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Understanding what generates symmetrical measures and the time differential in special relativity

by Roger Luebeck

A survey of scores of relativity books reveals, regarding the twins paradox and symmetry of measuring, a myriad of convoluted explanations, meaningless analogies or admissions of defeat, leaving the reader with an enduring mystery. While a purely relative approach (the standard approach) to special relativity lends itself to the spacetime model and facilitates efficient calculations, only an absolute approach enlightens on relativity of simultaneity, the twins paradox and symmetry of measuring; and it is completely compatible with the purely relative approach. [1] Notably, the absolute approach reveals the same thing that the relative approach assumes – that there is no privileged frame of reference in which to conduct experiments. In this article, we accomplish what absolutists of the past failed to do: we offer natural postulates to facilitate our absolute approach, define time-keeping and provide clear diagrams – in absolute terms – illuminating symmetrical assessments across inertial frames.

In this article:

1. A sound basis is provided for light having the maximum, as well as an unvarying, speed in an actual sense. This is our first postulate. (Einstein had rather postulated an unvarying *measured* speed of light, which becomes a deduction in our absolute approach.)

2. A fundamental definition of time-keeping arises from our just-mentioned first postulate. Lorentz and Poincare provided no such definition; and Einstein, with his purely relativistic approach, had no means to do so.

3. We note that the Principle of Relativity is inextricably bound with synchronization of motion along different axes, and we postulate that there is synchronization – in accordance with Machian reasoning – at the base of our structures (atomic level) for the sake of their stability. This is our second postulate.

4. That postulate, in combination with the assumption that photons are the maker of every relationship, leads us to a formal derivation of length contraction, both for rigid bodies and for the spatial separation of objects in the same inertial frame.

5. We provide diagrams, in absolute terms, showing how symmetrical assessments are made across inertial frames. (Einstein had merely *assumed* symmetrical assessments, without any hope of diagramming the process, due to his strictly relativistic approach which was dismissive of the underlying reality.)

6. Einstein's clock synchronization is diagrammed in absolute terms.

All the effects of special relativity can be explained and diagrammed independent of Einstein's clock synchronization against the backdrop of the universe in an absolute sense. That Einstein himself eventually expounded on the existence of space endowed with physical properties is largely overlooked, despite the fact that his general theory requires it. More on that further down.

Not presented in this article, due to space constraint, is the diagramming of a pair of twins paradox adventures or the diagramming, in absolute terms, of consistent light speed measure independent of inertial frame. There is nothing fundamentally different about such diagrams from our other diagrams. We'll leave them as simple exercises for the reader.

Why we need an absolute approach

Banesh Hoffman writes: “Though [relativity of simultaneity] may be shocking, we have to learn to live with it. .. the logical consequences [of Einstein's postulates] are often such as to outrage common sense.” [2]

With an absolute approach, there is nothing we need to "learn to live with". We would be shocked only to learn that there *is no* time-keeping differential between reunited clocks, which is one of the consequences to which Hoffman refers.

An absolute approach to special relativity eliminates the famous paradox involving reunited clocks (twins paradox). The paradox is that reunited clocks show a disparity in recorded time even though the typical relativistic interpretation holds that there is no meaning to be attached to actual hierarchy of inertial motion and therefore to actual hierarchy of clock rates. This stems from the relativists' strict focus on symmetrical *measures* across inertial frames.

A purely relativistic treatment gives us terminology only such as: "apparent", "as measured" or "as perceived".

An absolute treatment gives us all the above, and also tells us what generates such measures and perceptions by virtue of incorporating "actual", "absolute sense" or "God's-eye view".

> In two of the all-time best-selling relativity books, regarding the issue of "actual" versus "merely apparent":
>
> John A. Wheeler writes: “Does something about a clock really change when it moves? Absolutely not!” [3]

> Martin Gardner writes about simultaneity: “It is important to understand that this is not just a question of being unable able to learn the truth of the matter. There *is* no actual truth of the matter.” .. “Absolute simultaneity of distant events is a meaningless concept.” [4]

Similarly, Albrecht Folsing states that a person who “asks whether contraction is "real" or "apparent" misses the point: the [measure of] the kinematic shape is shortened for any measuring rod in motion relative to an observer.” [5]

In truth, reasonable people ask whether there is actual contraction *as well as* contraction as measured. We do see an *actual* difference in recorded time between reunited clocks. There is nothing relative or merely apparent about it. We thus easily conclude that time-keeping contraction is *actual*; therefore, necessarily length contraction as well (otherwise we would not have symmetry of measure across inertial frames). Our next thought is that we'd like to see the whole thing diagrammed in absolute terms.

In the absolute approach, there is an actual (and obvious) hierarchy of speed and subsequent hierarchy of clock-rates. Length-contraction and mass-increase are of course also regarded as actualities in the absolute approach. All the results of special relativity as we know them in Einstein's treatment fall into place, using simple diagrams and arithmetic in the context of a system of coordinates at rest with respect to the totality of the cosmos.

> It is precisely one's motion with respect to the universe – and to the same end, one's speed as a percentage of the actual speed of light – that dictates that party's ***actual*** clock rate, resulting in the ***actual*** time-keeping differential which is seen upon reuniting with the other party.

That actual time-keeping differential between reunited clocks, a physical reality which necessarily favors one party over the other, simply does not fit with a purely relative interpretation. That interpretation leaves one with a with a clock paradox (twins paradox) of one's own making. Einstein himself eventually made forceful statements amounting to the same thing. We'll get to that in a bit.

Although John Wheeler rejected the notion of actualities behind our symmetrical measures, he acknowledged that there is no physical experiment that can distinguish the absolute treatment from Einstein's purely relative treatment. [6]

Yet, countless commentators on special relativity, including the eminent John Wheeler, have attempted to explain the time-keeping differential without acknowledging an actual difference in clock rates.

Every one of those explanations falls into one of two categories, both incorrect:

1. The "inertial force" or "acceleration" explanation.

In truth, neither force, nor identically acceleration, is allowed in special relativity, which addresses purely inertial motion. This is seen in Einstein's 1905 paper on special relativity, as well as in all subsequent derivations of the Lorentz transformations. The time-keeping differential is deduced through purely linear uniform motion considerations. [7]

The correct paradigm for linear motion studies is the transfer of clock information across inertial frames between an outbound astronaut and an inbound astronaut.

2. The "lines of simultaneity" space-time explanation.

This is identical to the "space-time diagram", "kink in space-time", "jump in time", "misperception", and "lattice of clocks" explanations. They are all one and the same explanation.

These commentators seem to be not aware that the construct known as spacetime is dependent on Einstein's particular method of clock synchronization, a clock synchronization which is not required to deduce the results of special relativity, and which vacates, or neutralizes, an absolute frame of reference.

Similarly, Einstein's "relativity of simultaneity" vacates an absolute frame of reference. It has only to do with perceived simultaneity. [8]

Not only journalists, but also physicists, routinely speak of one clock running slower than another, as though it is (correctly) an actuality. However, as we've intimated, virtually every physicist will at some point claim that one clock does not actually run slower than the other.

(Again – Wheeler: "Does something about a clock really change when it moves? Absolutely not!") [9]

Rather, physicists typically limit themselves to asserting that each clock's reality is as valid as the other's (due to the symmetrical measures across inertial frames), and then attempt to explain the time-keeping differential by way of perceived-simultaneity argumentation. Not surprisingly, this leads to a great variety of convoluted explanations. We'll provide examples in a bit.

Spacetime is a useful calculation tool, yet it is a construct – entirely dependent for its existence on Einstein's particular method of clock synchronization. The best one can do with a spacetime argument in the context of the twins paradox is to note that a traveler, upon his turn-around, will observe a jump in the reading of the clock time of the stay-at-home using the "lattice of clocks" method dictated by Einstein's particular clock synchronization.

But of course no such jump in anyone's aging (or identically on anyone's clock) actually occurs.

In contrast with the spacetime argument:

When an outbound traveler transfers his clock reading to an inbound traveler, the incremental increase of the time-keeping differential between the travelers and the stay-at-home is obvious – as the participants can plainly see upon comparing notes later on. (Consider multiple iterations of this scenario, with ever longer round-trip journeys.)

Any attempt to explain an actual time-keeping differential while forbidding "the actual" is doomed to fail in a purely logical sense; in a purely mathematical sense. Einstein's clock synchronization, and therefore also spacetime, in fact vacates the actual as it vacates any sort of universal (absolute) frame of reference.

Einstein's clock synchronization method ($t_B - t_A = t'_A - t_B$) dictates equal time passage for a ray of light, whereby spatially separated clocks of the same inertial frame record equal time passage for a light ray moving in *either direction* through the particular frame, even though the particular frame might have non-zero speed relative to actual light speed. It does so by necessarily disregarding the physical nature of those clocks, and by disregarding the *actual* constancy of the speed of light.

Thus, that equation neutralizes "the actual" – the physical reference frame of the universe. Such clock synchronization leads directly to the "lattice of clocks" methodology which is in lock step with spacetime diagrams. It has the "jump in time" built in for any situation involving a change of inertial frame.

It is in a spacetime diagram that we find the infamous sudden shift of a line of simultaneity. The further away (or the higher the overall speed) the inbound and outbound astronauts are from the stay-at-home when the "sudden turn-around" occurs, the greater the magnitude of the "jump in time" as dictated by the "lattice of clocks" specific to the newly adopted inertial frame.

Spacetime, being dependent on Einstein's clock synchronization, is simply a geometrical construct. Those who wrongly think of spacetime as a physical reality will write, when attempting to explain the time-keeping differential, that we “travel” through spacetime or that we take “different paths” through spacetime; and this despite the fact that they describe the time-keeping differential as a sudden jump due to a sudden shift of perceived simultaneity.

Whether they see such "travel" as traveling through time or traveling through time-keeping is hard to discern. In either case, it's to be rejected.

We can travel through space. But to say we can travel through time in a pliable manner would imply ungluing ourselves from the march of time, in the sense of the "march of history". The most one can realistically say about our relationship to (historical) time is that we are carried along with time in an unpliable manner in accordance with time. It is our travel through space alone that is actually pliable.

Time-keeping (clocks or biological aging) on the other hand is pliable. Our aging will slow when we are in motion relative to the totality of the universe (meaning that our aging is virtually always slower than what it could maximally be).

The universe is the judge of the matter

Note that it is meaningless to ascribe linear motion to the whole of the universe itself (equivalently, its barycenter), considering that the universe is the baseline by which both accelerated motion and therefore uniform linear motion acquire meaning. (Acceleration implies an initial and final state of inertial motion, necessarily different from each other in an actual sense for the very reason that acceleration is actual.) That concept is fundamentally Machian, which we'll say more about in a bit.

The elimination of a universal (absolute) frame of reference leaves one with a circular definition of inertial frame (inertial system):

In a physical sense, to be in what is called an inertial system is to have an absence of experience (detection) of any force that could be construed as acceleration (or equivalently, gravity) based. The origin of such force must come from a relationship with the totality of the environment outside of the system in question, thus implying there is such an environment and that if your motion changed in relation to it, you would experience force.

Without the external environment (the universe), we can appeal only to kinematic measures of acceleration between two reference frames.

One might say "A is in uniform motion relative to B". But it might then be noticed that B is accelerated relative to C while C is in uniform motion relative to D. Who is in an inertial frame, and who is not?

One is also left with an unresolvable twins paradox of one's own making:

In *Spacetime & Electromagnetism*, Lucas and Hodgson, using the spacetime paradigm, wrestle with the twins paradox for fifteen pages, and claim no resolution.

In a footnote on page 73, they write: "Is it fair to give the Earth-bound twin the vertical world line? Does not that beg the question in his favor? Why not draw another diagram with his world line set at an angle to the vertical, and his lines of simultaneity correspondingly inclined (but at a contrary angle) to the horizontal?" [10]

That alternative diagramming of the situation is identical to the consideration that one might just as well consider that it is the earth, along with the entire cosmos, that changes inertial frames. That, in fact, is something we hear often from commentators on relativity, as they attempt to make their case for "no truth of the matter".

Of course, such claim simply makes the twins paradox unresolvable, as either party can then lay equal claim to being the party that ages the least. This is demonstration that one must consider the entirety of the cosmos, the imparter of inertial properties, to be the judge of the matter regarding actual motion.

As another example of spacetime madness, consider that John A. Wheeler, in his book *Spacetime Physics*, made two "spacetime attempts" to resolve the twins paradox and failed each time.

After claiming to have resolved it on page 131 of his book, he writes on page 170 that he will "finally! .. solve" it. But he remains trapped in the universe of perceived simultaneity and the lattice of clocks, and ends up mocking his own failed attempt.

He never stood a chance:

He failed to have an outgoing astronaut transfer his clock reading to an incoming astronaut, which would have plainly revealed the true incremental increase of the time-keeping differential.

Instead, he was constrained by Einstein's clock synchronization and the lattice of clocks methodology, which simply assigns an incoming astronaut a time reading for the Earth clock that represents the entire ultimate time-keeping differential; all in one fell swoop (which Wheeler refers to as her "misperception").

Wheeler has his astronaut proclaim – "as I turned around, a whole bunch of Earth clock ticks went from my future to my past. This accounts for the larger number of total ticks on the Earth clock."

Wheeler continues: “The astronaut renounces her profession and becomes stand-up comedian.” [11]

Wheeler has at that point twice failed to resolve the matter.

In a footnote, he refers his readers to an old journal article as perhaps a way to place a stamp of legitimacy on the nonsense.

The article is "The Clock Paradox", American Journal of Physics, Volume 31, (1963). See page 59 of that article. Even though its author, Edward Lowry, in his informal and incorrect verbiage, feels compelled to claim acceleration for the returning twin, Lowry in fact, in his diagram and further discussion, specifies an instantaneous turnaround "at the event B" and of course cannot provide the promised explanation for the ultimate time-keeping differential. Lowry instead attributes the time-keeping differential to changes in simultaneity as perceived by the parties involved. In other words, Lowry offered nothing beyond what Wheeler had offered. It is the "misperception" explanation. We are asked to believe that someone's *perception* explains the *actual* difference in aging or in recorded clock time between reunited parties.

An expanded account of what Lowry wrote – and which Wheeler cited – is in order:

Lowry attributes the time-keeping differential to changes in simultaneity by stating that “the rocket's current hyperplane of simultaneous points swings around so that events F and B become simultaneous”, and that “the acceleration of an observer induces a rotation of his coordinate axes and coordinate hyperplanes, resulting in an apparent displacement of the current readings of remote clocks”.

We're not making this up. “*swings* around”? .. “*acceleration* of an observer”? .. “*apparent* displacement of the current readings”?

The term "*swings* around" has no meaning. Acceleration is not allowed. "Apparent" is no explanation for the "actual".

In a single paragraph, Lowry (and by association, Wheeler) demonstrates the absurd state of affairs and lack of coherence or understanding among authors on the topic of special relativity.

Others fare no better than Wheeler or Lowry, specifically – not even any of the other most famous and well-connected physicists:

The widely read Michio Kaku states in *Hyperspace* that “the resolution of this paradox is a bit delicate” and refers the reader to his Notes section, where he is unable to convey anything other than the notion that “space and time become distorted in different ways in different frames.”

He was unable to provide any details as to the resolution of the paradox. He fares no better in *Einstein's Cosmos* where he again brings up the paradox and again fails to offer a resolution. [20, 21]

The emminent Richard Feynman simply refers to a force as being demonstration that there is a change of frames, and offers no explanation for where the missing time went.

He writes in *Six Not-So-Easy Pieces: Einstein's Relativity, Symmetry, And Space-Time*:

“So the way to state the rule is to say that the man who has felt the accelerations, who has seen things fall against the walls, and so on, is the one who would be the younger; that is the difference between them in an "absolute" sense.”

If Feynman had a clue as to how that leads to a time-keeping differential, he would have loved to tell us about it. But he had no clue. He simply had no business writing about relativity.

Feynman does not consider the transfer of clock information, which is exactly what needs to happen. No force involved. No acceleration. Simply kinematic deductions. [22]

Richard Wolfson entitled his relativity book *Simply Einstein: Relativity Demystified*, but absolutely does not demystify it. Instead, in trying to resolve the twins paradox of special relativity, Wolfson diagrams acceleration as part of his so-called resolution of the paradox, despite the fact that acceleration effects are absolutely not in play in the time differential of special relativity. How can one claim to demystify something that one obviously has never even read. [23]

And all of the above is simply status-quo throughout the literature, text-books and otherwise.

> Clarity:
>
> The time registered on a person's clock is dependent on the combination of their actual speed as a percentage of actual light speed and of distance covered in absolute terms. Differences in recorded time build *incrementally*, and the party that changes inertial frames will be the party whose clock registers the least time over the course of a "round trip". This is seen with clarity when everything is charted out in absolute terms.

There is nothing the slightest “bit delicate” about this. When someone fails to provide an explanation with the excuse that it's too “delicate” for you to comprehend, know that they simply have no explanation.

An even simpler demonstration of hierarchy of inertial motion

Regarding the time-keeping differential, we'd like to make an even simpler argument, whereby we consider a gent "A" orbiting the earth twice for each orbit completed by a gent "B" at the same altitude, and then have them compare their recorded clock times each time A passes by B. But in practice that's not possible since orbital altitude dictates orbital speed.

However, why not let gent A orbit at a radius less than that of gent B's orbit and have them simply compare their recorded clock times once back together on Earth. Since, in this case, the gents would also have clock rate differences due to their differing accelerations (per general relativity), one would need to allow for that.

Such studies have, in effect, been carried out, and the kinematical (special relativity) portion of the time-keeping differential can be separated from the total time-keeping differential. We find that the kinematical effect slows the clock of the faster moving gent A (in his lower orbit) more than it does that of gent B's clock.

It's a simple matter of conducting the experiment twice: In the first instance, we let A complete 10 orbits. In the second instance, we let A complete 100 orbits. Even though the acceleration portions are identical in both scenarios, we find that the difference in clock times between A and B is greater in the second scenario. And that greater difference is due entirely to non-accelerated kinematical effects.

> What this example accomplishes is to eliminate any sort of turn-around or transfer of clock information across inertial frames, clearly illustrating the incremental build-up of the time-keeping differential due to what is clearly an actual difference between the speeds of the parties involved. Form a picture in your mind and try to imagine that the difference in speeds is not actual in the context of the universe.

Trivially, such actualities imply an absolute frame of reference, despite the fact that one cannot experimentally discern one's motion relative to such frame of reference (the universe).

Yes, the universe actually exists, and I can therefore move in relation to it, just as surely as my house exists and that I can move in relation to it – walking from my living room to my kitchen. Are you getting a sense of how facetious it is to deny an ultimate frame of reference, which serves as a background for context, analysis and understanding? It's called the universe. And the universe is as actual as the actual difference in recorded time between reunited parties. When one utilizes this fact, paradoxes disappear.

Mach, the universe at large, the ether and spacetime in the words of Laughlin, French and Einstein

Nobel laureate Robert Laughlin writes: “It is ironic that Einstein's most creative work, the general theory of relativity, should boil down to conceptualizing space as a medium when his original premise [in special relativity] was that no such medium existed ... The word 'ether' has extremely negative connotations in theoretical physics because of its past association with opposition to relativity. This is unfortunate because, stripped of these connotations, it rather nicely captures the way most physicists actually think about the vacuum. ... Relativity actually says nothing about the existence or nonexistence of matter pervading the universe, only that any such matter must have relativistic symmetry.” (i.e., as measured.) [12]

A. P. French writes: “Note, though, that we are appealing to the reality of A's acceleration, and to the observability of the inertial forces associated with it. Would such effects as the twins paradox [specifically – the time-keeping differential between reunited clocks] exist if the framework of fixed stars and distant galaxies were not there? Most physicists would say no. Our ultimate definition of an inertial frame may indeed be that it is a frame having zero acceleration with respect to the matter of the universe at large.” [13]

It's clear that Einstein – unlike frequently cited authors such as Wheeler (who writes: “The Principle of Relativity rests on emptiness” [14]) – ultimately understood and acknowledged that there is an underlying reality to special relativity. In his 1920 lecture at Leyden, Einstein speaks at length about Mach's notions of an object's relationship to the universe at large. [15]

Quoting Einstein from that lecture:

“To deny the ether is ultimately to assume that empty space has no physical qualities whatever. The fundamental facts of mechanics do not harmonize with this view; for the mechanical behavior of a corporeal system hovering freely in empty space depends .. on its state of rotation, which physically may be taken as a characteristic not appertaining to the system [within] itself. [thus,] .. the modern physicist .. comes back once more, if he follows Mach, to the ether, which has to serve as medium for the effects of inertia.”

Einstein continues:

“Mach's idea finds its full development in the ether of the general theory of relativity. According to this theory the metrical qualities of the continuum of spacetime differ in the environment of different points of spacetime, and are partly conditioned by the matter existing outside of the territory under consideration.”

Einstein summarizes:

"Space without ether is unthinkable; for in such space there .. would be .. no possibility of existence for standards of space and time, [specifically] our measuring-rods and clocks, nor therefore any spacetime intervals in the physical sense."

Those preceding statements of Einstein's are in contrast to his confused beginnings, which are plainly evidenced in his 1905 paper on special relativity:

He begins that paper by apparently thinking in absolute terms: In his initial wording, his second postulate states that "light is always propagated in empty space with a definite velocity c which is independent of the state of motion of the emitting body." [16]

With the word "definite", Einstein implies that light has an absolute (actual) speed in reality, though he doesn't explicitly state that there is a physically defined universal reference frame against which light has this definite velocity.

The 26-year-old pioneering Einstein was still getting his mind around the subject even as his paper progressed, and three pages later, when he restates this postulate, he uses conceptually different terminology which fundamentally changes the meaning:

"Any ray of light moves in the "stationary system" of coordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body." [17]

Here he replaces "definite" with "determined" and uses quotes around stationary system. With this new wording, he abandons the absolute character of his postulate as initially worded, indicating he is already preparing (*with an eye on the results he anticipates*) to abandon the very reference frame which could have brought clarity to his treatment. Instead (and in keeping with experimental evidence of the day), Einstein proceeds to simply *assume* symmetrical assessments across inertial frames, without any hope of diagramming the process.

At the conclusion of Einstein's kinematical section, where he deduced the "peculiar" time-keeping differential between reunited clocks, he should have realized that his clock synchronization method was obscuring the reality underlying the symmetrical measures across inertial frames.

Thus, Einstein's second postulate is so replaced in our absolute approach. Or we might say we are restoring Einstein's initial wording of his second postulate. (Considering his strongly worded description of space years later in his Leyden lecture, we must assume he would agree with this.)

The consideration of photons being massless particles, along with the consideration that mass and energy are interchangeable, serves as the basis for postulating that light has an absolute speed and is also the limiting speed, with the photon having the property of existing in the form of pure energy. The preceding properties of photons and matter were actually known prior to Einstein's theory. Einstein himself, following the lead of Max Planck, introduced the notion of light existing in the form of a quanta of energy.

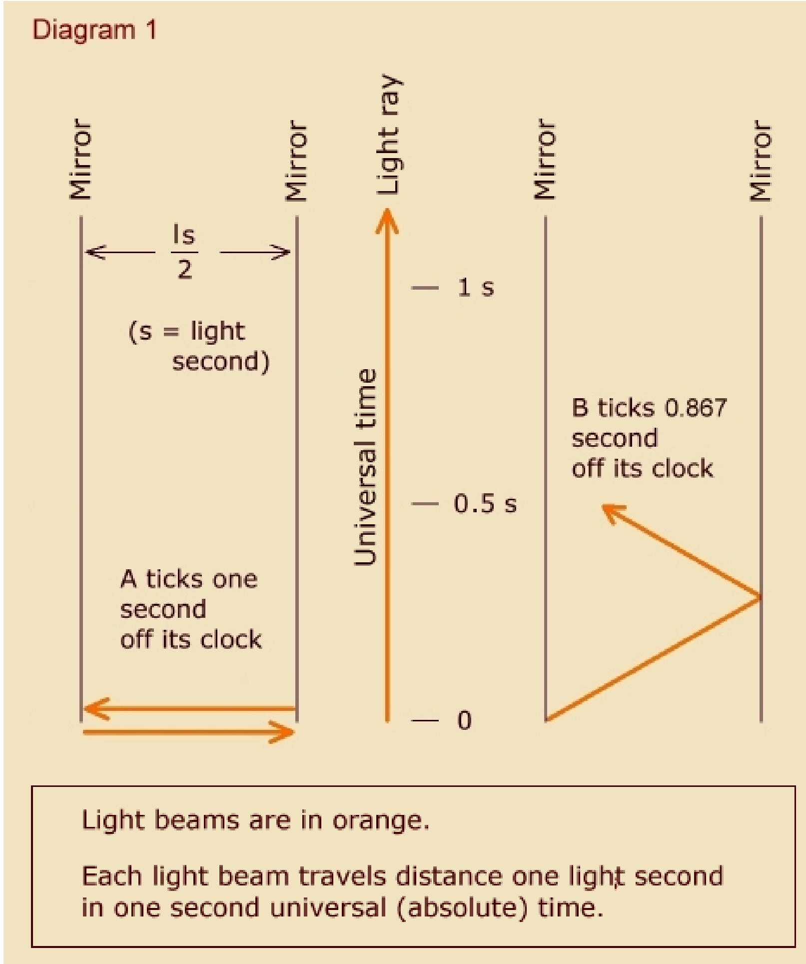
An actual difference in clock rates follows immediately from this postulate of the absolute nature of light, provided of course, that one assumes that photons are the maker of every relationship (specifically here, the regulators of atomic functioning; but also the carriers of force information and our means for perceiving events).

All processes are constrained by the speed of light. There is clock functioning at every level, dependent on light-speed and the inherent delay, even at the atomic level. Therefore, biological aging is affected by changes in inertial motion in the same manner as is a clock.

Diagrams

In diagram 1 below, we see a photon necessarily travel the same distance in the clock that is in motion relative to the universe as does the photon in the clock that is at rest with respect to the universe. Thus, the difference in actual time-keeping between the two clocks.

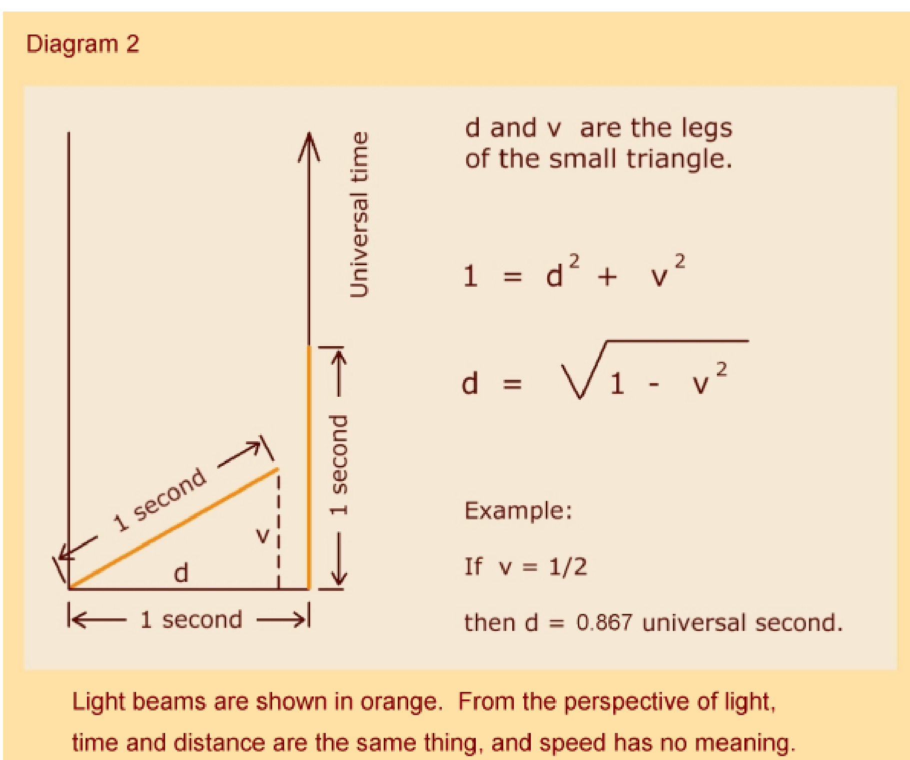
Although a moving source of light-emission cannot impart additional speed to a photon, it is reasonable that it would affect the vector components of the photon's motion, creating a vector component in the direction of motion of the source, while the perpendicular vector component is diminished. A photon does, after all, have a non-zero amount of momentum, and we can therefore imagine that a moving source of emission can have an effect on its trajectory.



The (actual) time contraction is easily obtained in diagram 2 below.

From the perspective of light, time and distance are the same thing:

One light second (unit of length) is also one second (unit of time).



Einstein's first postulate, which itself pertains only to *measures* of properties, is the Galilean Principle of Relativity extended to electromagnetism. As seen in the Michelson-Morley experiment, as well as in Galilean mechanical demonstrations, the Principle of Relativity is inextricably bound with synchronization of motion along different axes.

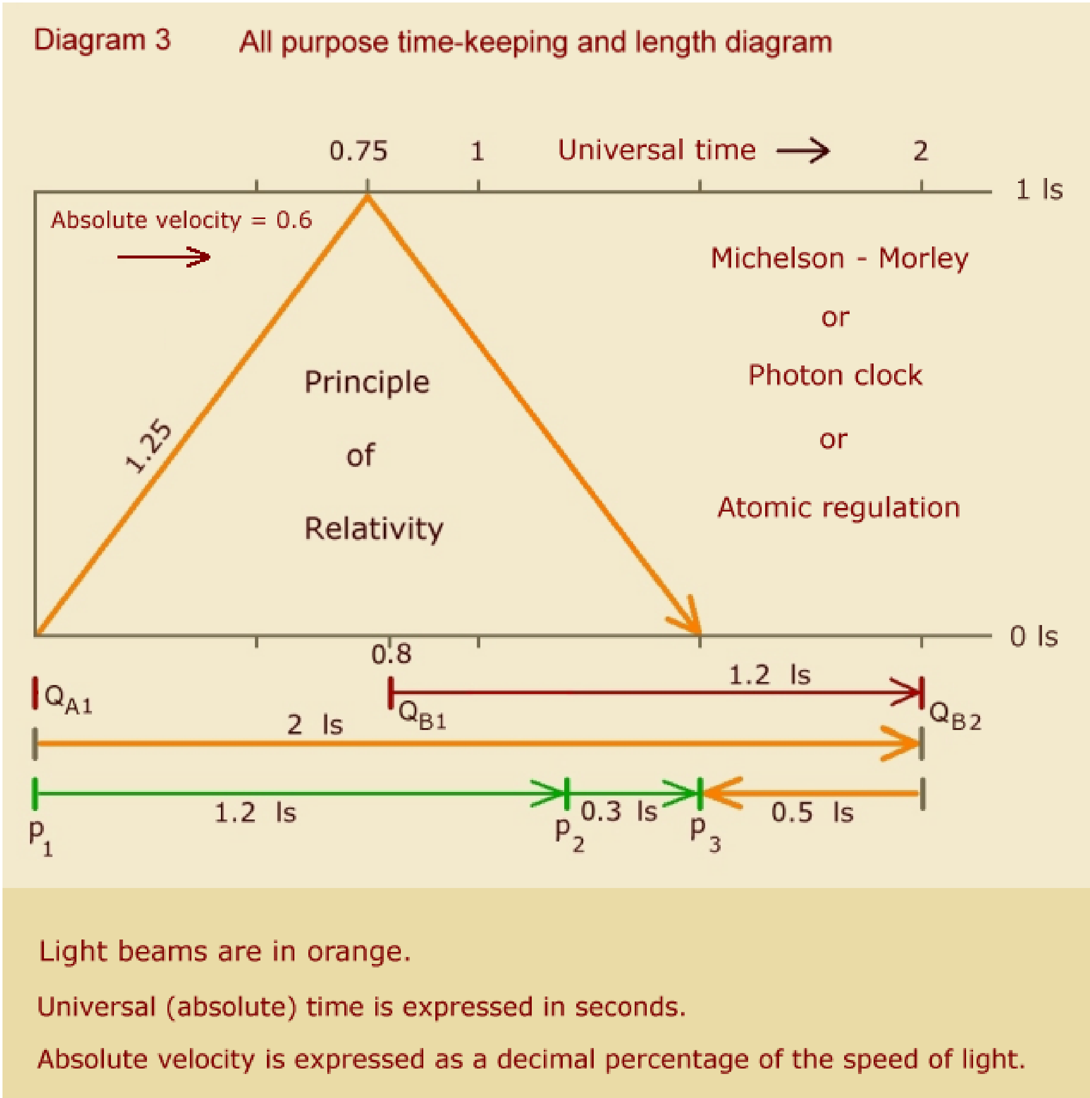
Einstein's first postulate is replaced, in the Gods' eye view, with the notion that there is actual synchronization at the base of our physical structures, for the sake of their stability.

The Machian notion of a particle's relationship to totality, along with absolute light speed, combine with the need for atomic synchronicity to explain actual length contraction. This is because photons (or virtual photon events, or some other massless particles) are considered to be the fundamental agent of communication within atoms, maintaining the organized structure of the atom. It is the equivalent of the Michelson-Morley paradigm, but on the atomic scale. Implicit here, is that particles have both a translatory relationship with the universe (with an ether so associated), and a rotational/orientational relationship with their translatory path, in the Machian sense.

Thus, an atom will shrink in the direction of its motion to maintain stability; and a rigid body, with its molecules sharing the outermost atomic valence, is dependent on the shape of an atom for its own shape. Furthermore, since the communication of force is constrained by the speed of light, objects that become spatially separated are subject to a contraction of their spatial separation consistent with whatever final state of inertial motion they achieve in absolute terms. Similarly, the laying out of contracted measuring rods establishes a contracted spatial separation of two objects in the same inertial frame.

Principle of Relativity diagrammed

The all-purpose diagram 3 below shows a photon clock P, which emits a photon in both a direction parallel and perpendicular to the motion of P. Light beams are drawn in orange.



The distance from mirror Q_A to Q_B is 0.8 light second (contracted from 1 light second due to P's absolute speed of 0.6).

P_2 is where P is at the moment his light beam reflects at Q_{B2}. Remember – this is the God's eye view, where simultaneity (a moment) is not something that is a perception of the parties involved. Observations made by an omnipresent God are not dependent on the speed of light. And that omnipresent being need be nothing more than the reader viewing this static diagram.

It's easy to see the naturalness of the Michelson-Morley result when you consider it on the atomic scale. The Principle of Relativity (POR) and the synchronicity of the atom are more than closely related – they're the same thing. Synchronicity is the atom's version of its own POR, i.e., the atom must behave as though it is not aware of its translatory motion. Photons are so aware, and they take care of things. The atom would fly apart if the nucleus was thrown off center; the table would get wet if Galileo's water-drops missed the neck of the vase. [18]

The stability of the atom is identical to the requirement that the POR needs to be true, where light is seen to be the actual agent of "action at a distance"; because if "instantaneous action at a distance" was actually true, all physical phenomena would still need to possess internal synchronicity at the deepest level to preserve any semblance of reliable physical laws. We can expect no less of the actual agent of "action at a distance" – light.

> We said that – for light – time and distance are the same thing. From light's perspective, it is everywhere at once, as though the universe was static. That is the realm to which we relegate mystery in our absolute approach to relativity.

Length contraction formally derived

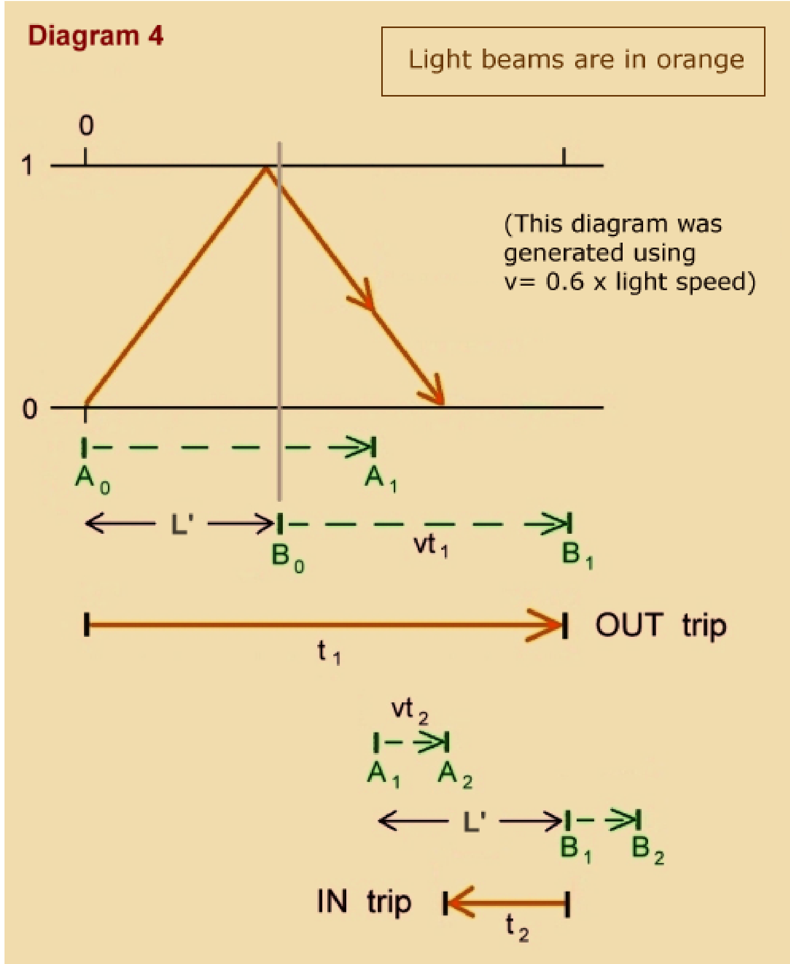
Note that length must be contracted to the same degree as time-keeping is contracted in order to achieve symmetry of measure across inertial frames.

Having found our time-keeping contraction expression:

$t' = t\,(1 - v^2)^{1/2}$,

we now wish to see whether the length, as yet unknown L', of the moving rod containing end-points A and B is indeed contracted to the same degree as the clock rate of AB.

That is what is required to make diagrams 3 and 4 valid.



The rest length L of the rod equals one light-second. (L = 1)

We wish to know whether $L' = (1 - v^2)^{1/2}$.

From diagram x,

Universal time $t_1 = L' + vt_1$ (out trip)

Universal time $t_2 = L' - vt_2$ (in trip)

$$L' = t_1 - vt_1 = t_1 (1 - v)$$

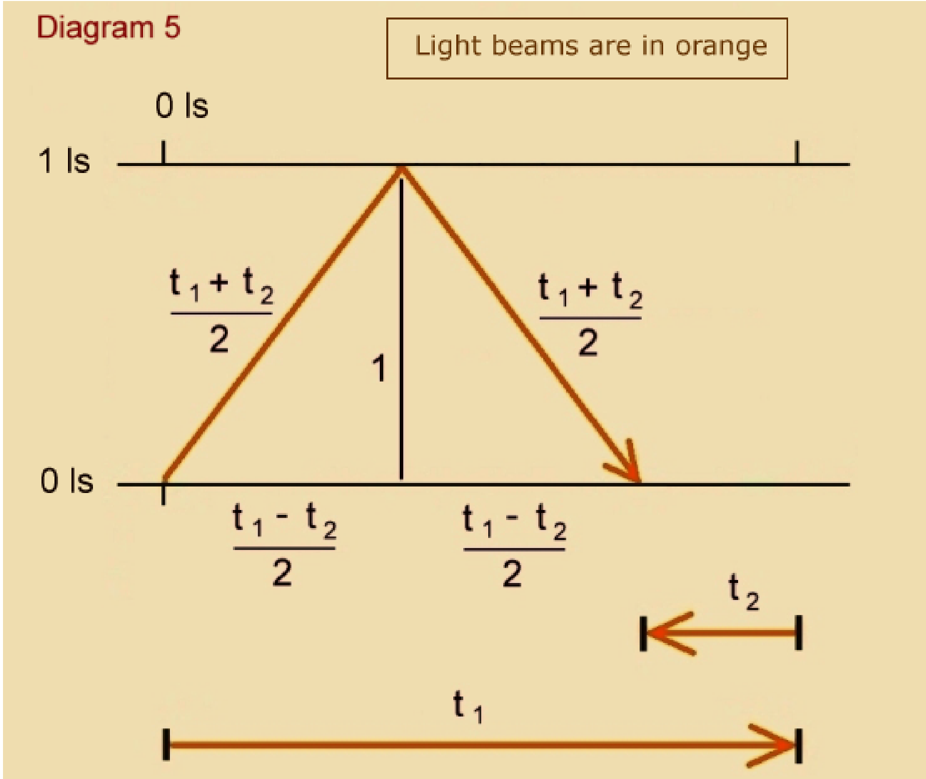
$$L' = t_2 + vt_2 = t_2 (v + 1)$$

$$\Longrightarrow \quad L'^2 = t_1 \; t_2 \; (v + 1 - v^2 - v) = t_1 \; t_2 \,(1 - v^2)$$

$$\Longrightarrow \quad L' = (t_1 \; t_2 \,(1 - v^2))^{1/2}$$

The answer is in the affirmative, provided $t_1 \; t_2 = 1$.

This we find by applying Pythagoras to diagram 5,
with the answer being in the affirmative.



Our absolute approach reveals the nature of measuring

Time-differential (twins paradox) diagrams, when presented in pairs, demonstrate the indeterminability of one's motion relative to universe; i.e. there is no priviledged frame of reference for conducting experiments. There is not enough space in this article to show those diagrams and the simple algebra that accompanies them, nor diagrams showing consistent measure of light-speed independent of inertial frame. However, the diagrams below, which provide an example of symmetry of measuring across inertial frames, incorporate the exact same techniques and simple algebra that we use in the twins paradox and light-speed measure analyses.

We will here present a mere example of the measuring process using numerical values, it being perhaps an easier thing to follow along with than a non-numerical proof.

Symmetrically measured length and time-keeping contraction across inertial frames

One cannot take measure of the length of a rod in motion relative to oneself without first assessing the relative speed of the rod to be measured. This relative speed will of necessity be treated as an absolute speed by the party taking the measurement. As he cannot assume anything regarding his own motion relative to the universe, he will, as is always the case in real life, conveniently regard himself as being at rest.

A person who considers himself to be at rest must, of course, consider his length and time-keeping to be not contracted. These considerations are used in the process of taking stock of the "moving" rod. And it is as true for any laboratory measuring device as it is using this set up.

Part one – A takes stock of B

We'll consider two spaceships, A and B, each with a rest length of 1 light second.
(These are very large spaceships.)
On board ship A are two clocks, C1 and C2.

Diagram 6 below shows ship A in motion relative to the universe U.
Ship B is at rest with respect to U. A is moving at 0.6 c, thus contracted to 0.8 light second from its rest length of 1 ls.

C2 sends a light ray towards C1 as C2 lines up with point Y of ship B. C1 is triggered by the reception of this ray, and ship A must necessarily allow that 1 second was required to effect the triggering. C1 then ticks off 0.67 second during the interval in which C1 proceeds to point Y of ship B.

Thus A calculates B's velocity as follows:

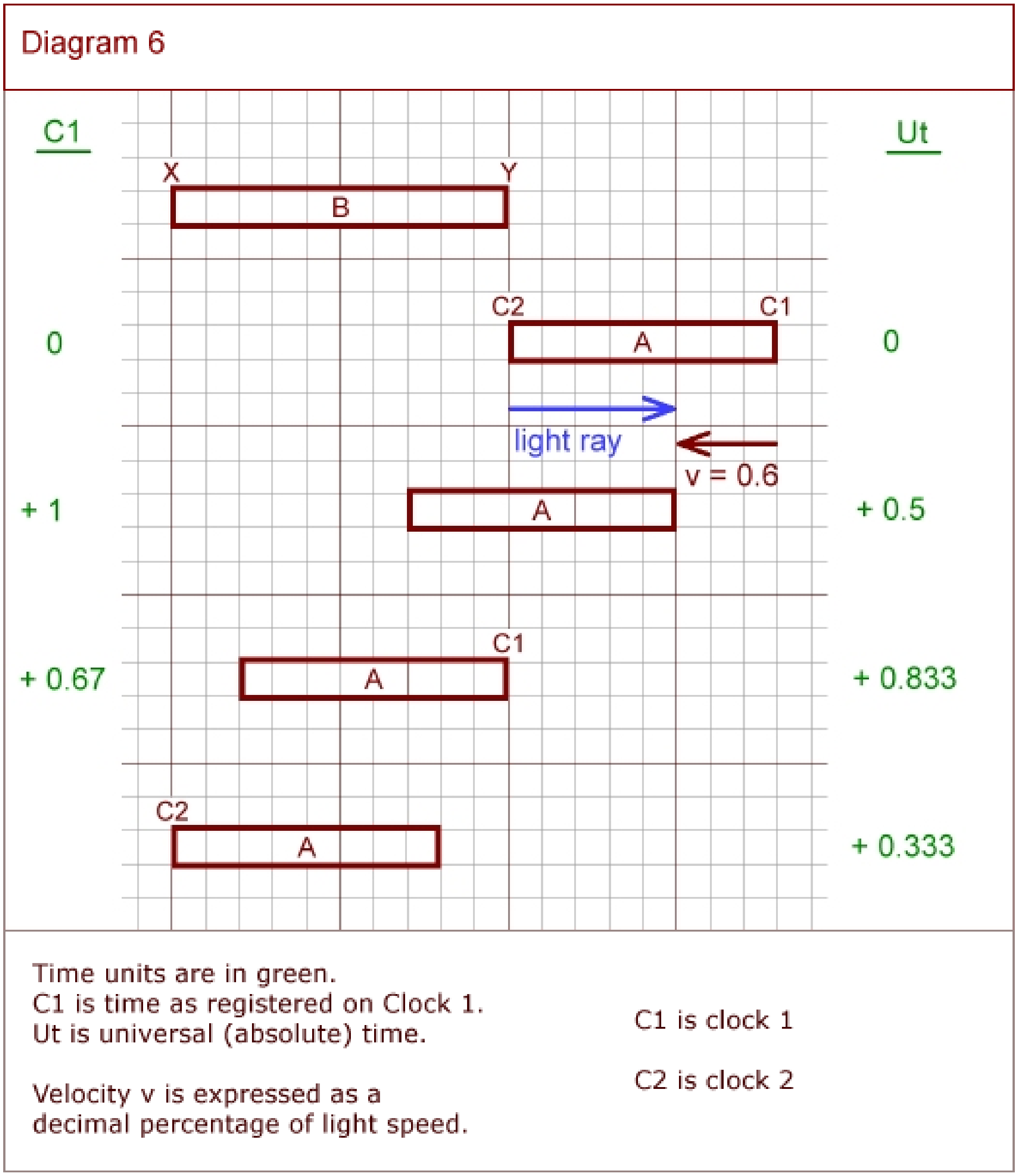
distance = velocity * time

1 = v * 1.67 which implies v = 0.6

(Remember, A considers its own length to be 1 ls.)

To calculate B's length, A uses the fact that C2 has ticked off 1.33 during the interval in which C2 travels from Y to X. (Ut during this interval is 1.67 seconds.)
d = vt yields 0.6(1.33) = 0.8 ls.

Ut = universal time = actual time = God's-eye-view time



We can see from this same diagram that A will measure the rate of a clock which B has placed at point Y to have a rate of 0.8 times its own:

As clock Y passes from C2 to C1, where clock-readings are exchanged, it registers a change of 1.33 seconds, the same as Ut. This is the interval during which A determines its own time passage to be 1.67 seconds.

Thus, A regards B's clock to be slowed.

Part two – B takes stock of A

In diagram 6, we showed that even though A is in motion relative to U, A still measures B's length as contracted, and to the same extent as its own contracted length as seen by U.

In diagram 7 below, we again have A in motion relative to U, with B at rest relative to U.

Now let's have B take stock of A.

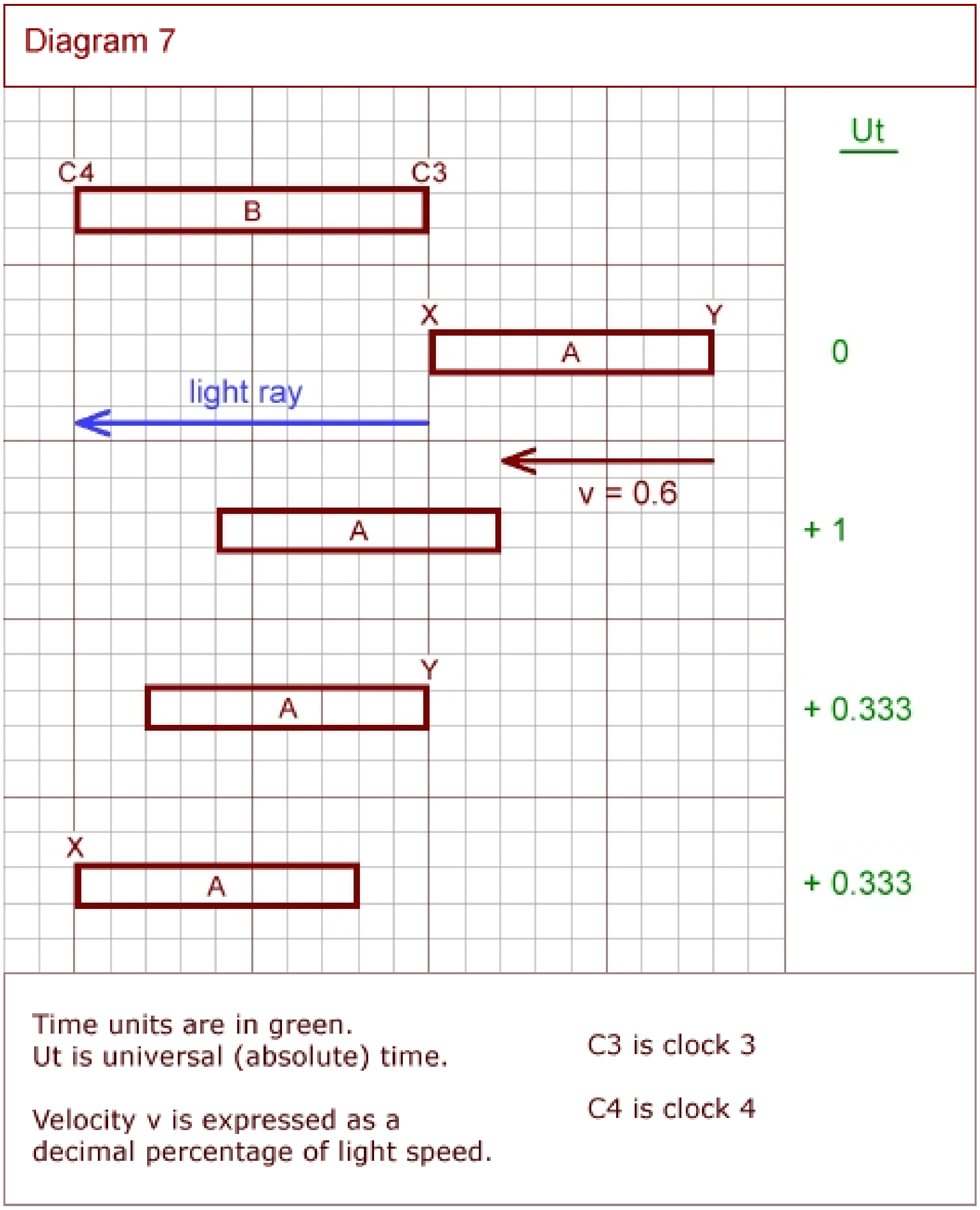
As point X of ship A lines up with C3, C3 sends a light ray towards C4. C4 is triggered by the reception of this ray, and B considers 1 second to have passed. C4 then ticks off 0.67 seconds during the interval in which point X travels from C3 to C4.

Thus B calculates A's velocity as follows:

distance = velocity * time

1 = v * 1.67 which implies v = 0.6

To calculate A's length, B uses the fact that C3 has ticked off 1.33 during the interval in which C3 travels from X to Y.
d = vt yields 0.6(1.33) = 0.8 ls.



We can see from this same diagram that B will measure the rate of a clock which A has placed at point X to have a rate of 0.8 times its own:

As clock X passes from C3 to C4, where clock-readings are exchanged, it registers a change of 1.33 seconds, in keeping with its time contraction of 0.8 Ut. This is the interval during which B determines its own time passage to be 1.67 seconds.

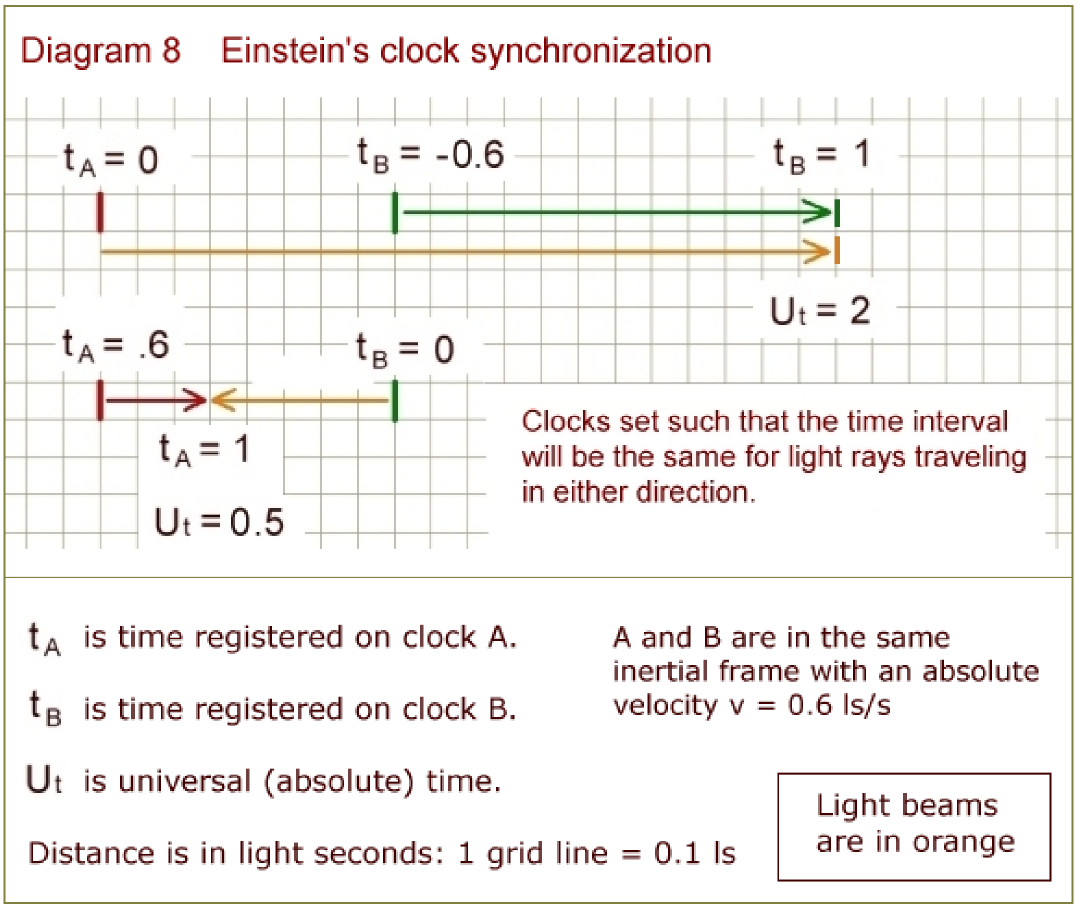
Thus, B regards A's clock to be slowed, with precise symmetry of measure preserved between the two cases.

Note that the calculations in the preceding examples apply to all measuring devices, the components of which can communicate with each other no faster than light-speed. We need to assume that our devices are true to their markings, knowing nothing about our true motion status relative to the universe.

Einstein's clock synchronization

Let's examine Einstein's assignment of tA - tB = tB - t'A in the context of the universal frame.

Consider the following situation in the context of the universal frame:



In our discussion below, velocity is expressed as a decimal percentage of the speed of light.

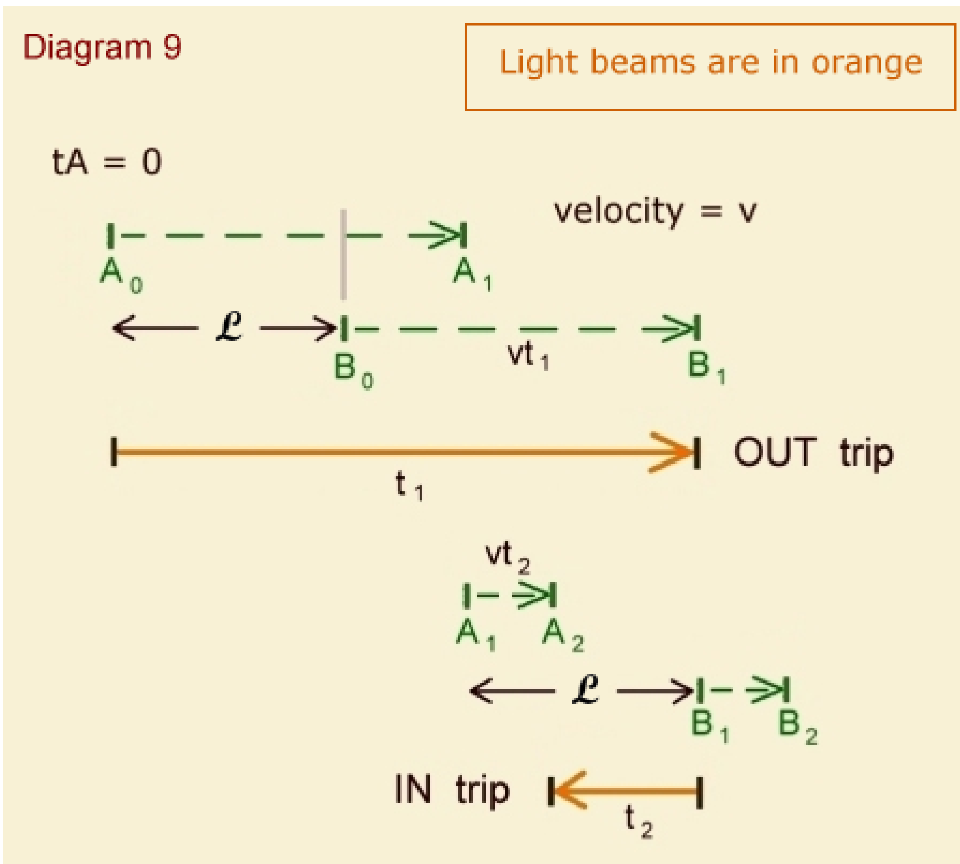
Clock B is in the positive direction of the AB motion from clock A, the AB system has an absolute velocity of 0.6, and A and B have a rest spatial separation of 1 ls (0.8 contracted) as seen against the universal reference frame.

Einstein's definition of what constitutes a synchronization of those two clocks dictates that B's reading will be 0.6 second less than A's reading as seen against the universal frame (God's eye view of a moment), 0.6 being the velocity of AB. (We derive that below.)

Keep in mind that Einstein had no awareness of this superimposition onto the universal frame, and thus no awareness of these numerical values. This superimposition diagram, as with all the diagrams in this article, is the original and unique work of this author.

Using this convention (the assignment of tA - tB = tB - t'A) amounts to a disregard of an analytical incorporation of an absolute frame of reference. It is in keeping with Einstein's notion of simultaneity, wherein he elevates a direct observation of distant events to a perceived-reality of simultaneity, or lack thereof, for a given observer.

Regarding Einstein's clock synchronization as diagrammed above, we here show that B's reading will be 0.6 second less than A's reading as seen against the universal frame.



Having already determined that $\mathcal{L} = (1 - v^2)^{1/2}$, we note the following:

For the out trip:

Distance traveled by light ray = t_1
where t_1 is universal time.
Distance traveled by AB system = vt_1.
$t_1 = vt_1 + \mathcal{L}$ ==> $\mathcal{L} = t_1 - vt_1$ ==> $\mathcal{L} = t_1(1-v)$
$t_1 = \mathcal{L}/(1-v)$ [eq 1]

For the in trip:

Distance traveled by light ray = t_2
where t_2 is universal time.
Distance traveled by AB system = vt_2.

$t_2 + vt_2 = \mathcal{L} \implies t_2(1+v) = \mathcal{L}$

$t_2 = \mathcal{L}/(1+v)$ [eq 2]

Einstein's clock synchronization requires that tB = 1 and that t'A = 2, so that tA - tB = tB - t'A (i.e., 0 - 1 = 1 - 2) for all v.

B's clock rate is $\mathcal{L}$t. Therefore, from eq 1:

$tB = 1 = \mathcal{L}(\mathcal{L}/(1-v)) + t_iB$ [eq 3]

where t_iB is the initial reading of clock B (when clock A reads 0) as seen against the universal frame.

We wish to know if indeed $t_iB = -v$.

A's clock rate is of course also $\mathcal{L}$t.
Therefore, from eq 2:

$t'A = 2 = \mathcal{L}(\mathcal{L}/(1+v)) + \mathcal{L}(\mathcal{L}/(1-v))$ [eq 4]

Doubling eq 3 makes it equal to eq 4, therefore:

$2\mathcal{L}(\mathcal{L}/(1-v)) + 2t_iB = \mathcal{L}(\mathcal{L}/(1+v)) + \mathcal{L}(\mathcal{L}/(1-v))$

$2t_iB = \mathcal{L}(\mathcal{L}/(1+v)) + \mathcal{L}(\mathcal{L}/(1-v)) - 2\mathcal{L}(\mathcal{L}/(1-v))$

$2t_iB = \mathcal{L}(\mathcal{L}/(1+v)) - \mathcal{L}(\mathcal{L}/(1-v))$

$2t_iB = (1-v^2)/(1+v) - (1-v^2)/(1-v)$

$2t_iB = [(1-v)(1-v^2) - (1+v)(1-v^2)] / (1+v)(1-v)$

$2t_iB = (2v^3 - 2v) / (1-v^2)$

$2t_iB = -2v$

$t_iB = -v$

Complexity, emergence, simple universes, and where is the center

We note that the smaller a thing is in relation to its environment, the greater is the meaning attached to its properties. No meaning whatsoever can be attached to an *overall* property of the universe, any more so than to a single component universe.

This has everything to do with the notion of complexity giving rise to the meaningfulness of physical properties, which is implicit in all our arguments pertaining to an object's relationship to totality. A very simple universe would impart inertial properties in a much rougher manner than does the universe in which we live, and those properties would mean much less. When relativity authors present us with a twins paradox wherein only an astronaut and a brick exist, they unwittingly provide us with an exceedingly confused, impossible and meaningless scenario, as seen in Martin Gardner's *Relativity Simply Explained*. [19]

Our absolute approach to relativity is perfectly compatible with the notion that one cannot determine that they are not at the center of the universe. At the edge of the universe, all gravitational source is on one side of the person at the edge. Thus his line of sight is always curved in towards the interior of the universe, as is any translatory physical path along which he might venture.

Finally, note that this author has also diagrammed and computed symmetrically measured effects of inelastic collisions across inertial frames, including transfer of mass, in absolute terms. Subsequently this author derived, on an absolute basis, $e = mc^2$ – all for the sake of reasonable completeness.

Summary

Instead of hundreds of thousands of hours – on a world-wide basis – being wasted every year by tens of thousands of educators and students wrestling with an unresolvable twins paradox of their own making, such time could be spent on fruitful endeavors. All attempts to explain an actual time-keeping differential without acknowledging other actualities need to end. Identically, all attempts to explain symmetrical measures and relativity of simultaneity without incorporating actualities need to end.

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