ON THE NATURE OF TIME

By Thomas Garcia

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Where it concerns time theory, two thought experiments developed from Relativity theory to describe the paradox of "time dilation" lead conclusively to the proposition that the passage of time varies at rates inversely proportional to the speed of individual objects and therefore, *time* is a property of discrete matter. This simple time and motion relationship, which I defend herein with evidence confirmed many years ago, is as relevant to science today as were Albert Einstein's principles of Relativity published in the early 1900s.

Of the many new wonders Einstein's work revealed to the world, one was, in paraphrase of his words, that the rate at which time passes depends on the speed of individual observers.[1] Unfortunately, that small detail failed to gain the attention it deserved then and it seems no one ever followed up on it. The research for this essay, much of it gathered from public internet discussion forums, revealed that all correspondents continue to believe the passage of time imposes itself on space and on all objects equally throughout the universe. Other research also failed to find a single person who believes otherwise.

Yet, that belief is contrary to the well-accepted findings of Albert Einstein, as shown in two common thought experiments reviewed below. Consequent to the lack of interest, a very good clue regarding the nature of time fell into the pile of ideas that must sometimes wait for hundreds of years before scientists return to the pile to find perhaps some old information that may have more relevance than previously thought.

Unfortunately, it happens more often than anyone would care to admit. One reason for that may be that scientists prefer to turn, in their search for science's Holy Grail (aka the "Theory Of Everything," or TOE), to the highly imaginative but un-confirmable complex theories proposed today as better explanations for nature's mysteries.

After all the centuries of people asking "Just what is **time**?," Modern Physics has progressed no further in Theoretical Physics, essentially, since Albert Einstein's premise of time and space <u>interdependence</u> and the assertion that both time and space are flexible and dependent upon the state of motion of an observer.[2]

Without question, it is difficult to figure out time. It could be that the study of time, being that it is visible only indirectly, requires a more intense focus on every newly found implication. For example, Einstein's premise of time and space *interdependence* bonds time and space as partners absolutely and forever, where "one cannot exist without the other."[3] Yet, space has no such dependence on time, while time is dependent on space only indirectly as a property of matter. Matter, of course, is directly dependent on the existence of space.

The result of the misunderstanding above is the creation of a virtual "blind alley" (aka "the box" of creative thinking). There is nowhere else to go from there as the premise discourages any in-depth consideration that there may be more relevance to time other than the usual understanding of it as being simply the Siamese twin of space.

Everyone commonly thinks of time as a "continuum" or a "fabric" that exists throughout the universe causing all things, including empty space, to be equally subject to aging. However, that standpoint requires time to have or to be a *force* of its own. By definition, then, time either must be energy or must contain energy if it is to impose itself as a force on anything. So far, there exists no evidence to refute the claim that time is indeed a force.

In physics, **force** is a vector *quantity* because it has both magnitude and direction. Time qualifies as a force because its quantity, or magnitude, is any amount of the passing of time which is measured indirectly by clocks, and it moves (passes) in one direction, as shown in the concept of **entropy**. That leads to another blind alley because we find we cannot explain certain "loose ends" that come up again in explaining that time is a force.

For example, if time must be or must contain energy in order for it to be a force that imposes itself onto objects and to space, what is the source of its energy? In addition to that, if time is necessarily a force of nature, would that not make time a fifth fundamental force yet unrecognized? Yes, of course it would.

Is time a *field*, then, such as a gravitational field, with particles like the graviton or the bosons of the Higgs field? If so, the latter cannot be the final particle to search for, as some claim it to be. Furthermore, the time field, like gravitation, can exist only locally, as it accrues only to objects having mass, thus excluding empty space from being one of its "subjects."

Another problem too is the Twin Paradox (TP) thought experiment, as it refutes the unsupported claims that time forces space to age. The following section shows conclusively that time accrues only to objects having mass.

The Time "Dilation" Effect

In order for scientists to support the idea of the existence of an interdependent space-time continuum, they had to come up, for lack of more-precise terms, with the notion there are time and space events that they describe as time "dilations" or "warps" and the "curving" of space. For humans, though, while it is easy to say it, it is not possible to imagine the physical warping of time and the curving of boundless space in any way other than as the literary trick used in science fiction stories as a relatively quick and easy way to travel about the universe. It is the same as with *infinity,* easy to say, impossible to imagine it from start to...the end - because it never ends.

However, because space is transparent but exists everywhere particles of mass do not, it is therefore more likely interpretations of any observed effects of space and time will vary among freethinkers. Other than that, it could be a case similar to the Michelson/Morley experiment conducted in 1887, which was set up to discover the existence of the *ether*, but could not accomplish that task because the experiment was invented under the assumption that Newtonian relativity was invalid and thus it was possible to measure absolute motion.[4]

Nevertheless, several participants in my research avowed publicly they could imagine time dilation and the curving of space. However, whereas everyone has yet to come fully to terms with Relativity's TP, though many say they have, I find that also too incredible to believe. To read more about the limits to our imagination, there is a brief excellent article on this site:

http://philosophicalpontifications.blogspot.com/2011/02/testing-limits-of-your-imagination.html

The TP is an imaginable experiment, but it *is* difficult to understand even after reading the examples provided below of "time dilation." Reading both, however, may serve to answer questions left open in one but perhaps answered in the other. It is a task too difficult to imagine time "dilating" and space "warping" because the human mind cannot reconcile the claim that empty space and invisible time can "do" or "perform" such physical acts. For scientists to take ideas from science fiction or from nature's tricky effects as physical reality is a risky adventure, as that can too easily become a case of the tail wagging the dog, as it were.

"Absolute space," when defined as "physical space independent of whatever occupies it," cannot be seen as a non-existent absolute ideal, if only because its existence cannot be logically denied. We know time passes and matter has motion, but is empty space truly able to physically "curve"? Experiments purported to show it does that may prove something, but not *that*, necessarily. Again, it is likely the term is used for lack of better ways to explain the effects.

Even so, if anyone wishes to (perhaps only so as to help resolve these lingering questions), they can easily imagine space as something quite independent and separate from time, contrary to what most, if not all, scientists publicly believe today. Just how that may be accomplished is a topic for review herein too.

In a common textbook example of Special Relativity theory, two observers - one seated inside a moving passenger train while the other is positioned outside as the train goes by – take accurate measurements with their synchronized clocks of the amount of time it takes light to travel from a ceiling lamp to the floor of the train car. In a surprising conclusion, the result is that time passes *slower* for the observer traveling on the train, but only when compared to the rate of the passage of time for the stationary observer standing alongside the railroad tracks.

That does not seem right, though, because how can an experiment show such a thing, and why would it apply only to the two observers? It does that by being a *thought* experiment, which is the best way (and likely the only way in this case) to reveal **why** the measurements differ. This is, because the only relevant difference between the two observers is that they are not moving at the same speed with respect to each other. I submit this well-known yet little-understood experiment as the support for my initial premise of the first paragraph.

From the viewpoint of the outside observer who took his measurement as the train went by, the light traveled "distance *x*" in moving from the ceiling to the floor, ***plus*** "distance *y*," which is the distance the train moved in the time it took for the light to travel to the floor of the car. For him, a line tracing the path of a single light particle as it fell would show a diagonal line of travel drawn downward but curving in the direction of the train's movement. For the passenger, the light fell plumb downward from the ceiling light bulb to the floor of the train, but for the outside observer, the same light did not fall straight down.

For him, the falling photon curved as it fell, simply because the train had to be moving faster than he was as it passed by. For the observer in the train, however, the light particle traveled only the "distance *x*" because the falling light was moving down but *not* moving past her since she was on the same train as the light she measured. For the train rider, then, a line drawn based on her observation would be a vertical line because she is moving along inside the train with the photon as it falls. Thus, there is no "distance *y*" involved in her measurement.

In comparing the length of the two lines, the diagonal curved line is longer, of course, meaning that it had to have taken more time for the light to reach the floor, as far as the stationary observer is concerned, but less time than that as it pertains to the measurements of the train passenger observer.

If for the stationary observer the event took, e. g., two seconds to occur by his clock, but for the train passenger it took only one second, then, in this particular frame of reference wherein two observers move at different speeds through the universe, time passed for the stationary observer at twice the rate that the train passenger underwent. Clearly, the train passenger aged slower and thus less than did the stationary observer.

The experiment illustrates the time and motion relationship of inverse proportionality in showing that the faster observer accrued and underwent a slower time rate. This is an instance where two accurate yet different time measurements of a **single** event were obtained; yet, *that hardly seems possible*. The speed of light (c) is constant; therefore, it cannot be *that* which changed and caused the differences in the time measurements of the two observers.

However, if c did vary in order to accommodate the situation it would explain the time difference and it could be said then that c "adjusted, slowed, curved, or warped" to that particular situation, and so it would not be necessary for time and space to do all that. In addition, if it was the case that the speed of light varied instead of the rate of the passage of time (as opposed to just the passage of time), that would mean time must be a force stronger than that of the electromagnetic force.

It cannot be that the speed of light changed during the experiment, though, simply because c is not subject to the force of time, since light has no mass and time only accrues to massive objects. Light does not age, according to the Standard Model, which declares there is no such thing as "tired light." Thus, the rate of time varies for each observer at rates inversely proportional to their particular state of motion. Up to this point, many already agree with the latter case, perhaps unknowingly, as will be seen below.

The Separation of Time and Space

Within the context of Einstein's interdependence premise, it is clear that both time and space must at some *unknown* point warp, fold, flex, bend, dilate, or curve in order to reconcile the differences in the rates of the passage of time as measured by the two observers above. The premise is a conclusion necessarily adopted to explain the time differences, since the speed of light does not vary in the vacuum of space. Beyond that context, it becomes extremely difficult to apply such physical terms to time and space because both time and space are only indirectly observed, and because such terms are rendered unnecessary after the experiments cited herein are thoroughly understood.

For those who think that time is or is part of, a medium or a physical "space-time continuum" in which all things are held equally captive in time and thus held equally subject to its immutable flow, then it becomes necessary to invent such terms as time and space "warps" and to imbue space with forces impossible to confirm. Such necessity often arises when we are confronted with natural inconsistencies of the type shown in the experiments developed from Relativity for which there seem to be no better explanations.

In the experiment above, the rate of the passage of time varied due to the difference in *speed* between the two observers. It becomes easier for us then to think that the reason for the time differences is that each observer measured the event from within a time rate corresponding to his and her own speed.

Remember that both measurements in our train example are accurate and so, essentially, the only difference in the situation between the observers is that one is moving faster at the instant they each measure the light traveling from the ceiling to the floor inside the train car. They are both moving in space along with planet Earth. The stationary observer is at constant velocity with respect to the earth, but the train passenger is not because while the train has all the motions imposed upon it by the moving planet, it also has the added speed of moving with respect to the earth, as it moves along the tracks.

In the resolution to the so-called Twin Paradox thought experiment, a twin travels in a spaceship for a few years then returns to earth. He finds that his twin has aged more than he has, because nature apparently grants a slower time rate to the accelerating space traveler.[5] That conclusion has prompted many to work out highly complex mathematical calculations that purportedly show precisely how that happens. However, of the many proposed resolutions to this paradox, not one has yet explained just <u>why</u> nature should grant different time rates to moving objects.

The Twin Paradox is an example where there has been widespread agreement (albeit perhaps subconscious agreement) for some time now that the time rates of discrete objects are set inversely proportional to their states of motion. Since questions abound still, it seems little has been advanced concerning ideas about time. Centuries back, the argument was whether time passes in a continuous flow or in brief spurts. The issue was not resolved then and it seems forgotten today, perhaps rightly so if it is as unimportant an issue as it appears to be.

This essay lists important discoveries about time, but as one thing leads to another, similar discoveries regarding other currently unresolved mysteries have occurred in other areas not critically reviewed here, but which may benefit from such reviews. It has become clear that whenever it seems nature simply and freely "grants" us something, we should be wary of accepting her "gift" so readily because in so doing we could miss a good clue.

<u>The Time and Motion Relationship</u>

Greek philosopher/scientist Aristotle argued that all "heavenly" objects traveled around the earth because it was in their *nature* to do so. That had a ring of logic to it then, and though it seems no better argument was offered as to *why* it was in their nature to do so, many accepted it, most likely because no exception to it could be observed. Of course, we know now that under that logic, there could not have been any exceptions, as today bodies in space still *seem* to revolve pell-mell around the earth.

People of that time may have acted too eagerly in accepting Aristotle's logic, as if the question of "why" is of little importance to our insatiable thirst for knowledge. It would be very nice for us to know why nature chooses one observer over another, as in our examples above. It would be wonderful for us to be able to imagine as a physical feat the "warping" or "curving" of time and space, and perhaps in the distant future humans will evolve to such an extent, but for now we can accept "very nice" over "wonderful" by accepting the alternative conclusions presented in this work.

Many who believe the universe is one of cause and effect also agree that the "why" of any effect is required before its study is complete. If the why of it is not readily evident, it should be so noted for others to see we have yet to know the reason *why*, or rather, the *cause* of that certain effect. For example, we know that light frequencies vary depending on whether objects are moving toward or away from an observer. That is *how* we can tell if it is coming or going, but it does not say *why* the frequencies vary. To say they vary because they are moving away or toward us is circular logic so far as the why of it is concerned.

Thus, scientists should feel there has to be a reason *why* nature would "gift" one observer over the other with a slower time rate. If we agree that an object has a longer life span (due to a slower time rate) than another object moving at a slower speed, then we are saying that for any discrete object, time passes at a rate of inverse proportion to its speed. That being so, the aging rate of the twin in the spaceship would be *slower* than on earth at any instant whenever the spaceship's speed became higher with respect to the earth's speed in space, rather than at some arbitrary point in time and space, as is currently accepted.

Upon returning to earth, the traveling twin aged *less*, as far as all the people on earth are concerned, simply because his ship would have to accelerate faster than the earth's speed in order to leave the planet and then return to it. The resolution is quite simple, in retrospect, compared to the mounds of math work built up in trying to explain the "why" of the time paradox. Complex conclusions tend to show an author's uncertainty about his topic, while the more simple solutions tend to leave less room for argument.

Yet another reason why this idea has not been further developed (that time rates vary as a function of the speed of matter in space) may be due to an alleged claim that Einstein once said, "…Motion is meaningful only between two bodies moving relatively to each other." Since the universe is expanding, all observable matter in it must be in motion; therefore, we cannot locate a stationary point in the universe from which to measure the motion of a single body. All of our measurements of motion must be obtained by comparison to the relative motions and positions of other objects, simply because of Einstein's reinstatement of Newtonian relativity in Special Relativity: "Absolute, uniform motion cannot be detected."[6]

Nevertheless, is not Einstein's other premise (page one in the fourth paragraph) that time and space are dependent on the state of motion of an observer - simply the one exception where motion is indeed meaningful to something other than the relative motion of two or more bodies in space? Einstein's premise of the paragraph above holds true when we wish to measure the motion of objects in space because that requires other bodies to enable us to compare their motions relative to each other. It was noted above, e.g., that it is the difference in speed of two or more objects that yields consequential outcomes in measurements of time.

Can it not be validly deduced from all of the above that the rate of the passage of time for an object depends on that object's speed and not on the fact that two or more bodies are moving relatively to each other? This is a relevant argument because, if it were true in all cases that motion is important only between two bodies, it may be argued that time rates vary only when bodies near each other move at different speeds, because in such a case they affect each other's speeds and thus each other's time rates as well.

Bodies moving within each other's gravitational fields affect each other gravitationally, but bodies in deep space free of other gravity fields will maintain their speeds so long as their inertial mass does not change. However, Einstein's interpretation of relevance is in reference to the spatial positioning of bodies in order to enable measurements between them for various purposes, and that does require two or more bodies, as he correctly noted in his (alleged) "meaningful" relevance statement.

Still, motion *is* meaningful to something other than just between two or more bodies. If it is a fact that the rate of time is dependent on the speed of individual objects, it is quite important to note that discrete matter in space accrues its own time rate depending on its own speed, independent of the speed of any other object. Therefore, motion is indeed meaningful for even a *single* object because it exists subject to the force of time.

It may appear to some that reference to a single object moving in space is invalid because that violates the Newtonian/SR principle against the existence of absolute motion, as it did to a few of the research subjects online. If it was a violation of that, both statements could not be true, obviously. There is no conflict between the two, though, since there is no relation between absolute motion and a simple statement that objects move in space.

Others may infer from the above that the time rates of matter vary because *observers* may by their presence or by some other method cause them to do so. From there, it would be easy to argue that time rates vary only when and if there are observers around to measure them. Yet, why would the rate of the passage of time not simply depend upon the state of motion of discrete objects, with or without observers?

The answer is, of course it does. If we agree *a priori* that the diagonal line in the moving-train example is a longer line, whether or not we actually trace the vertical and curving diagonal fall of the light particle, then we can agree that the differences in the time measurements do not occur only because someone is there to make them. At least, not any more than the sunrise depends on someone being there to observe it.

If it is true instead that time alone - *sans* space - is dependent on motion, then the rate of the passage of time for an object depends at any given instant only upon the speed in space of a single object. A small point, admittedly so, but a relevant one nevertheless because, after all, how can the existence of space depend on time or motion? In addition, if the reader is in agreement with the arguments so far in this essay, then the goal of freeing space from its binding ties to time is hereby achieved.

The Universal Rates of the Passage of Time

Therefore, space now remains a property of the universe, but time must be recognized as an essential property of all matter that has mass. It should also be understood that the rate of the passage of time for any discrete object depends on the speed of that particular discrete object within the universe, and not upon an interdependent relationship with space.

If time rates accrue to objects in inverse proportion to their speeds, there should be universal time rates that apply to each of all possible speeds attainable by all objects in space. At the speed of planet Earth in the universe (as it revolves around the Sun, and as the Sun revolves within the galaxy, and as the galaxy spins and races through space), there is a specific time rate accruing to the earth and to any other object moving at the same speed, irrespective of their location within the universe.

As the Sun moves through space slower than Earth, for example, its time rate varies from Earth's time rate due to the Sun's particular speed in space. When another star in another galaxy far away moves through the universe at the same speed as our Sun, its time rate should be the same as the time rate of our star, in accordance with Einstein's Relativity Principle that natural law is the same throughout the universe. Only in this sense may the property of time be considered a universal imposition of the so-called "fabric" of time.

The discovery that galaxies far away are moving at great speeds from us (as indicated by redshift measurements) may affect our calculations regarding the age of the universe. The time rates for such galaxies would be very much slower compared to the time rates of our galaxy. We may need to consider that fact in order to find answers to the problems surrounding the true age of the universe, especially where its current accepted age appears to be inconsistent with reports of recently found objects purported to be much older than the universe!

The Birth of Time

Most scientists accept the Big Bang Theory (BBT) because it conveniently covers every event that had to occur in order to explain how the universe got to where it is today. It claims, e.g., that space as well as time came out along with the pure energy of the singularity that exploded to create the universe. The same energy apparently caused the required Inflationary Period (IP) that explains the homogeneous distribution of the elements within a universe that appears to be the same in all directions.

At this point, the reader must wonder, "If space and time came out of the BB, just what did they came out into? The BBT has an answer for that too. The contents of the BB emptied out into something called the "Great Void." However, such a thing is impossible to imagine; just try to think of a place with not even empty space in it. Not to worry – no one else can either!
An alternative to that method of research, i.e., thinking backwards systematically, is to think forward logically instead. For example, if time is a property of matter, yet no matter came out of the BB, time could not have existed then if time is a property of matter. There is some basis for the IP sub-theory in that several of its predictions have been "confirmed through observation" as shown at this link: http://en.wikipedia.org/wiki/Cosmic_inflation [Wikipedia, the free encyclopedia, "Inflation (cosmology)," (Redirected from Cosmic inflation), page 1.]

The IP provides for a field and/or a particle named the *inflaton*, believed to have caused the faster-than-light expansion of the initially small universe. The inflation rate supposedly slowed soon after its initial burst of FTL speed, but the universe continued to expand. What other explanation can there be to explain the homogeneous, flat, and isotropic nature of the universe? Is it possible, however, that the IP was simply a function of the initial interactions of particle pairs as electrons formed? And if not, why not?

The problem is, though, that the fact uncovered by Hubble that the expansion rate is increasing (which he did not necessarily agree with, it is said), leaves an unexplained hole in this story between the time the expansion rate began to slow (presumably to a constant rate), to the time when it started to increase again. It is possible the inflaton particles became low in number to the extent that allowed the rate to begin to increase, but why has no one suggested that before? Is anyone else looking for better alternatives to those that lead nowhere?

Obviously, it is easy to fill in gaps like that regarding better ideas about the inflaton particles when anything is possible; but in science, not everything is possible.

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[4] Ibid, Page 1102.

[5] J. Ray Dettling, "TIME TRAVEL: THE ULTIMATE TRIP," (Science Digest Magazine. Volume 90, No. 9, September 1982). Page 84.

[6] Paul A. Tipler, Physics For Scientists and Engineers, Third Edition Extended Version, (Worth Publishers Inc., New York, NY, 1991). Page 1106.