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The True Meaning of Time

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It is now well over 30 years since my conclusion that 'time' does not exist. Since my renewed interest in relativity in 2003, when a 'revelation' about time simply explained the validity of my conclusion of about 25 years before, it has become apparent that time is not a well understood concept in physics. It is hoped that this essay will provide some clarity in the midst of what appears to be quite widespread confusion.

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Introduction

In my recent paper *The True Meaning of Einstein's Relativity* [1], a very short paragraph was included explaining why, unlike spacial dimensions, time does change with speed. The subject of time, however, appears to create such confusion that further explanation is required for many physicists.

I examined the question of time in Chapter 1 and Appendix 4 of my book, *The Special Theory of Reality* [2]. This essay copies the relevant parts with further clarifications added now.

Time

For most people I suspect that time is considered to be something which 'flows' relentlessly and continuously; which you might be able to slow down if only you could move fast enough; but which you have to live with, and through, and the very existence of which, surely nobody can ever challenge. To me it is 'the relativity of events' and with no events there can be no such thing as 'time'.

I also suspect that most people think of energy as a slightly mysterious entity that is vital to our very existence and without which we can do nothing; something which can be extracted from, or converted from, matter. I consider it to be no more than a useful concept, which helps in the formulation of laws and in calculation, and which can even be shown to be relative. This, together with the explanation I have suggested for the constancy of the speed of light in *The Special Theory of Reality* [2], would mean that relative speeds in excess of the speed of light, and relative 'energy' vastly in excess of anything conceived before, may be theoretically possible.

Time is that concept which helps us consider and record the relativity of events. The way we do it is arbitrary. We choose a recurring 'event' which we think we can rely on being always regular, e.g. the orbit of the Earth around the Sun. We then compare the frequency of that event with all other events, such as the spin of the planet, which we can then use as a related standard. But we can only consider this to be relative until we are absolutely sure that the 'time' taken by the orbit or one revolution of the Earth's spin, does not change. Given that these may depend on the rate of spin of the galaxy, and the motion of the galaxy through space, it would be a reckless man who claims to be confident that we can measure time absolutely.

What we need to be very sure about is precisely what we mean by 'time'. Einstein clearly considered it to be relative and variable and it was not his 'fourth dimension'. Einstein said that the expression, "four-dimensional space-time continuum" was a very "common place statement". His next words were, "space is a three-dimensional continuum". He said that, according to General Relativity, the geometric properties of space are determined by matter (a statement which needs very careful consideration). All quotes of Einstein are from his popular book on the special and general theories [3].

The motion of matter in space and the indisputable relativity of all motion, means that all locations must be considered in terms of four <u>linear</u> dimensions, the fourth of which is relative displacement, particularly bearing in mind that relative motion may be curved in a system that is rotating for something with otherwise straight line motion. Thus 'curved space-time' is an inevitable consequence of the nature of our universe if I am right to say that it is rotating. But as I am sure Einstein would confirm if he were here, 'space-time' cannot exist nor have any meaning without matter. It is very important to distinguish between the concept of completely empty space, which as Einstein said would be three dimensional, and space plus matter, which requires a four-dimensional approach for clear and accurate representation.

So the meaning of 'time' needs very careful consideration. Einstein said on page 141 [3] :

> "It appears to me, therefore, that the formation of the concept of the material object must precede our concepts of time and space."

I think, therefore, that the best way is to consider a universe in which all motion has ceased. The temperature would be absolute zero. Without electrons spinning, oscillating or orbiting nuclei, there can be no elements, without elements there can be no material and thus no 'clocks' of any kind; not even the simplest event, such as the collision of two particles can occur. Comparison of events cannot happen so 'time' has no meaning.

So the concept of time can only exist when there is motion, and thus some form of material object as Einstein suggested. And all motion has to be relative. If there are only two particles in the universe, and one passes the other, which is moving? Try as you may, with no other reference point, motion can only be seen as relative. This is known as the principle of impotence, and in this case Viagra, or anything else, can do nothing about it. Energy, therefore, can only be considered in the same way, and it cannot exist without motion. I suspect a few raised eyebrows at this point. What about chemical energy?! Well, can chemical energy exist without motion in and of electrons and other particles?

If a particle is moving in otherwise completely empty space how can the concept of speed have any meaning? Speed is only the comparison of a change in position with the regularity of an event. We clearly need to have more particles before we can begin to think about speed. So what is the minimum number required? If we had one more, which happened to be spinning, we could define one revolution as one unit of time if only we could be sure that the rate of spin was not changing. But then there would be no standard by which to judge distance, apart from the particles themselves, which may change in size, perhaps as they move or spin. What then if there were two particles spinning at different rates, at positions which we hope we can assume remain fixed relative to each other? If we compare the two rates of spin for long enough we might be tempted to assume that they must be regular and that one or other could be chosen as standard time.

We would then, however, be guilty of ignoring the possibility that the rate of spin of both might be changing at the same rate. The two spinning particles might also both be moving through space at the same indeterminate speed. We then see that it does not matter how many particles there are. We will always have the problem that time can only be a comparison of rates with no certainty of constancy; and speed is likewise just a comparison with whatever we gamble on to be fixed and regular. Time can thus only be one rate as compared with another; and that is why I define it as the relativity of events.

If rates of spin and speed can only be compared, the same must apply to energy. So to think of time and energy as though they have some sort of independent existence is clearly wrong. They were the 'Calx' and 'Phlogiston' of the 20th century. For those who do not know, before Priestly discovered oxygen it was thought that combustion was the giving off of 'Phlogiston' leaving 'Calx'. It is tempting now to laugh at this idea, but it must have seemed logical. Consider a dry, heavy log; when burned, the pile of ashes clearly weighs less. When Priestly said that combustion was combination with oxygen to give a net increase in weight, supporters of Phlogiston theory probably scoffed. The greatest danger in science is assuming that something has to be right. Should we assume that the Universe has to be expanding, or that the speed of light cannot be exceeded?

The above analysis demonstrates that it is clearly wrong to think of time as an entity that can be measured. We do not 'measure' time; all we do is compare frequencies. Time does not exist. This should have been apparent when Einstein showed that it was relative, but instead the view prevailed that by travelling at different speeds you change the rate at which this mysterious entity 'flows'. This idea results in paradoxes and when this happens the most likely answer is that we are not looking at the problem in quite the right way.

There is a good reason why we find it difficult to recognise the true nature of time. Time is the relativity of events and without events time has no meaning. Our very existence is, however, dominated by events, even when we might think that we are doing nothing. If we imagine ourselves motionless in otherwise completely empty space, we still find it difficult to rid ourselves of the idea that time is still passing because events are still occurring. Even if we imagine bodily functions to stop, such as breathing, the very act of doing so and being conscious of it, involves chemical and electrical activity in the brain. Such activity is a stream of events, the relativity of which is our own personal record of what our minds tell us is 'time' 'passing'. We can compare our rate of breathing with our pulse, and we may then be tempted to think that we have a good measure of the rate of each breath; but if we let the enormity of this achievement go to our head and get a little excited, our 'clock' may start to run faster.

As I have showed, being sure that something maintains a constant rate in absolute terms is very difficult. It is effectively impossible for us at this point in our understanding of the universe; so all we can do is compare rates one with another. You could call this 'Beck's uncertainty (time) principle'. We then see that Lee Smolin was close when he said that, "time advances by the discrete ticks of innumerable clocks" (Scientific American, Jan 2004, p.62 [4]). It is simply a matter of choice. If we choose to compare everything to the rate of spin of a tiny particle, or rotation/vibration of some form, we have to be aware that this constant will change with speed. Unfortunately Lee Smolin spoils it by still implying that time "flows", albeit by discrete ticks rather than smoothly, but this still gives time an independent existence.

What then is the best way of recording the relativity of events ('time' if you like) to minimise this effect? If the essence of the problem, as I have explained it, is a question of conservation of energy, then clearly the rate of spin of a small particle, with energy of spin dependent upon mass, dimension and rate of spin ($E = 1/5^{th}\ mv^2$, where $v = \pi Df$), will have to reduce significantly if speed of translation, relative to its mass, size and rate of rotation (or oscillation), is great. You may ask why we should be bothered about how fast a tiny particle is spinning if we move away from it at high speed.

The answer lies in the principles of impotence and equivalence. We cannot move away from a particle without assuming it to be equally valid to consider it to be moving away from us. So in the absence of any force which propelled the particle, we have to assume that the particle has lost rotational energy in gaining speed of translation. We are thus forced to conclude that the particle is now spinning more slowly relative to us, and that our 'measure' (or rather 'assessment') of time has changed significantly.

So perhaps we have chosen quite wisely in having the rate of rotation of the planet as the basis for comparison. You have to move pretty fast to make much difference. This was fine while we were considering our small-scale motion on the planet; but what if we start considering motion which is much faster by comparison? As Einstein showed, time as we 'evaluate' it, must be considered variable when relative speed is significant (relative to the Earth I would suggest). But if we chose something either spinning very fast or something much larger than the Earth, we would have a measure of time which is less affected by relative motion. Perhaps then, if we travel the Universe, we should adopt the rotation of something like a fast rotating, large, dense star as our new standard.

I am, however, suggesting that there is no limit to how fast we can go. So what if we were travelling at several times the speed of light? Perhaps then we need to use something really large such as the whole galaxy; but then ours rotates very slowly. The ultimate solution would, therefore, be the rotation of the Universe; if we can ever detect it. Observing such rotation is, however, difficult. I have suggested that the only way we could be aware of such rotation would be by the very fact that the Universe appears to be expanding, because of the apparent curvature of light relative to everything else. This is not quite right and, as I have said, if everything is rotating about one axis, the illusion of motion away from us would be less significant for galaxies near the axis of rotation.

Illusions, however, can be very tricky. Our whole concept of the scale of the Universe and distribution of objects within it would need re-thinking. The galaxies which appear to be the furthest away (and apparently receding the fastest) would actually be much closer; and those with much less red-shift, which are actually near the axis of rotation, and have been assumed to be much closer, could be as far away. It is thus clear why we have not observed the tell-tale signs of rotation; they are neatly disguised in our glib assumption of expansion. I said in my book that until we make observations on the basis that the Universe may be rotating, we may never discover this possible reality. Since then, however, I have become aware of various indications of an axis in the universe, as mentioned in my NPA paper of 2011 [5].

One aspect of time, which I have not yet mentioned, and which is given much attention in Relativity, is the question of simultaneity. This is a very interesting question, and one which may be very confusing. It may have confused me in my teens because I see that I had pencilled in the word "no" next to Einstein's conclusion that two lightening strikes which are simultaneous relative to the embankment are not simultaneous relative to the moving train.

I cannot remember my precise reasoning now for sure, but I think that it was a question of cause and effect. If, for instance, the train were longer than a platform, and the two strikes were actually experienced as damage (including two clocks known to be synchronised precisely) at each end of the platform, then there would be simultaneous damage to the train at precisely the same distance apart. So I may have thought that the only conclusion that could be reached, from a subsequent investigation of the damage, would be that it was the same two lightening strikes which caused damage to the platform and the train at *precisely the same time* (when both clocks stopped). But it seems that I may have forgotten (or maybe doubted) the contraction of the train with speed suggested in special relativity, which, if we could measure accurately enough, would place one of the lightning strikes later for the train (on subsequent examination of the stationary, longer train), than one of the clocks. Did Einstein forget that the Lorentz transformations would allow correction for this effect to demonstrate the simultaneity of both lightening strikes? Or was I accidentally or prophetically correct in my teens, because it seems clear to me now that dimensions do <u>not</u> <u>physically</u> change with speed?

If I am correct to suggest the latter, then clearly simultaneity can be a meaningful concept locally. The question is, if events are physically separate, does simultaneity remain a meaningful concept as distance makes interaction less possible?

What we have to think about, of course, is exactly what we mean by the words 'precisely the same time'. My pencilled note was about fifteen years before I concluded that 'time' does not exist. Clearly, from this new standpoint, 'precisely the same time' needs re-thinking. If time is not something we can consider to 'flow' steadily and consistently, relative to which points in 'time' can be marked, can the statement 'the same point in time' have any meaning? I hope that the reader will forgive me if I answer yes and no; an answer which, of course, requires considerable amplification. We need to consider the general sense and the specific case. I have shown that time does not exist, so in the general sense, there can be no such thing as a point in time. This is really the same conclusion that Einstein reached when he said in Chapter1X of his popular book on the special and generally theories [3]:

> "Every reference-body (co-ordinate system) has its own particular time; unless we are told the reference-body to which the statement of time refers, there is no meaning in a statement of the time of an event."

So it is apparent that I am just amplifying and clarifying what Einstein said, and drawing the only logical conclusion, which many, including Einstein himself possibly, appear to have missed; that is the impossibility of time existing as an entity which can flow (relative to anything).

There are only events, and time is purely the concept of how these events relate. So in the general sense, when we are considering events, simultaneity <u>appears</u> not to be a meaningful concept. If, however, we consider the specific case of physical interaction (such as the lightning strikes), it has to be of crucial significance. Take, for instance, a baseball player; if he swings early or late, he may miss the ball. The arrival of the ball at the point where he hopes to hit it and the arrival of the bat at the same point have to be simultaneous. Tell a baseball player that there is no such thing as simultaneity and he will tell you that you are just a crazy scientist.

What we can learn from this rebuke is the sensible way to consider the relativity of events (time). If event A (the arrival of the bat) is to influence event B (the arrival of the ball), the relativity of these events has to conform to the otherwise meaningless notion of 'at the same time'. In practice there is some margin for error in the example given, especially if the bat is swung through the same plane as the end of the ball's trajectory, but the principle is clear. If any event is to have any effect on another event there has to be an order representing 'before', 'now' and 'after'.

So we can define the concepts of 'before', 'now' and 'after', in terms of the possibility of them affecting another event *at the same locality.* And the last phrase is then defined in exactly the same way, because the concept of position in space carries the same implications as the concept of a position in time; both statements are meaningless until we relate them to some physical, localised reality (event).

If we wish to quantify the extent of how much before and how much after, we can only do so by making a choice by which to compare. This may be with regard to fractions of events whose supposed regularity exceeds the period in question, or with multiples of events which seem to occur regularly within the period in question. So time, and its 'measurement', is always just a question of the relativity of events; we can compare one string of events to another string of events, and that is the simple extent of the concept of time.

It should then, I hope, be clear to the reader that "time travel" is a nonsense. The only way we can define the concepts of before and after is by the possibility of influencing another event. So, by definition, it is not possible to do anything after an event which can ever influence it. It does not matter how fast we go or whatever we do, because this is then just a series of events which can only follow in the same way; before events which have not happened and after those which have.

Many readers will, I am sure, be starting to doubt the certainty of this view. The reasons for this are the limitation of our senses and the eternal desire to be able to correct mistakes and change things for the better. How many people must have contemplated the possibility of going back and killing Hitler before he inflicted so much harm on humanity? I will make no comment here on the moral, ethical or religious connotations of such an act; my views in general in this respect are contained in my autobiography (A Nutcase in the Universe [6]). But the emotional aspects are significant because we tend to believe what we want to believe.

It is, I regret to say, a failing of the Human species that we tend to think far too often with our emotions rather than logic. This tendency, combined with the already mentioned limitations of the function and experience of the Human mind, make it difficult for us to free ourselves from the concept of events existing at points in time. Our own built in recording and replay system (memory) convinces us that reality is similar with 'time' acting like video tape, with events stored in sequence. A mixture of emotions, ranging from guilt to curiosity, maintains the constant desire to be able to 'replay' the 'tape'.

If we approach the problem in a purely logical way, realising that 'time' is just a word which requires careful thought to ascertain the nature and limitations of its meaning, we see that it is just comparison, in the same way that 'energy' is just comparison; and events only exist for the duration of their physical reality.

Now I need to explain the underlining in, "So in the general sense, when we are considering events, simultaneity <u>appears</u> not to be a meaningful concept".

The principle of impotence is relevant here. It may be impossible <u>in theory</u> for an imaginary observer to judge the absolute motions of two particles in an otherwise empty universe, but the problem is <u>assessment</u> of the reality, not the question of it. There may be many possible realities in theory; in practice, there can only be one. It is this problem of assessment that applies to the problem of remote simultaneity. Time is about our comprehension of reality, and I have demonstrated the uncertainty associated with the absolute regularity of whatever we choose as the means of comparison. In the same way that there can be difficult to assess absolute motion, there can be difficult to assess simultaneity.

I include the word 'special' in my '*Special Theory of Reality*' in recognition of these difficulties. Perhaps when we have calculated the rate of spin of the universe relative to the otherwise straight line motion of light in the absence of all fields, a 'general' theory of reality may be possible, but how long might it be before we can rule out a further reality, relative to which the rate of spin of our assumed 'universe' may be different? See Appendix 6 of my book [2] for the difficulties associated with observation of the full extent of the universe.

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