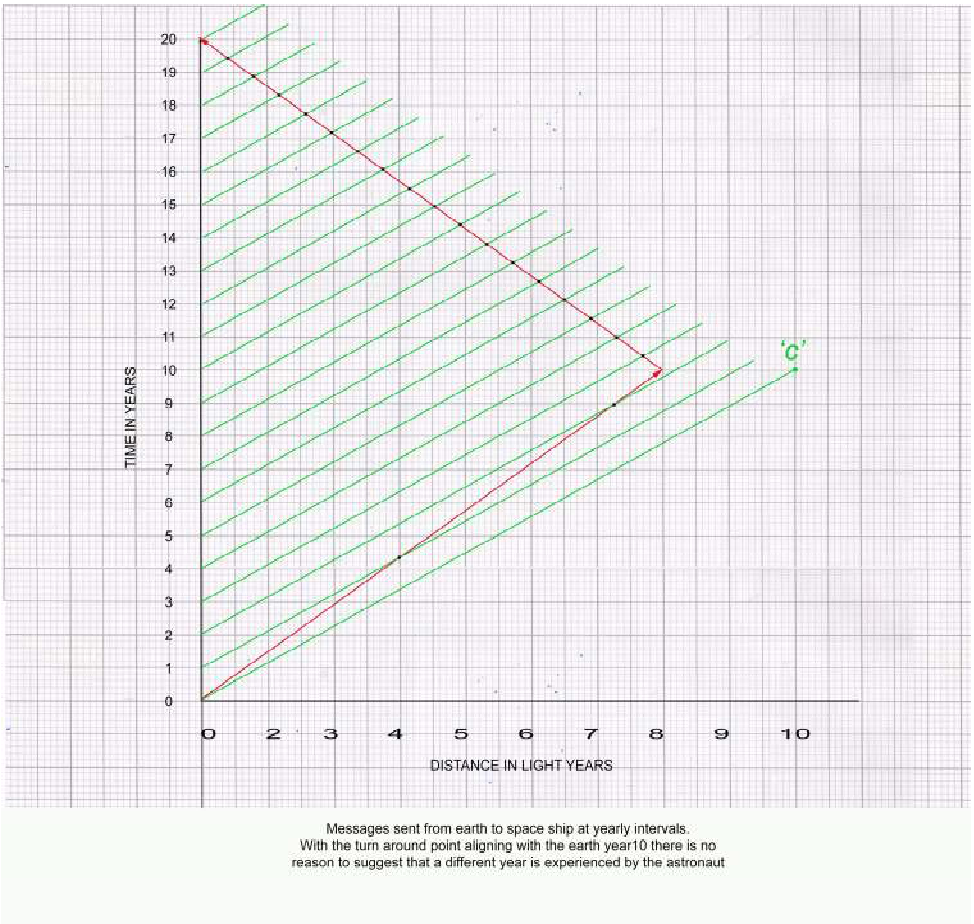
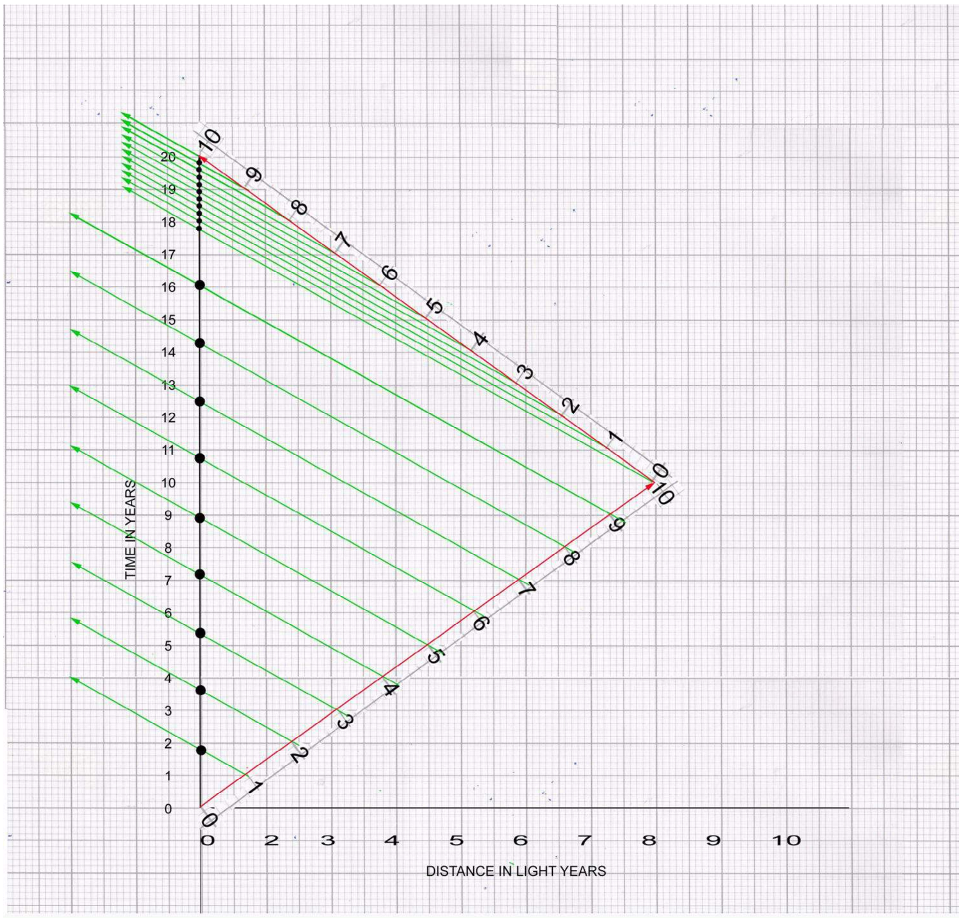


Diagram 13; messages from earth to spacecraft.

Part of this chart coincides, and agrees with, the erroneous graph of diagram 12, in that the astronaut receives far fewer messages from earth on her outward journey than she does on the return trip.

This would not concern or confuse either party as they are competent physicists and know that the distance between them both, was firstly expanding, and latterly contracting.

Now we look at signal 'messages' being sent in the opposite direction; from the astronaut to her home-based brother.



messages sent from the astronaut to earth. The earth bound twin knows when his sister
has turned aroiud as the signal periods close up to a new pattern

Diagram 14; message from spacecraft to earth

Let our astronaut take with her a very basic Japanese electric wristwatch. (and maybe a spare battery) She has no need of an atomic clock on board, even if there *was* enough space for such a huge piece of equipment (plus the cooling apparatus to protect its accuracy). We do not need this kind of precision as was required, at the time, and failingly used, by Hafele and Keating.

Unaware of speed and the affects of any gravitational forces, this watch will inevitably keep to earth time.

Messages from ship to shore will again expand and contract time-wise, from outward trip to return journey. And we can ignore what each protagonist *appears* to understand of their sibling's account of time passing as, looking at this graph, it goes without saying, that at her speed of 0.8c, in 10 years, she will have travelled for 8 light years. Her return trip matches this.
On her return, the Twin's ages again coincide.

I have admonished earlier, the several physicists who have made woolly claims concerning 'time dilation', based solely on conjecture and supposition. I now address another 'paradox' that equates to that of the 'Twins', whereby, once again, the *impression* or the *opinion*, of one observer, concerning the behaviour of another observer, is allowed to dictate physics.

In this case, the way in which one observer *appears* to comprehend another's activities, leads to the concrete conclusion of 'length contraction'.

As length contraction and time dilation are both controlled by the Lorentz transformations, the ladder paradox can be seen as a physical correlate of the twin paradox.

Below I show exactly what are the erroneous exploits of the protagonists involved in the "Ladder in the Garage".

I describe events as they are currently accepted by physics, whereby solid objects cannot be perfectly rigid under special relativity. I also show, once again, where physics fails in the *complete* concept of reciprocity.

THE LADDER IN THE GARAGE PARADOX

It is claimed that length contraction occurs at speeds close to the speed of light. This phenomenon is based on the hypotheses I have been criticising above; the comparison between a *moving* frame of reference versus a *stationary* reference frame.

Here in diagram 15, (frame **1**) we have a static ladder, at its 'proper' length, which in subsequent frames is allowed to travel at 80% the speed of light towards the open doors of a garage, having a solid back wall.

An observer within the 'static' frame of the garage, *perceives* that the approaching ladder is shortened by 'length contraction'.

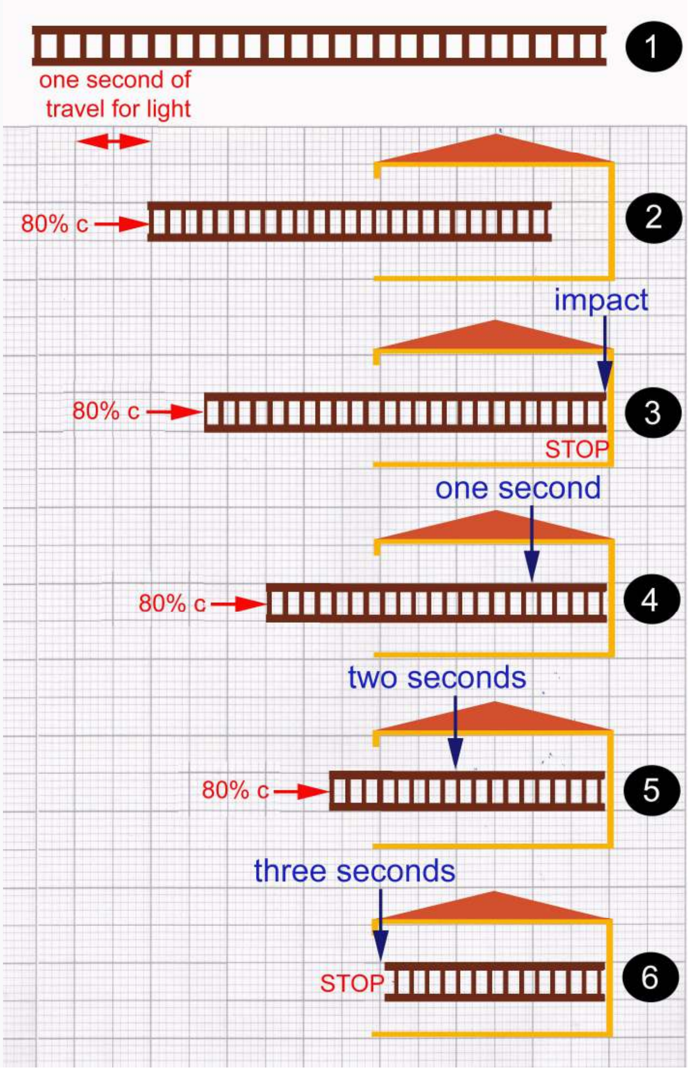


Diagram 15; a high-speed ladder seeks to enter a static garage

Frame **2** shows the shrunken ladder approaching the garage, at 80% c (it crosses 8 of the small squares per second).
Light (and information) is travelling at 10 small squares a second.

Frame **3** shows the front of the ladder impacting against the solid rear wall of the garage.

Physics now tells us that the *back end* of the ladder *does not know* that the *front* of the ladder has stopped, as all information about the impact has to travel at c. Therefore, the *back end* of the ladder *keeps* moving into the garage at 80% c (8 squares a second) until the 'impact message', (the blue arrow, at 10 squares a second) reaches the ladder's back end, (frame **6**) and tells it that the rest of the ladder has stopped; so, the back end stops too! (and for that tiny moment fits into the garage).

Now, this doubly-shrinking experience is considered to be consistent with effects upon an observer *moving with the ladder,* travelling at constant velocity and occupying the ladder's own inertial frame, when travelling into the inertial reference frame of the garage.

For a second observer, (with the garage), by the principle of relativity, the same laws of physics must apply. There *must* be a reciprocal event, as we know that it is never possible to state, in any such situation, exactly 'who is moving'

So now we must consider the garage travelling at 80% c towards a 'proper' length static ladder.

For the observer travelling with the garage, her analysis of what is occurring will be different from the observer in the reference frame of the ladder.

She notes the ladder as being stationary, and accepts that the garage is moving at 80% c.
In her interpretation of the event the garage is length contracted, and therefore, with its initial size already being too small to take the ladder, there is no hope at all that the garage will ever contain the ladder.

This is all well and good *if* one continues to adhere to length contraction theory. However, in every example of this paradox, *crucial action* is missed.

I am about to add to the interpretation of this event by addressing situations previously unconsidered.

<u>A NEW POINT OF VIEW </u>the Ladder

If we accept that, when the ladder struck the end garage wall, its *front* stopped whilst the *backend* continued to travel, then, by reciprocity, when the *back* wall of the travelling garage impacts with the static ladder, and stops, the *front* of the garage should *keep moving* (at 80% c) until 'information' (at 'c') from the impact reaches the garage's front end, and tells it to stop. This circumstance has *never* been addressed.

Below is a diagram demonstrating the reciprocal circumstances that *should* be considered to match diagram 15 above.

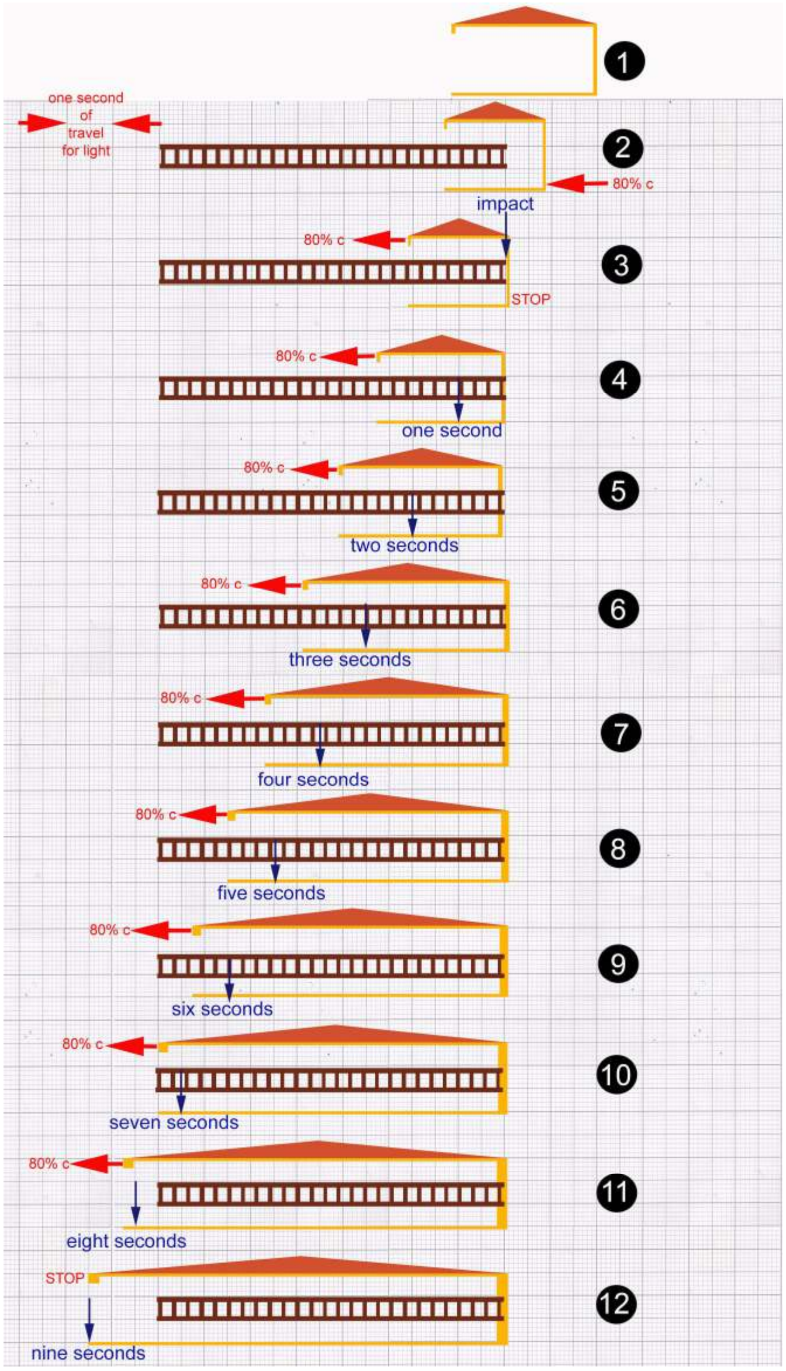


Diagram 16; a high-speed garage seeks to enclose a static ladder.

Frame **1** is a non-shrunk 'proper' length garage.
Frame **2** is the garage, travelling at 80% c, and considered to be shrunken.
Frame **3** is the impact of the *back* of the garage against the front of the static ladder, about which the *front* of the garage is, as yet, unaware.

Frames **4** to **12** show the impact information, (the blue arrows) gradually catching up with the still-travelling *front* of the garage, until the building actually *appears* to enclose the ladder!
Frame **12** shows exactly where the impact information (blue arrow) coincides with the front opening of the garage.

As if this hypothesis isn't complicated enough, let us have one thousand 'static' people watching this charade from an adjacent hillside. What to they see? If they take a photograph what do they record?

Let's add a passing car, travelling quickly in one direction, past the garage, and another car, at a similar speed, travelling, close by, in the opposite direction. What do the occupants of these cars see?

If the behaviour of moving objects can be modified by the interpretation of any and all observers, it becomes obvious that this hypothesis is not only completely unwieldy, but it totally leaks credibility, as it demands an infinity of possible solutions.

RECIPROCITY ISSUES

Now I am going to examine the whole issue of reciprocity in physics as we can see already that desperately poor attempts have been made to employ this method in order to substantiate beliefs in time dilation and length contraction.

So, physics has, as part of its armoury, a tool that allows the determining of the time-stretching possibilities of fast travel, and this faulty concept has become the corner-stone for the solving of the Twin's age difference in their Paradox.

Physics clearly asserts the following, with the questionable wording highlighted;

"A moving clock doesn’t move so fast through time as a stationary one."

"A clock sitting at rest (being the outside observer) travels along in the time-direction at the speed 'c' with no motion through space"

Although it is often agreed that one cannot tell *who* is moving, it must be false *always,* ever to consider that one-of-a-pair is truly 'still'. We should *never* be able to agree whether there is *ever* a 'stationary’, or an 'at rest' clock.

Brian Cox tells us that we can *choose* whichever observer we like, to be the one considered to be 'at rest'. But why should we have to do this when we know that *nothing* can *ever* be in that state. How would things look if we *refuse* to allow *either* person to be 'at rest'?

Everybody and everything is moving; the earth, its population, the sun, the planets, the Universe; *nothing; nobody* is truly still.

So, to select one of two protagonists, and claim that *that* particular observer, in any examined event, is 'still', is disingenuous and unacceptable.

Also, the notion that every person can consider themselves 'still', in relation to themselves is absolutely pointless and without meaning, as, if that fact is common to everybody, then any virtue that suggestion might have had, is lost though equivalence.

I want to investigate further how such a restrictive view of reciprocity is yet another erroneous contribution to the solving of the Twins' Paradox.
So, here we go again;
"Einstein's theory allows us to contemplate the possibility of travelling huge distances, (perhaps nearly 3 million years to the Andromeda galaxy), in a human lifetime."

Einstein's contention, then, accepts a *time-stretching factor* straight away as a solving tool for the Twin's Paradox, allowing the conclusion that the astronaut's life may be slowed down, relative to her twin on Earth, to enable great distances to be travelled.

This time-stretching formula, at its root, *appears* to compare different times passing between two observers, *as* if it is actually *completely* addressing the issue of 'who it is, who is in motion'.

But does it?

We can see from physics' current answer to the Ladder Paradox that reciprocity is not *fully* taken into account when considering those matching events, and therefore we should look further into other examples of reciprocity to discover how accurate and honest are those attempts at providing corresponding circumstances to pertinent incidents.

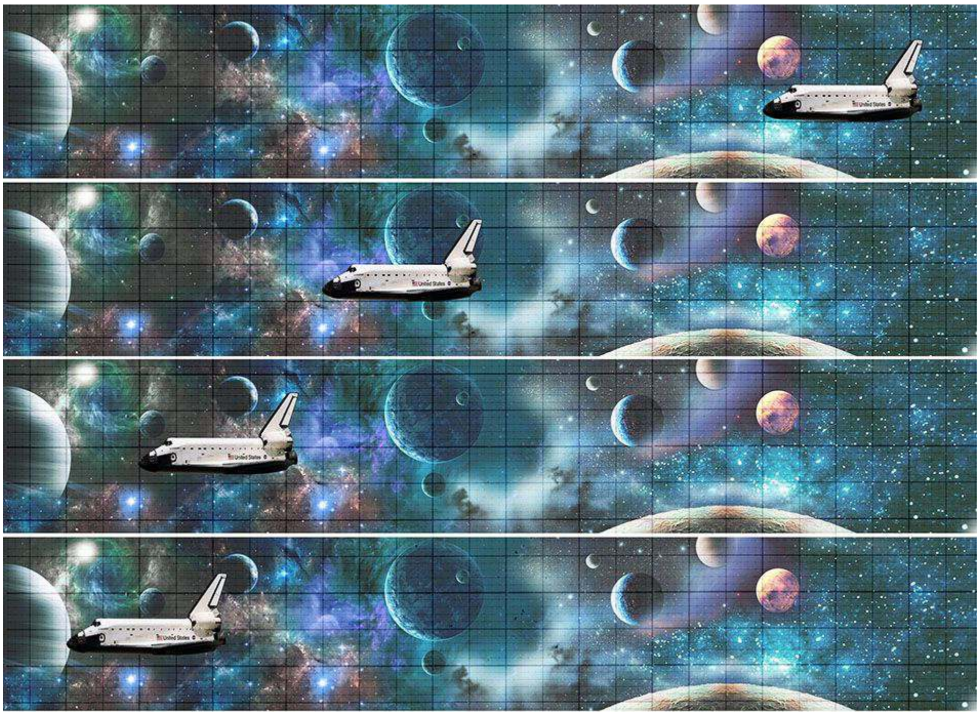


Diagram 17; the astronaut Twin travels through space.

Diagram 17 shows a spacecraft progressing from the large planet on the lower right, until it noses up against another pale planet on the left.

If this is our astronaut twin, then physics requires that we should investigate the reciprocal event for stay-at-home brother.

For this matching event the astronaut is free to say that she is standing perfectly still, (relative to herself - whatever!), in her space rocket, watching *the earth* fly away at high speed.

And that’s that! But, as with the ‘ladder paradox’, this interpretation of the astronaut’s mirrored view is *unbelievably incomplete*.

<u>NEW POINT OF VIEW</u> reciprocity investigated

It cannot *just* be the *earth* which in a reciprocal situation, when it 'flies away from our astronaut at high speed'. This is *far* too selective, it ignores the fact that the earth *is a part of* the Universe and cannot be separated from it. The earth cannot change its place in the firmament at the whim of an astronaut!
Therefore, it must be the *whole of the Universe* that speeds away, past her stationary craft.

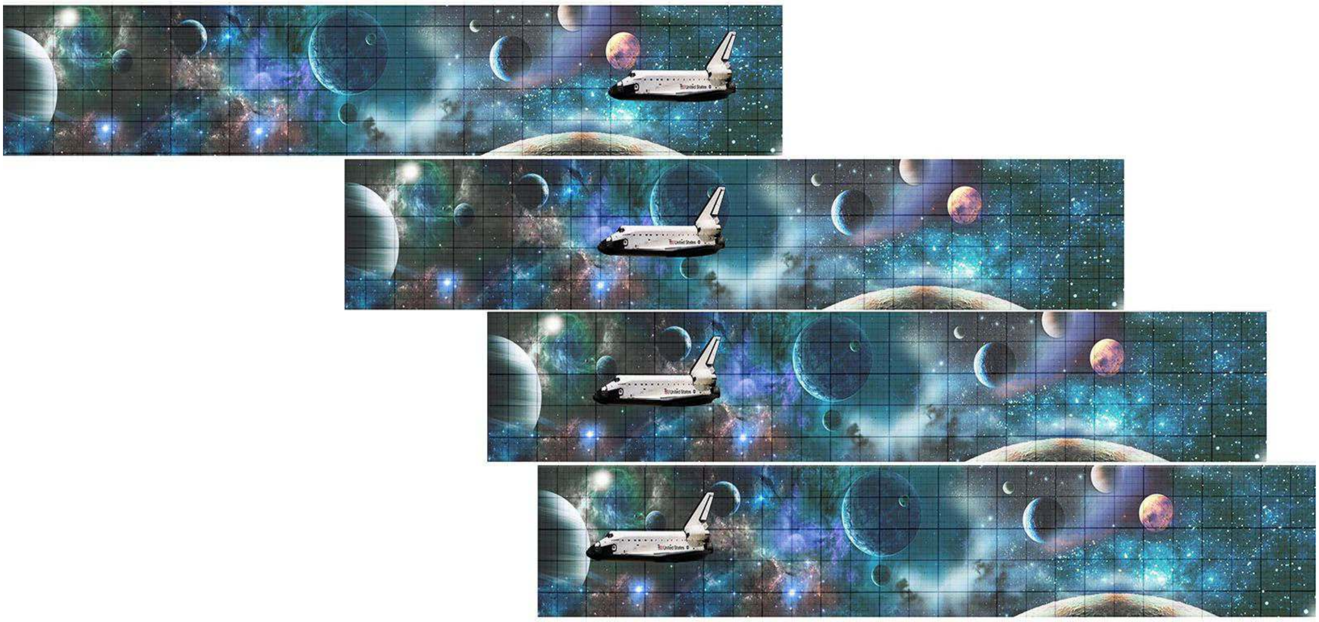


Diagram 18; the earth PLUS the whole Universe speeds to the right,

<u>the proper reciprocal event</u>

The Universe, then, must be considered to travel at exactly the same (reciprocal) speed, but in the opposite direction, as the spacecraft travelled, when we consider it to be the astronaut as static.
In the diagram above the gap between craft and planets matches the earlier diagram. However, the spacecraft stays central to the frames now, and all of the planets move to the right.

In a nod to reciprocity physics asks; "Can it really be that both of the twins age more slowly relative to the other?"
"Obviously they cannot *both* be younger, or older, than the other."
"So, who is the older on the astronaut's return?"

But, of course, if the reciprocal event is considered *properly* then, an *exactly replicated* matching circumstance would *have* to affect the home-bound twin, in *exactly* the same way as we are claiming the astronaut is undergoing. And this would indeed *cancel out* any such age changes, and that would answer those questions above.

<u>reciprocity forgotten 1</u>

Physics would rebut with "Time is not universal". However, I have argued earlier that time *can* be consistent throughout the Universe.

When Physics automatically employs the time-stretching formula (when considering the 'speed of motion through space-time') to *one* observer only, in a misunderstood, reciprocal environment, inconsistent time-frames arise. (where the reciprocity between two protagonists is forgotten)

I have already criticised space-time diagrams; and their unreliability is demonstrated again in diagram 19 below, where the generally agreed paths through spacetime taken by the twins, as measured using clocks and rulers *'at rest'* relative to the earth are configured. (their possible reciprocal circumstances are forgotten)

So, one part of this accepted illustration below has the earthbound twin *'at rest'*. And, once more, the relationship of the earth to the rest of the Universe is abandoned. (universal reciprocity is forgotten)

In this diagram the stay-at-home twin remains on the earth (ignoring the movements within the Universe, that affect his twin too) and consequently his path only is considered to travel up the time axis, where almost all of his allocated speed through space-time is expended travelling through time. (the reciprocal event is ignored)

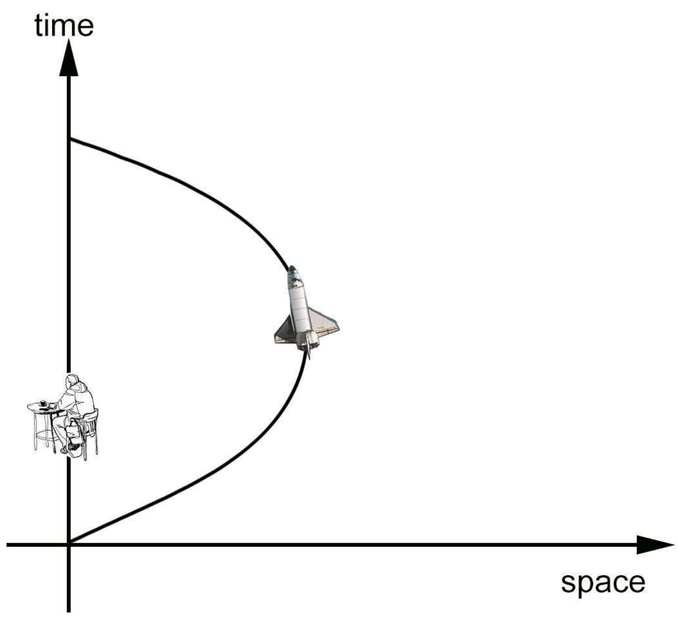


Diagram 19; considering the astronaut as the traveller.

Here the astronaut twin, travels close to light speed, and therefore uses up, mostly, her space-time speed.

We can see, represented, that the twins take different paths through spacetime, even though they start and finish at the same point. (and this is reciprocity forgotten once more.)

Also, let's recall from the first part of this paper, that If she had taken an orbiting route for travelling the same distance 'through space time', this could not be represented on this graph.
The above space-time diagram implies, as we have seen earlier, that the astronaut travels *away* from her earthbound twin, and then *back* towards him.

reciprocity restored 2

However, sticking with this illustration, it has to be possible to demonstrate that the earthbound twin is the traveller. In which case, the distance between the twins *must* also match throughout *his* journey. He will be moving *away* from the astronaut, then *towards* her, mimicking *exactly,* but opposite, the distances and directions that his twin sister has followed.

Diagram (20) correctly looks at the possibility that the spacecraft is the item 'at rest'. In which case the astronaut would have almost all of her allocated speed through spacetime expended *travelling through time*.

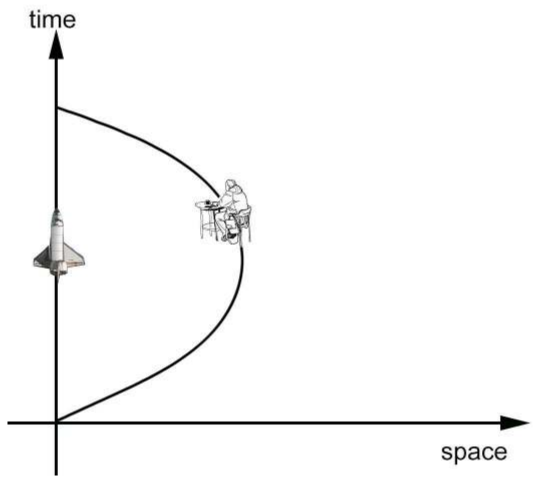


Diagram 20; considering the earth-bound twin as the traveller.

Here we have the earth-bound twin moving.
But, of course, now, he also is considering himself static, relative to himself, which makes obvious how woolly is this notion. The result of this reciprocal event *must be* that we are able to cancel out any time deviations at all.

With this matching circumstance, the distance that separates the two twins must correspond *in every respect*, so it will be *he* who occupies the graph's curved line. If we all agree that the space-time concept *must* embody reciprocity, then this graph too must stand and be pertinent.

The protagonists start and finish at the same point on the upright axis, and, as the graph shows, they both arrive at the same time and date on earth.

This still fulfils current physics' claim that the length of two different paths in spacetime can be different. They are, in both the above cases. Everyone can thus still agree on the *particular* length of any individual path through spacetime, with the lengths of any paths being different.

We have been told that the formula for distances in spacetime is, $s^2 = (ct)^2 — x^2$. and physics has it that the space-time distance is biggest for any path that has $v = 0$. (other paths must be shorter because of having to subtract the $+x^2$ factor). With *either* protagonist travelling along the time direction (with x near zero), *either* path can still be the longest possible path! We still then have the issue of which twin is the older. So, for physics, this paradox has not been solved.

<u>reciprocity forgotten 2</u>

For the final justification that time differences do exist between the twins, current physics chooses to abandon reciprocity once more when attributing *acceleration and deceleration* to the astronaut only. (yes, reciprocity forgotten)
Being pressed back into her seat with speed changes is considered by physics as an action / event that can *only* occur for the astronaut. This then permits their claim that, after all, it is only *she* who is in movement. (yes, reciprocity ignored)

This separate misunderstanding of the essential matching of circumstances, allows for the unforgivable assertion that *speed changes* determine a *special direction* in space: a direction of the acceleration which the astronaut only experiences when she turns her craft around. (reciprocity seriously disregarded)

<u>reciprocity restored 2</u>

And this is the *major* flaw, in stating that an acceleration and deceleration can *only* affect the astronaut.

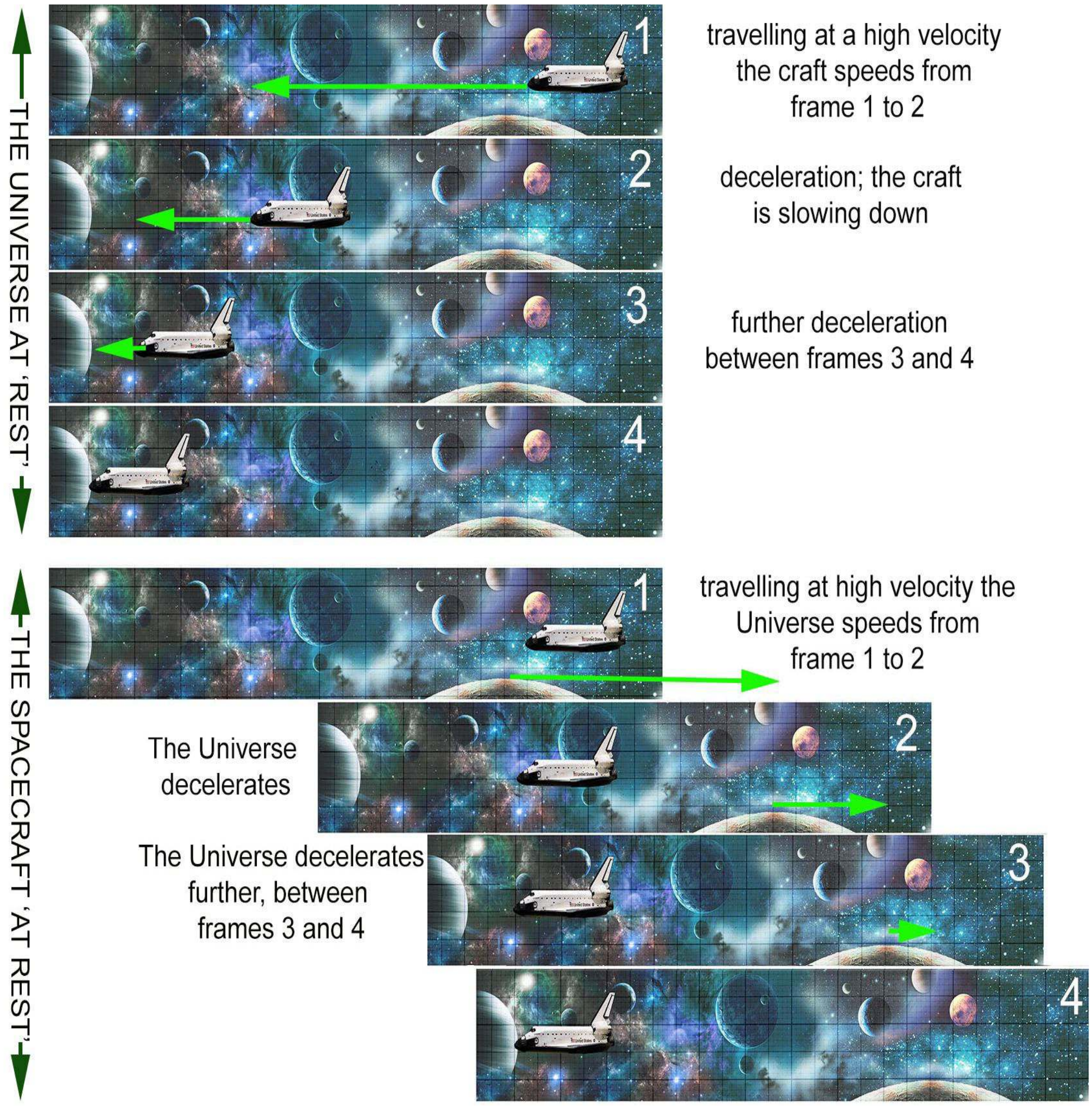


Diagram 21; showing the reciprocal effects of deceleration on both the space-craft and the Universe.

Here we have images that match the earlier illustrations of the spacecraft moving through the cosmos.
The upper four frames have the cosmos 'at rest'.

The spaceship's gap between frames 1 and 2 establishes a particular speed.
The shortening forward progress of the craft between frames 2 and 3 indicates a deceleration, as the distance travelled is less than before.
Between frames 3 and 4 that gap has lessened further. The craft continues to decelerate.
The craft, overall, has travelled from the pale planet lower right up to the planet far left.

The second (lower) set of frames, from 1 to 4 keeps the spaceship in an 'at rest' situation, and, still diagram 21, the *Universe* travels to the right.
But, once more, the green gaps from the top four images *must* match the lower four images for a reciprocal event to occur.
The Universe is at a set speed between frames 1 and 2. The *gap* lessens between 2 and 3, and also between 3 and 4, exactly as it did in the upper frames.

This clearly shows that acceleration and deceleration *must* be experienced in both circumstances. They *cannot* be applied to one party only.
True reciprocity has to match *everything* from *both events*.

An accelerometer is a device that measures proper acceleration, that being the acceleration, or rate of change of velocity of a body in its own instantaneous rest frame. The top four images of diagram 21 have the Universe as the rest frame; in the lower four images, it is the space-craft that is the rest frame.
At any point in spacetime the equivalence principle guarantees the existence of a local inertial frame, and an accelerometer measures the acceleration (and deceleration) relative to that frame. So, the space-craft has its deceleration measured in the top four images, and the Universe has its deceleration measured in the lower frames. There is no getting around this!

Therefore, an accelerometer, present in *either* reciprocal event, as in diagram 21 above, would register the *same change* in relative velocity. The accelerometer would *inevitably* read an acceleration/ deceleration, and the astronaut *would* be pushed back (or forward) in her seat in *either* reciprocal events, as the mass of the Universe affects the spacecraft in both situations. Otherwise the word reciprocal has no meaning.

The claim that when the spaceship fires its rockets to turn the craft around, the stay-at-home twin ages rapidly, relative to the astronaut, is totally unacceptable. And offering that as the reason why the astronaut ages more slowly during the non-accelerating phases of the expedition is derisory.

I would like to think that I have demonstrated the unlikely circumstance of two twins aging at different rates, by offering the concept of orbital travel to denounce the use of space-time diagrams, and by criticising the erroneous notions of events that are considered reciprocal, but aren't.

Now I will address a third issue currently allowing physics to adhere to the notion of differing time-frames, by criticising the maths, whereby equations are being based on the applying of Pythagoras' theorem to the ubiquitous light-clock, an instrument both unfeasible and immaterial.

THE LIGHT-CLOCK RATIONALISATION

The theoretical light-clock, from Einstein, is the root source; the fundamental premise, from which the belief in the feasibility of time-stretching stems.

This invention, along with the imagined observations of two very special protagonists, has formed the basis for all time dilation mathematics since.

If I were to propose a series of presumptions predicated on the premise "what if a ray of light could penetrate a sheet of steel" I am sure that there would be no-one reading further than that initial introduction.

Light cannot do that- ever, that's an unquestionable fact, so we need go no further with linked, predicated, or guessed at assumptions, that *might result* from such a ridiculous scenario, as they would be, a-priori, worthless.

And yet, all of the events implicit in explaining the Twin's Paradox have been *initially* predicated on an *equally impossible* premise; the light-clock.

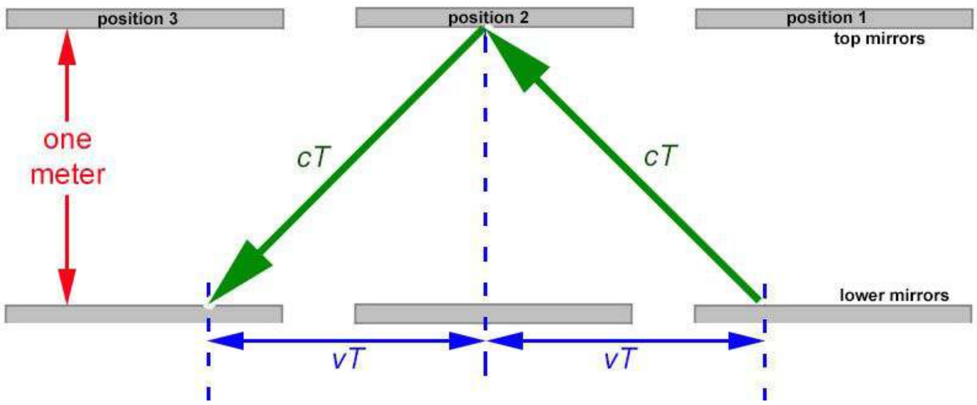


Diagram 22; the light-clock principle.

For those familiar with this diagram, and the concomitant maths that attend it, which purport to explain the differing time-frames between a moving and a ‘static’ observer, please skip these next few paragraphs.

This image depicts a light-clock.
A train is traveling, and within it are two parallel mirrors facing one another.
The two green arrows indicate, time-wise, a bouncing beam of light, between those mirrors, within this train carriage, as an <u>outside observer</u> might see. This illustration acknowledges that, as the train moves, the mirrors move too; they are not at the same place when they receive the reflected light, as they were when that light was emitted.

The beam of light travels from the lower mirror to the top mirror and back again, at 'c', the speed of light, constituting one full tick of this timing device.

The train is moving at speed *v.* so the clock on the train must move *vT* for each half tick. The upright distance is shown as one meter. (And twice that is considered to be the 'one-tick' experience for the travelling observer.) Therefore, physics considers it possible to construct the following equation, based on Pythgoras' theorem. $(cT)^2 = 1^2 + (vT)^2$. This equation may then be used to work out *T* by reconfiguring the numbers to give; $T^2 = 1/(c^2 - v^2)$

Therefore $2T = 2/\sqrt{c^2 - v^2}$. gives the time taken for a tick on the train, but *only* as 'seen' by the outside observer.

The time as 'seen' by the train traveller is just $2/c$, as for her the mirrors *stay one above the other,* during each reflection. (an error consistent with the mistaken belief, earlier, that a flash-*source* in a carriage *stays* positioned central to that travelling carriage).
Comparing the two results gives a slow-running ratio for the train-clock of $1/\sqrt{1 - v^2/c^2}$ which, in relativity theory, is shown by the Greek letter Gamma; γ, and this is considered to be the 'time-stretching factor' approved to influence all and every mathematical formula when considering the time differences experienced by two observers in differing reference frames.

"Travelling at 90 percent of the speed of light, the train's clock would, therefore, (in the opinion of the outside observer) tick at less than half the rate of the watch on his own wrist", continues the erroneous assertion.
This, then, allows for the presumption, that we have met in great detail above, whereby the traveller is *aging* more slowly than the outside observer. And this is the mathematical explanation of why a travelling twin returns to earth at a much younger age than her stay-at-home twin.
(so, once again, we have a mathematical *opinion*, from some casual by-stander who is considered to be 'still', being actually, physically able to alter the time-frame of a moving vehicle.) The maths is therefore nonsense.

NEW POINT OF VIEW debunking the light-clock

So, Pythagoras and Einstein's light-clock have a lot to answer for. Together they are accountable for the time-stretching factor of relativity, that I hope I am debunking.

Build your own light-clock
In diagram 23 we have an easy construction whereby a spark is being generated across a gap by the bringing together of two poles, carrying a high-amperage,

DC, electrical current from a battery. The arcing gap is placed centrally between two parallel, front-silvered mirrors.

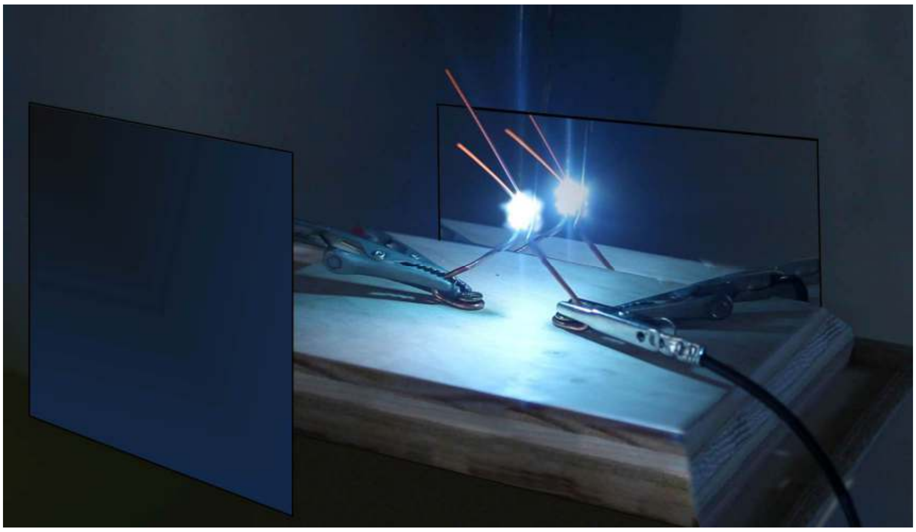


Diagram 23; A DC spark between parallel mirrors.

Whilst the battery is connected, a fast-growing sphere of light will continue to expand away, in every direction, from this bright source.

But when the battery is disconnected, everything goes dark. Oh dear! Why is this? Why doesn't this apparatus immediately become a light-clock?

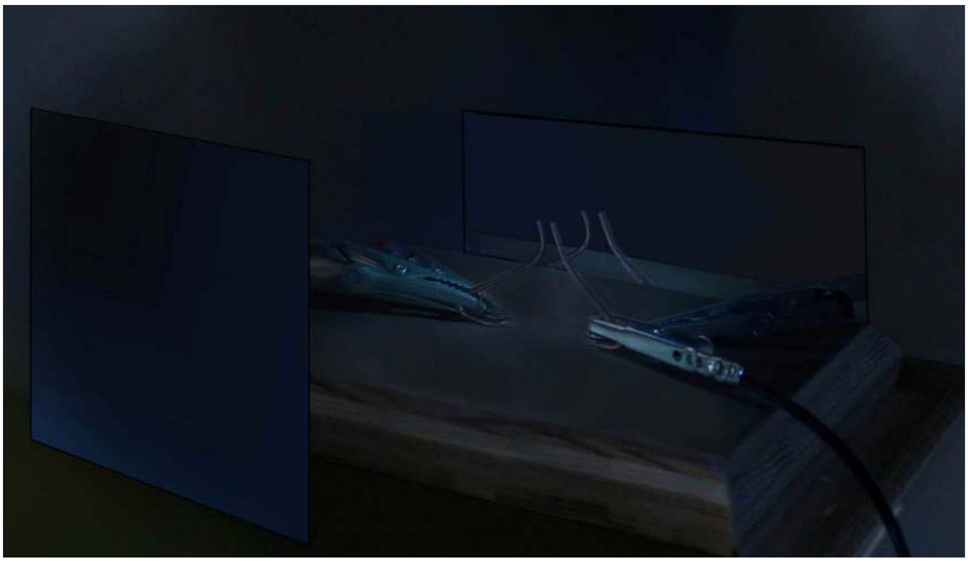


Diagram 24; The spark extinguished.

1) When this spark is flashing between these two opposing, parallel mirrors, light expands from the source *in all directions*.

2) We know that, should any number of light beams cross one another's paths, the brightness of those beams is never diminished, diverted or blocked by the others. Therefore, any light bouncing back from either mirror will not be impeded by the continuing flashing of the central spark.

3) It is *inevitable* that some of that expanding light from the spark will hit each mirror, at a perfect right-angle.

4) We would therefore expect those two, isolated, beams *not* to be extinguished when the spark is switched off. According to Einstein's light-clock hypothesis, and according to the continuing belief of physics generally, a beam of light, generated at the time of the spark, should continue to bounce back and forth between such mirrors for ever, especially when those mirrors appear to be 'at rest',(perhaps as seen by a casual <u>outside observer,</u> sitting in Brian Cox's café).

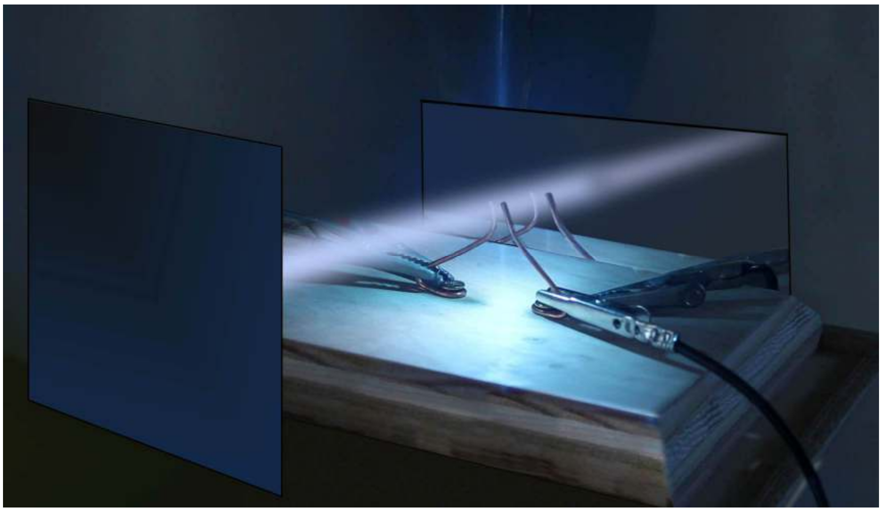


Diagram 25; The expected, but impossible, 'light-clock' beam.

And herein lies the answer as to why no beam continues between the mirrors after the current is switched off. We have met this answer before;

WE ARE NOT 'AT REST', *EVER*.
We are no more 'at rest' than the imagined <u>outside observer</u>. And he could be as much, or more, or less, in motion as the <u>travelling observer</u> on the train. Nothing is properly, completely, even temporarily, 'still'.

The speed of the earth at the equator is approximately 1000 miles an hour, and the earth orbits the sun at 67,000 miles an hour, and this, of course, combines

with all the others relevant movements within the Universe. Therefore, our mirrors speed away from the *source* of the spark, *immediately.* After which, those mirrors are *no longer* in a relevant position to reflect that beam.
The light emitted from the spark, at the moment of the flash, is *relative*, spatially, to *absolutely nothing*, (except to itself), as we have previously explored in the "Flash in the train carriage" experiment earlier.
So, the same naive mistake is being made once more.

When the sphere of light expands from its source, its position in space *is not at all* locked to the position of the mirrors, as it was *not at all* locked to the position of the flash-source in the train carriage.

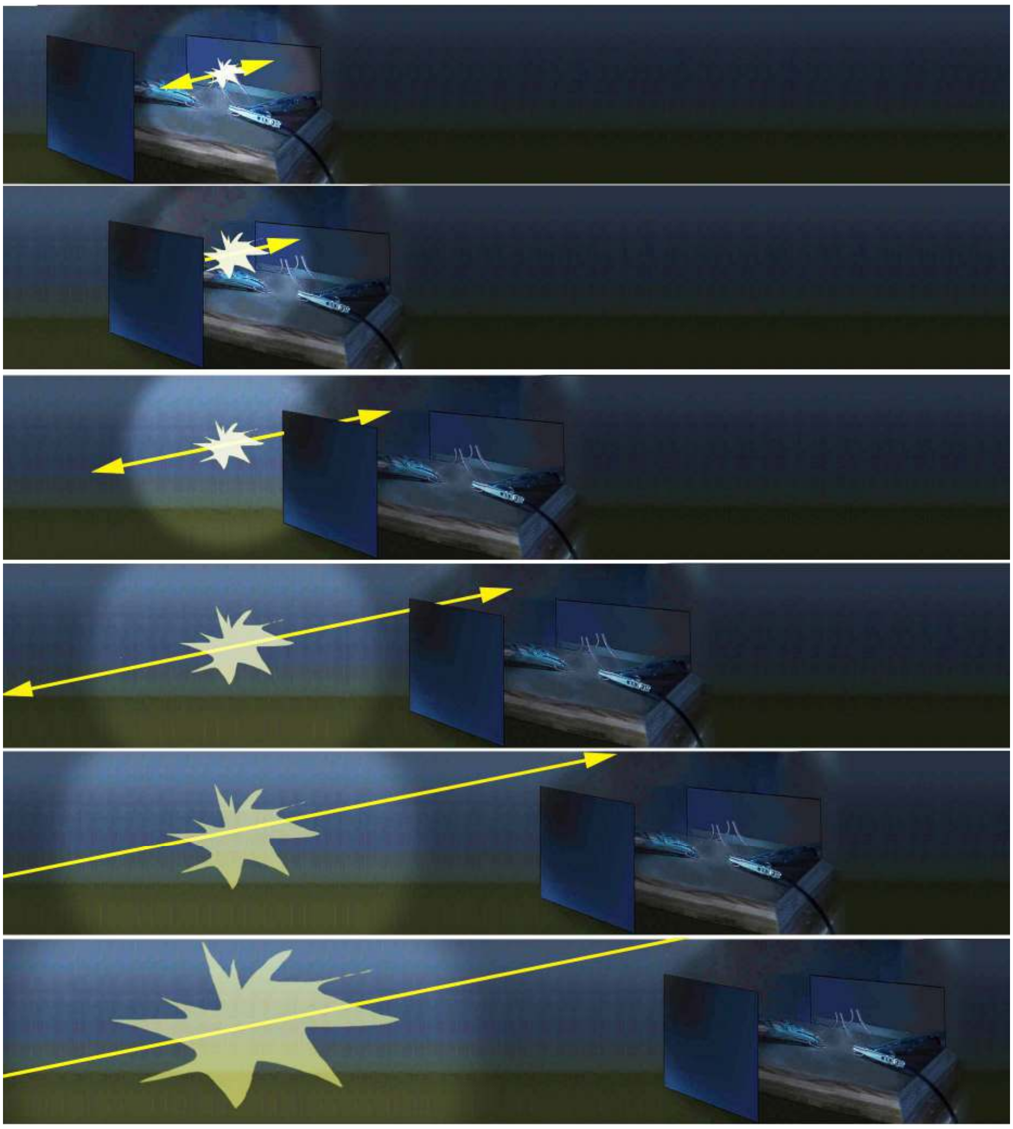


Diagram 26; the mirrors are swept away with the earth and planets. The flash, being independent, is not.

The nano-second the source is extinguished, the light beam's position, between these mirrors, cannot relate, *at all*, any longer, to its origin, because *we move in space*.
Diagram 26 illustrates a mirror being propelled sideways, at a phenomenal rate, by all the movements within the Universe, leaving behind the expanding beam of light, which remains over its original co-ordinates.

On a larger scale, diagram 27 below describes the expanding light sphere as it grows in size around the initial point of its emission. (Red locating arrow). That growing bright light *cannot* be pulled along by the mirrors, or by its source. Once the beam is 'in flight' it is *totally independent* of absolutely everything.

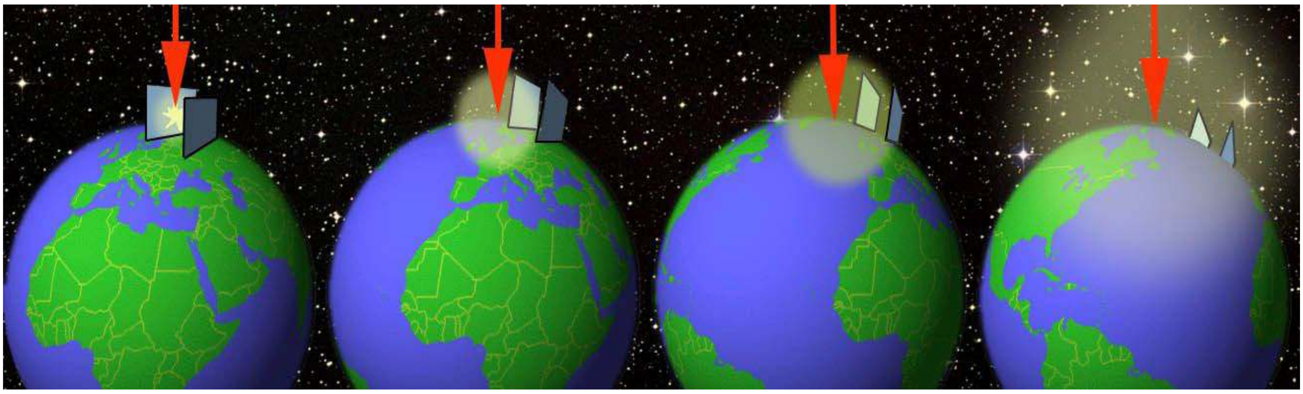


Diagram 27; The parallel mirrors turn with the world; the expanding sphere of light does not follow.

The diagram above shows the world turning at 1000 miles per hour, at its equator, but the expanding sphere of light does not accompany those mirrors as they disappear over the horizon. Thus, to achieve a light beam continually bouncing between two parallel mirrors is *impossible.*

Now, this failure to build a system whereby two ‘static’ mirrors fail to maintain a beam of light between them, leads on to test the light-clocks *further* claim that fast travelling mirrors *will* have the ability to deflect a perpendicular beam of light *tangentially* whilst travelling at speed.

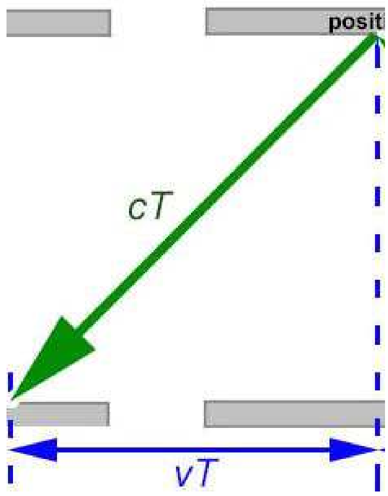


Diagram 28; Is this deflection of a beam of light ever possible?

This next experiment has sadly, at the moment, to remain theoretical, as although practical, it is, presently, financially out of my reach to carry out.

The time-stretching condition for the 'travelling' observer relies on a beam of light being continually *deflected*, between two mirrors, which, themselves, are constantly re-positioned in their relative space due to travelling at high speed. That is, the light-clock hypothesis counts upon a reflected beam, continuously being able to bounce off a 90-degree mirror, at a *deflected* angle. My experiment endeavours to see whether or not that trick is ever possible.

THE EXPERIMENT spinning mirrors

A two-meter circumference disc is set to rotate at a colossal speed, utilising a 100,000 rpm ultra-centrifuge, with a fixed angle rotor, revolving at 1666.66 revs per second.
Two mirrors, on opposite sides of the top of the disc, would allow an 'exterior point' to see *one* of those mirrors passing 3333.33 times a second.

Then, let this 'exterior point' be a green, narrow-beam, laser, light-pulse source, emanating at a distance of 1000 meters from the revolving disc, to hit each of the two mirrors in turn, via a top-mounted, front-silvered mirror.

The Laser
The divergence of a laser beam is proportional to its wavelength and inversely proportional to the diameter of the beam at its narrowest point.
The angle of 'beam spread' is measured in radians or milliradians (1 milliradian = 3.4 minutes-of-arc or approximately 1 mil). For small angles where the chord is

approximately equal to the arc, the increase in the diameter of the beam is numerically equal to 1/1000th of the range in meters multiplied by the number of milliradians of beam divergence.
That is, at 1000 meters range, a beam divergence of 2 milliradians would produce a beam diameter 2 meters wider than the emergent beam diameter.
In general, the thicker the starting laser beam, the more collimated it is, so if we have a (visible wavelength) laser with beam starting at 1cm thickness, we will have an almost perfectly collimated laser beam.
In this instance we require the following;

Laser power;	30mW
Beam diameter at aperture;	1.3mm
Beam divergence;	0.1mrad
Beam diameter after 2000 meters;	601mm
Area of laser point after 2000 meters;	283,969.89 mm²
Laser intensity after 2000 meters;	0.00008804 mW/mm²

Clearly, if the disc is stationary, the path of the reflected beam will coincide exactly (If the mirrors are angled correctly) with the path of the emission beam, as in Diagram 29. After travelling both ways, (2000 meters), the beam width, back at the laser source, will be 601 millimeters.

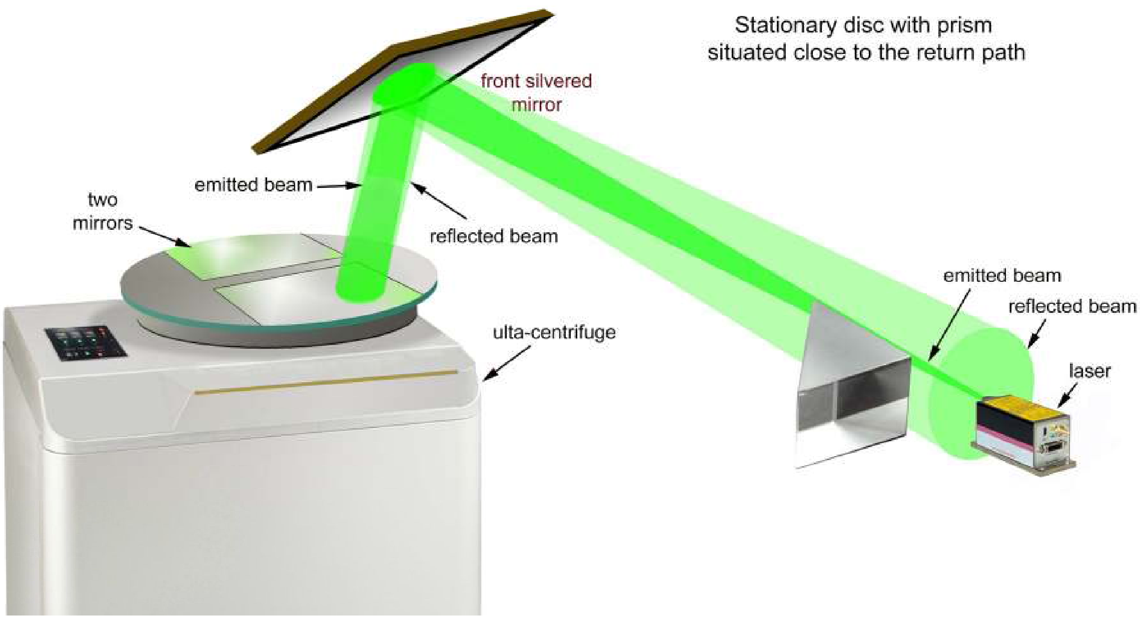


Diagram 29; Testing the light response from 'static' mirrors.

The established formula for detecting the *possible offset* of a pulse of light, emanating from a distant 1000-meter source, and being reflected back from each of the 2 revolving mirrors is;

$d = D \times v/c$

This would give;

The offset **=** (pulse distance to mirror) 1000 meters x 3333.33 mps (the speed at which the mirrors pass per second) divided by 300,000,000 meters per second. (the speed of light)

$d = 1000 \times 3333.33 / 300{,}000{,}000$

RESULT is 11.00 mm. offset

To test this we place a prism, (with a sharp edge reading of approx 0.1016 mm), adjacent to the laser source, as tightly as possible *to the edge of the returning beam*, such that it does not cut into that reflected beam at all. Diagram 29 shows a static disc and a prism situated close to the reflected beam.

Now we set the mirrors in motion. (diagram 30) Should there be any offset of the reflected beam, created by the interaction of the high-speed mirrors, as predicted by the above equation, it will be deflected in the direction of the mirror's spin, towards the prism.

The prism's sharp edge will separate some, or all, of the 'offset' reflected beam, refracting it sideways onto a receptive screen.

Diagram 30 shows the spinning disc, at 100,000 rpm, and part of the 'predicted' offset beam, being caught and redirected by the prism, then to be recorded on a screen.

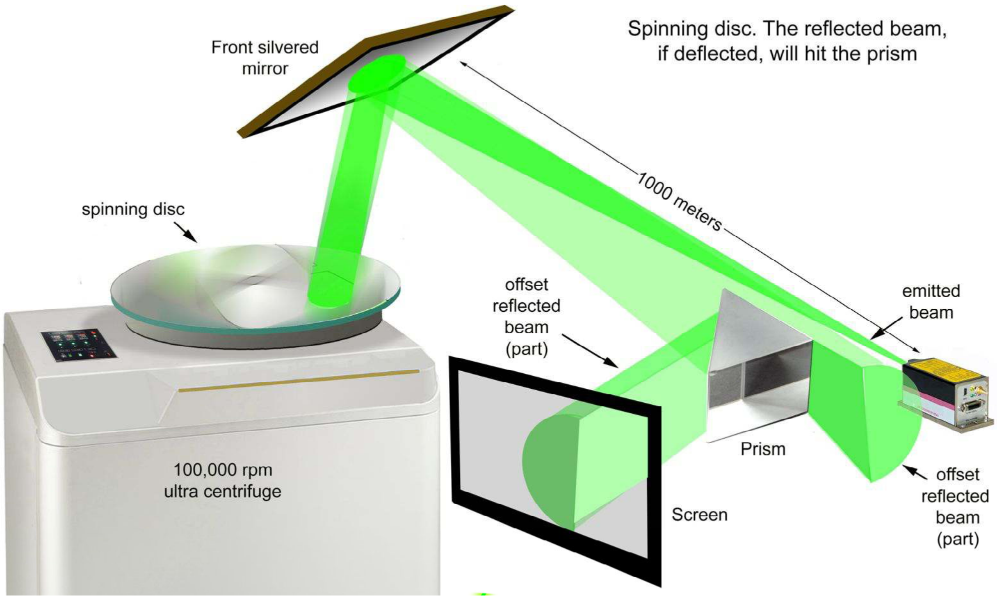


Diagram 30; the unlikely circumstance of a light beam being influenced by the mirrors spinning at a very high speed.

Now the bad news! I have yet to build this apparatus and am currently approaching science and physics departments at Universities and Research establishments for the required space and equipment.

Einstein's "thought experiment " will be proven if the apparatus *is actually* able to demonstrate any offset whereby the original beam is deflected sideways in the direction of the fast-passing mirrors, to appear, via the prism, onto the screen.

If the pulse of light is reflected back *exactly* along the line of the *approaching* pulse, as it was when the mirrors were still, then, again, the whole idea of the 'light-clock' is bogus......

My thoughts are, that momentum cannot be imparted to a mass-less particle. When photons hit the spinning mirror, the beam's reflection will return along the initial path as it did when the mirrors were still.

Light, bouncing between two parallel mirrors, cannot / should not, be used, even as a notion, to establish further comment, predictions or research.
A light-clock, obviously, is as inadmissible as my earlier proposition of light beam being able to penetrate a sheet of steel.
And this, clearly, also dismisses any such claims for there ever being a 'static' observer.

But Einstein's light-clock has become a crucial, theoretical tool, and a mathematical device which has triggered allsorts of practical experimentation, which purport to endorse figures for the stretching of time.

For a full breakdown of the erroneous conclusions that have resulted from time-dilation research, in addition to NOTE 1 below, please see page 21 onwards from;

http://gsjournal.net/Science-Journals/Essays-relativity%20Theory/Download/7081

where all the famous experiments that 'prove' time dilation are dissected, criticised and their faults revealed.

Meanwhile I deal with the two favourite explanations for time dilation and show how mistaken are the conclusions.

==

NOTES

NOTE 1 Repudiating two favourite proofs of time dilation

A) Muon decay

At the beginning of this essay I asked you to consider the muon decay experiments in the alternating gradient synchrotron at Brookhaven, where the 14-meter diameter tube is used to provide the potential for journeys of infinite length, and that this concept could present a similar context for my orbiting astronaut.

In the same way as I have suggested that a line from the Earth to the North-star could provide a start and finishing point for our astronaut, a similar marker was utilised, at Brookhaven, for an accelerated muon to pass, each time it sped around the apparatus at 99.94c.
Time dilation was responsible, physics then claimed, for the muons' lifetime being extended from living for 14 laps of the ring to living for 400 laps, before decaying.

This was explained as being that a muon (from its own point of view) shrinks the size of the 14-meter Synchrotron, *because* it is travelling at 99.94% 'c' allowing it to travel further in its own (longer) ‘personal’ time frame before decaying.

Also, it is claimed, that, should it be possible for a passenger to travel along with the muon, she too would experience an identical time dilation. The circumference of the ring would be reduced from the viewpoint of the muon, and the passenger too. And this effect of time dilation, it could be argued, could appear to apply to my examples of orbiting astronauts. However……….

A NEW POINT OF VIEW Stanford

Another experiment, made at Stanford, California provides a less fanciful reason for the increased life of that accelerated muon. Their experiment demonstrated that, as an object increases speed, so it also increases its energy; it acquires kinetic energy- energy of motion.
Now energy is assumed to possess mass.

Stanford scientists accelerated subatomic particles down a straight tube 3 kilometres long. By the time the particles emerged at the other end they had a mass 40,000 times larger than when they began their journey.

The muons accelerated at Brookhaven, similarly, must have experienced a huge increase in their mass, and this greater mass would clearly take a longer time to decay than the far smaller, original mass of a muon living outside a particle accelerator.

This explains why the accelerated muon is able to complete far more laps than a 'stationary muon', as its additional mass will take this longer time to decay.

Similarly, if we try to apply the 'Brookhaven' thinking to our astronaut- to try and explain the conflicting issues of time, between a straight-line journey and my orbital trips, we would find that, for our astronaut (from her own point of view) to shrink the size of her orbital diameter, would be to travel much closer to earth. But this can't work, as her orbital path would then be shorter as would be the message-times, when the signals are sent back to her earth-bound brother. Thus, all the figures for the trip would be undermined; distance, speed, height etc. This would clearly lead to the various other pertinent and accepted physical laws just not adding up.

<u>NEW POINT OF VIEW</u> reciprocal confusion resolved

Those choosing to believe the results of the Brookhaven tests are clearly amongst those physicists who have *not* addressed the consequential issues of reciprocity. As has been noted in other examples considered in this essay, there is a failing here too in the contemplation of all the equal and opposite circumstances of this widely quoted experiment.

As we have seen in the 'Ladder in Barn Paradox' physics requires us to deliberate on mutually conflicting occurrences. In this case, such a mutual event would be one where the muon in the ring is 'stationary'.
This would require the synchrotron, its scientists, all of Brookhaven, all of the USA, all of the world and the Universe to be rotating around that 'static' muon.

You will note the comparison with the reciprocal event in the case of our astronaut, where, when she is considered to be 'static', *all* of the universe is required to revolve around her craft.

If we were to apply Occam's razor here, the overwhelming complexity of such equivalent incidents, would be tossed out for its sheer convolution.

<u>Repudiating two favourite proofs of time dilation</u>

B) GPS satellites

<u>Background</u>

The clock settings within GPS satellites are considered to be a proof of Einstein's Theory of Special Relativity. The consequence of time dilation, due to relative velocity, physics maintains, is that GPS satellites clocks run slow by 7,200 nanoseconds per day, as they travel at approximately 8,700 mph with respect to Earth.

However, General Relativity maintains that those same clocks will *gain* 45,900 nano-seconds a day, due to *gravitational* time dilation, where, at a height of 19,000 km they perform within a weaker gravitational field than equally accurate clocks on earth.

If it were not for those adjustments, physics affirms, global positioning would be tens of meters out of alignment per day.

<u>Error 1</u>

This assertion however, ignores the obvious mistake whereby should the original calculations have been made at *sea level*, then any effects of time dilation on GPS equipment would give *different locations* for ground- based vehicles than for aircraft, travelling over the same global coordinates.

<u>Error 2</u>

The time dilation explanation for the way GPS behaves also ignores the fact that the Earth is rotating, whereby the speed of a satellite relative to a GPS receiver would be different at *different latitudes*. Thus, the amount of dilation would vary according to the proximity to the equator, either resulting in an increasingly inaccurate positioning of the receiver, or a requirement for the receiver to carry out very complex calculations regarding its own position on the globe. However, the satellites make their own fixed time adjustment for all points on Earth.

<u>True operation</u>

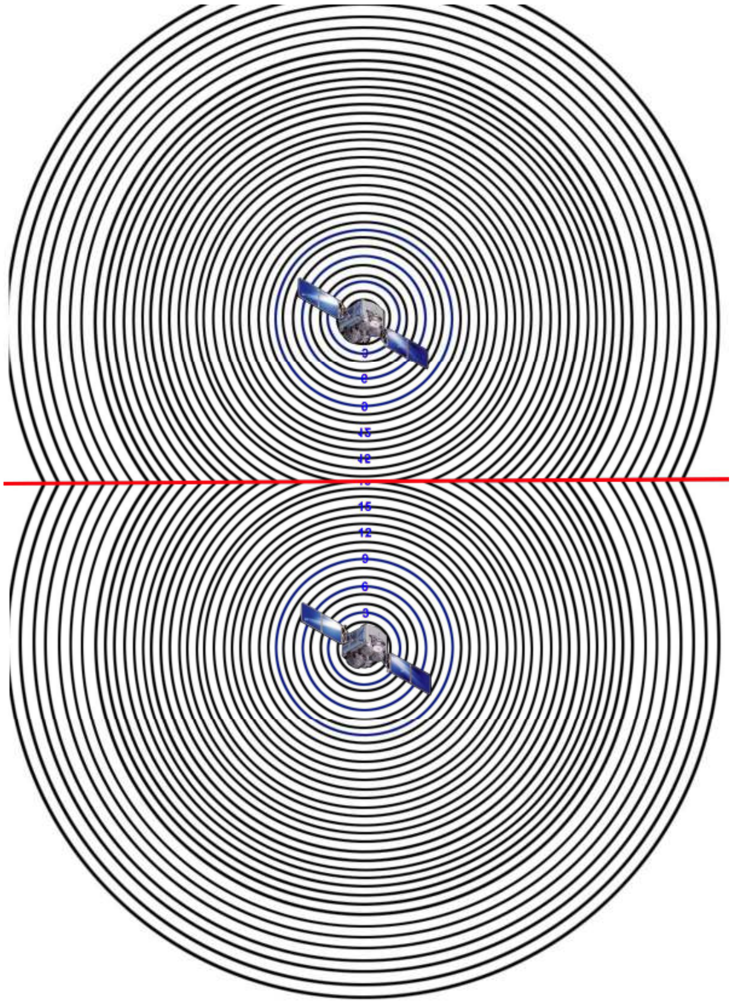
How the GPS system actually works is by the comparing the difference of received signals only. There is no correction for time dilation as the satellite's clocks' speed, relative to Earth, is unimportant, and, whether they run faster or slower than earth-bound clocks, will not alter their measured time differences.

GPS satellites are fitted with atomic clocks which broadcast a synchronised time-stamp to one another. As they are each in orbit, a satellite's orbital characteristics are also transmitted along with the time-stamp, whereby the receiver determines exactly where they are on their predicted path. As all these signals travel at 'c' (the speed of light) the earth-bound vehicle's receiver can therefore calculate how far away is each broadcasting satellite, and thus determine the receiver's location relative to them.

Each distance is equal to the time at the receiver less the delayed time at the satellite multiplied by 'c'.

<u>Example</u>

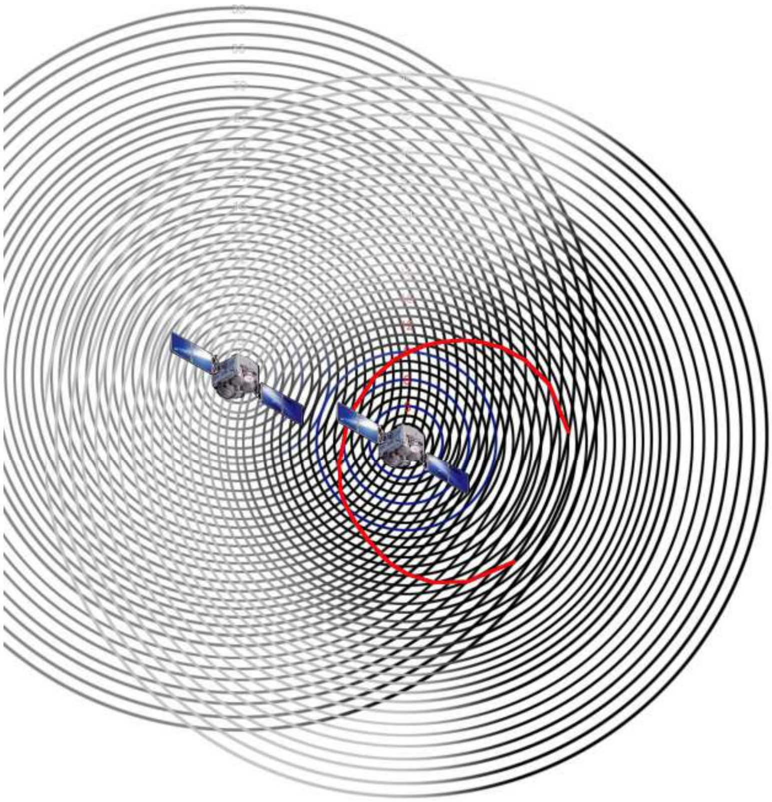
If the time stamps from 2 satellites match, then the conclusion is that the receiver is at an equal distance between them. A line, of infinite length, at right angles to them, could then be drawn half way between them.



2 satellites, 36 units apart and equidistant from a receiver.
The receiver may be anywhere upon the red line

Diagram 31; the signals from two satellites exactly match; allowing the receiver's location to be *somewhere* along the central straight line.

If the time stamps do not match, the *receiver* will know that it is, itself, closer to one than the other. And subtracting the larger from the smaller with give a figure for the receiver to use.



Two satelites 18 units apart, provide a possible location at every point at a 2 to 1 ratio.
12/6; 13/26; 14/28; 15/30; 16/32; 17/34, 18/36 etc.

Diagram 32; Two satellites, at unequal distances from the receiver, provide a curved line on which the receiver will be located in two-dimensional space.

Instead of a straight line we will now have a curved line produced, (red) whereby any part of that line will be in the same ratio of the distance-difference established by those delayed time stamps. And this figure the receiver multiplies by ‘c’.

By adding the time stamp info from a third satellite, arriving at the receiver, we have another curved line, (yellow) now intersecting with the first. This establishes satellite 3's distance from the first two satellites as the receiver calculates those new distance-differences.

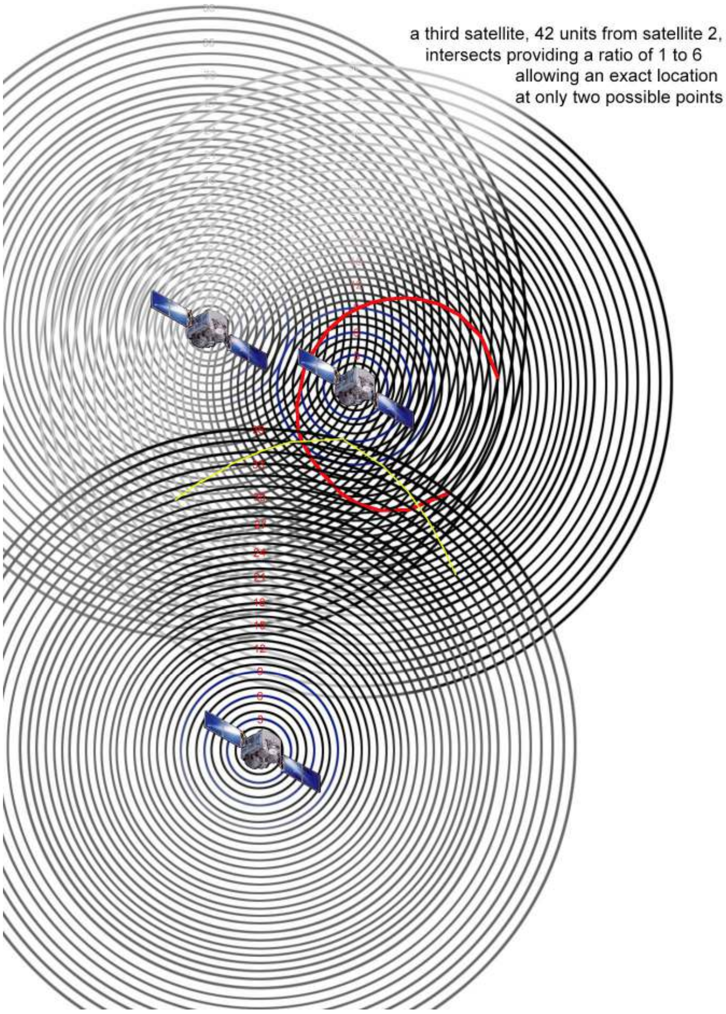


Diagram 33; Three satellites reduce to 2-only-possible locations in which the receiver may be found.

This new curved line intersects with the first, giving the receiver its position, but still in 2 dimensions.

Three spatial variables then refer to the time stamp of a fourth satellite which gives the receiver the intersection of three overlapping 'parabolic' cones. (green).

The receiver then discards the time data as those four satellites combined will pinpoint the receiver's position almost exactly.

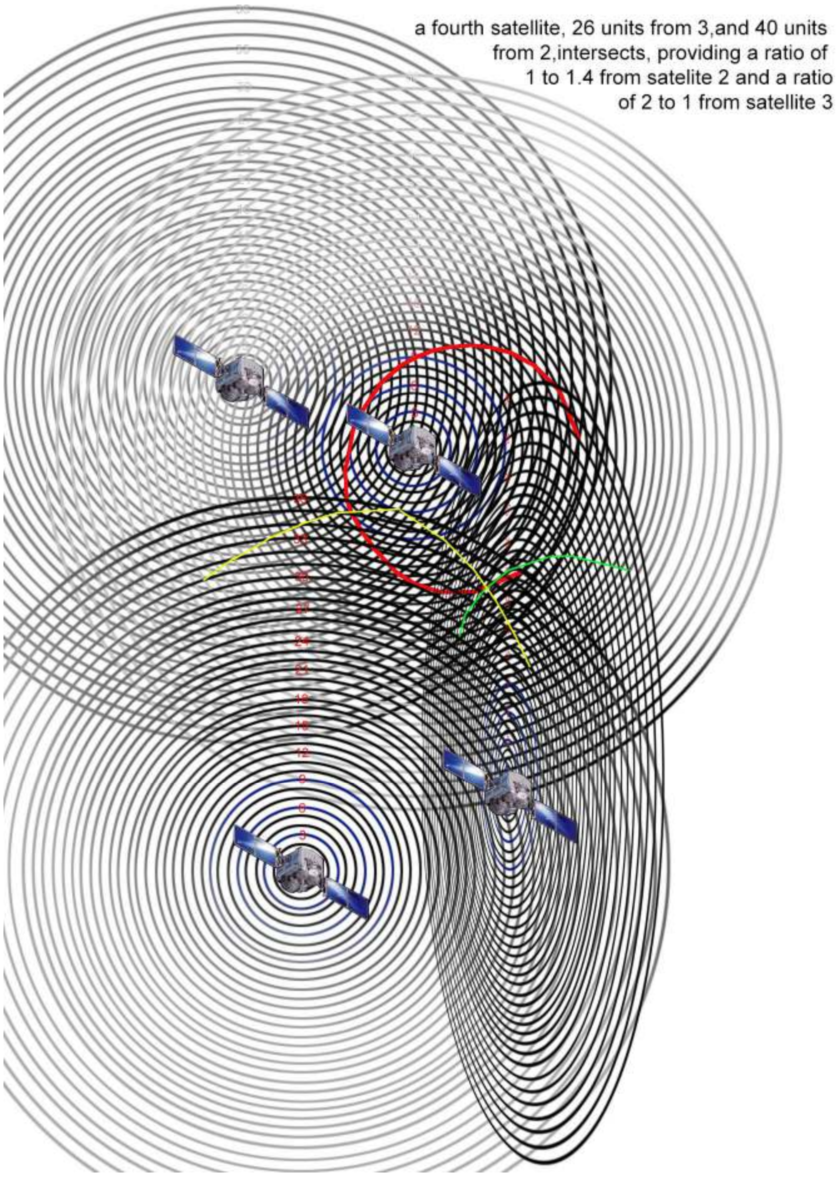


Diagram 34; Four satellites locate the receiver in three-dimensional space.

This operation has not required a time factor, and any consideration concerning whether the satellite's clocks are running faster or slower is irrelevant as their time stamps match.

And the receiver has located itself by knowing the *differences* between those satellite timestamps rather than by the time of the timestamps themselves.

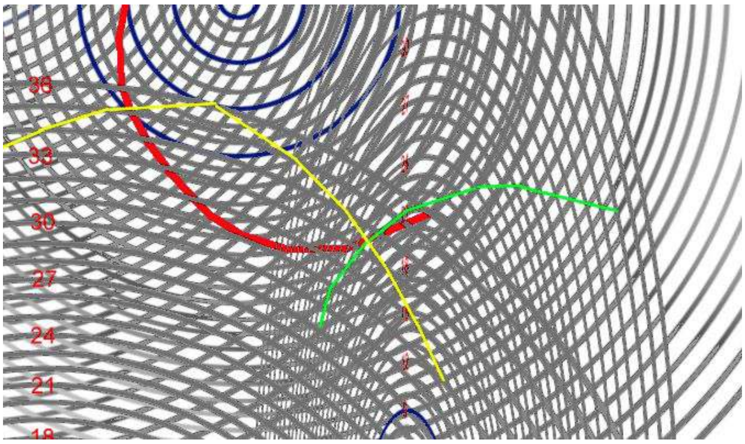


Diagram 35; A closer look at the intersecting point of four satellites.

So long as the satellites' clocks all run at the same rate, these timestamp differences will be independent of the actual clock speeds, plus these times are calculated relative to a 'reference epoch' which is reset weekly giving a consistent GPS accuracy of approximately three meters.

Should the earth-bound clocks run at a *different* rate from the satellite's clocks, as is maintained by Relativity and time dilation, then the gaps between 'time at receiver' minus 'delayed time at the satellite' would *increase* each day, giving a totally *false* reading.

<u>The receivers</u>

Currently, GPS *receivers* contain no atomic clock because, although modern technology has reduced their size enormously, they have yet to be employed in the vehicles themselves, so comparing earth-bound clocks with satellite clocks to any useful accuracy for proving time dilation would not be possible.

In fact, the 'time at the receiver' *is determined* from the satellites' clocks and if the satellites' clocks were running faster (or slower) than those on Earth, this 'time at the receiver' would likewise run faster or slower *by the same degree*. In which case there would be no positional error, and no cumulative position error either.

If the clock in the satellite was constantly running slow, this would mean that the time discrepancy between the satellites and the vehicle's receiver would gradually fall out of sync. If the satellites clocks were just running *late*, but keeping the same time (but albeit some minutes late) as earth bound clocks, all could be well, but a continuously growing divergence would, clearly, soon allow huge errors in the locating of any receiver.

Clearly time dilation is not proven by the operation of the GPS satellite system.

NEW POINT OF VIEW Shrinking issues

Current physics also believes that, close to the speed of light, objects shrink in the direction of travel. If this length contraction was an assured phenomenon, then this would be a disadvantage for a high-speed craft in *any* of the Twins' explanations.

A shorter craft will, 'apparently', have a greater distance to travel. If the craft has shrunk to half its length, then it will have a prospective journey of twice the original distance!

Diagram 36; A shrunken ship has further to travel.

If the craft is 250 meters in length, it has to travel 502,654,824 times its own length in just one revolution of the wider orbit.
Should it shrink to half its 'proper' length, then suddenly, it has to travel 1,005,309,648 times its *new* length for the same journey.

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NOTE 2 Outrageous claims

From the outline on page four I again refer to Brian Cox's claim that on a return journey to the Andromeda galaxy, of an earthy forty years, with 10 years of acceleration each way and 10 years of deceleration each way, the ‘proper’ time on earth will have seen 59,000 years pass.

Outcome 1; When our astronaut arrives at Andromeda, her turn-around point; the Andromeda galaxy (and the rest of the Universe) must have aged by 29,000 years. All the objects which she passes on her trip must also age quickly and proportionally relative to her.

Any space detritus lurking in the cosmos, through which she passes when at a *quarter* of her journey, for example, must have aged by 14,750 years. So, as the spaceship is also an object in this cosmic scenario and also exists at those locations that I have chosen to mention, then the craft *must* have aged to those degrees also. It is therefore very odd that an occupant of a space craft ages at a different rate from the vehicle in which she is travelling.

Outcome 2; if the stay-at-home twin experiences the *same time* passing as the Universe in which *he* lives, (which he must) then it won't just be the earth that ages with *him*, but all the stars and planets everywhere, (as is normal) whilst his sister is journeying.

So, what a responsibility he has, whilst he is *presuming* his sister to be aging so slowly. His thoughts seem to be determining the time-frame of everything everywhere! And what if the stay-at-home twin dies? Who is going to continue 'believing' the astronaut's clock to be running slow?

Outcome 3; Once more, I question where does the spaceship fit into all this? Even with Artificial Intelligence the craft won't have an *opinion* about its own journey time. Therefore, it will be at the mercy of several issues. If it did shrink whilst travelling by length contraction would that, in itself, be prohibitively restricting for the fuel load. If objects shrink solely in the direction of travel will its internal compartments suddenly become tall and thin? Will the food supply be squashed longitudinally?

A journey to Andromeda would require, at Brian Cox's suggestion of a constant 1g acceleration, 4,100,000 kilograms of fuel *per kilogram* payload; and that, only if it has a 100% efficient engine.
The deceleration at the halfway point will increase fuel consumption to forty-two trillion kg of fuel per kg of payload which is equal to 10 times the mass of Everest of fuel per single gram payload.
The engineers responsible for preparing this craft for its long-time journey will have a huge set of problems to solve.

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<u>NOTE 3</u> Polaris

The North Star, Polaris, is known to stay fixed in our sky. It marks the location of the sky's north pole, the point around which the whole sky turns. However, Polaris actually lies just a short distance away from where Earth's axis points, about 1 degree off to the side of the north celestial pole, therefore Polaris *does* move a little, tracing a very small arc in the night sky, around which the other visible stars make wider circles. This movement is so slight as to be insignificant with regard to the above results.

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CONCLUSION

Physics endorses the idea of Occam's razor. But that razor must be blunt, or have been shelved, for all these complicated and bizarre justifications to be accepted in explaining the inconsistent time-frames for the Twin's, and for the time-stretching assertions of high-speed travel. Clearly simpler and more straightforward explanations, such as I have been discussing, should be reviewed extremely carefully, as I believe they point to a much more honest and logical view of the world.

Of course, if time and distance *can* actually *be* modified by 'perception', and along with the slowing down of biological aging and changing clock time-keeping, a wonderful kind of magic will have been performed.

END

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FURTHER READING

"Light-clock flaws and practical work to disprove the great time-advantage claims of time dilation".
http://gsjournal.net/Science-Journals/Essays-Relativity%20Theory/Download/7081

"A physical experiment which repudiates all theories based on Einstein's light-clock".
http://gsjournal.net/Science-Journals/Research%20Papers-Relativity%20Theory/Download/6962

"The significant consequences of the widespread misunderstanding of light's behaviour relative to inertial reference frames".
http://gsjournal.net/Science-Journals/Essays-Relativity%20Theory/Download/6738

"The equivalence principle, its flaws and their consequences"
http://gsjournal.net/Science-Journals/Essays-Relativity%20Theory/Download/6649

"Has Mathematics Hijacked the Speed of Light?"
http://gsjournal.net/Science-Journals/Essays-Relativity%20Theory/Download/6253

"Examining and Dismissing the Arguments for the possibilities of Superluminal Travel as posited by Einstein, Minkowski, Cox, Forshaw, Hawkins and others."
http://gsjournal.net/Science-Journals/Essays-Cosmology/Download/6448

"Repudiating the idea of Time Dilation and other fallacies".
http://gsjournal.net/Science-Journals/Essays-Relativity%20Theory/Download/6227