return to updates

Is Time an Illusion?

NO!

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About once a year now, **each** major science rag like *Discover*, *Scientific American*, *Popular Science* and *Physics Today* runs an article with a title like "IS TIME AN ILLUSION?" You may have wondered why they are doing this. I am here to tell you.

There are two major reasons, one rather mundane and one far deeper and uglier. Let us hit the mundane one first. You may have noticed that these articles on time being an illusion usually seem to be linked to the dark matter controversy. One reason for this is that a guy named Julian Barbour came up with a lame solution to the dark matter problem many years ago, using a squishy interpretation of Relativity to ditch both time and dark matter. For instance, see this 2012 *Discover* article selling his theory for the thousandth time. Here are the things to notice as you read it:

One, Barbour and his colleague Westman are trying to use the failure to detect dark matter as proof of their theory. If you read the 4-page article, this is about the only indication in favor of their theory. The theory is threadbare in the extreme, even compared to mainstream theory, and the non-detection of dark matter is about all they have.

Two, another ally, David Wiltshire, is supposed to provide the punch on page 3, when he finally gets around to telling you what they are up to, but the little jab turns out to be nothing but air. He says,

The flow of time near galaxies could be slower than the flow of time in empty space. In a truly relativistic view, the age of the universe differs from place to place. By ignoring those nuances, cosmologists have misinterpreted the positions of the distant supernova explosions used to determine how quickly the

universe is expanding.

As you already see, these guys are doing nothing to unify gravity and E/M, or gravity and QM. They are simply using a trick of Relativity to get rid of dark matter.

You will say that, like me, they are claiming the mainstream equations are wrong. Yes, that much is true. But because they haven't been able to pinpoint where the equations really *are* wrong, they have simply reverted to a hamhanded trick. I beg you to notice that, unlike me, they haven't plopped down a real set of mainstream equations, showing you the fudges in them. Instead, they have taken the time variable in GR, disconnected it from the field, and used it to fill the dark-matter gap. In doing so, they have replaced one fudge with another.

Again, notice they haven't pulled apart any mainstream equations, because they can't. *They aren't allowed to*. No one who gets published is allowed to contradict the various standard models in any way. So although they say something is wrong with mainstream equations, they never get around to telling you what. They never show any real errors. Instead, they do what Barbour and his pals are doing: hem and haw and say they are being revolutionary, without doing anything revolutionary. If they attack anything, it is something they see as squishy, like the definition of time. In Modern physics, you aren't allowed to contradict the standard models or the big names, but you can attack the definitions of words all you want. You can't contradict current physics books, but Webster's dictionary is fair game. If you want to re-define what velocity means or what mass means or what time means, fine; but don't actually look closely at any of the old equations that are in textbooks.

Barbour and company have basically said, "Hey, time isn't real, so we are going to take the t-variable from GR and re-define it as a second cosmological constant. But we are going to do Einstein one better, because instead of a cosmological constant, our stolen t-variable isn't a constant. It is a *variable*. We can *vary* it to fit any hole. Since time differs from place to place, we can just propose greater or lesser time in any area that isn't acting like we want it to. If our mainstream equations are failing—giving us these 95% misses as in the dark matter problem—we can just fill that hole with our t-variable!"

Three, I beg you to notice the contradiction in this. If time is an illusion, then how can you assign a mathematical variable to it? Is it normal procedure for physics to assign a physical variable to an illusion? What I mean is, for time to be slower near galaxies than in empty space, time must be *real*. Only real things can go slower or faster. An illusion cannot go slower or faster. A car can go slower or faster; an illusion cannot.

Four, Einstein already said time was variable in this way, so these guys are proposing absolutely nothing new. Which means that all the horntooting in these articles is completely empty and false. Barbour and his comrades are sold as radicals, but they are not radical in any way. We should already have known that, since mainstream magazines do not sell radicalism. They either sell standard-model dogma or manufactured misdirection. In most cases, they are doing both (as we will see here); but they *never* sell radicalism.

Five, time moving faster or slower can't begin to explain things like dark matter or the Galactic Rotation Problem, and that is widely known. It is known because, again, GR *already* contains the idea of faster or slower time. The Galactic Field that has always existed in this problem has always been a GR field, which of course contains transforms, which of course contain time which is supposed to slow down or speed up depending upon the accelerations in the field. But the Galactic Rotation Problem and Dark Matter Problem exist *on top of that*. I say they exist on top of it because Relativity can't possibly

solve these problems. The overall field curves are all wrong. Which is why they don't show you any real math or graphs in these articles. If jacking with the time variable could solve the Galactic Rotation Problem, Barbour et al. would have done the math showing it, and the problem would now be in the can. They haven't.

I have. I have solved the Galactic Rotation problem with a few simple equations, which is how I *know* these guys haven't done it. I have shown the solution is achieved with the charge field, which already existed in the old mainstream equations. Since the charge field fills the hole in the Galactic Rotation Problem like a hand in glove, I know that Relativity is not the answer.

Six, for the same reason, I know that Relativity is not the answer at the quantum level, either. Without producing any simple equations, these guys claim to be able to solve the unification problem. How, you may ask. Like this,

In his [Barbour's] true Machian theory, there is no space-time fabric that could be torn apart by quantum fluctuations. In fact, there is no fundamental dimension of time to create conflict between general relativity and quantum mechanics, removing any obstacle to coming up with a complete theory of gravity that works in both cosmic and quantum realms.

Wow. Talk about a solution by fiat! The only way Barbour could be more hamhanded or clunkier is if he claimed to solve the vacuum catastrophe by asserting that there is no matter and no forces at the quantum level, since both are illusions. "There are no problems in physics, since nothing really exists. Physics is an illusion. This is all just a game in an alien's head, and we can say whatever we like!"

You may think I am joking, but this is where physics finds itself. The articles in the magazines have devolved to about that level, and they are not in jest.

Generally, these time-lacking theories try to pad themselves out by going back to the old Wheeler-Dewitt equation, which at least has some pedigree. The W-D equation attempts to unify by ditching the time variable completely. Unfortunately, even mainstream sources admit that equation and its adjuncts have been useless for solving any real problems. As Wikipedia puts it,

Decades after the equation was first written down, it has not brought physicists as clear results about quantum gravity as some of the results building on completely different approaches, such as string theory.

Of course that is amusing, since string theory has not solved a single thing concerning quantum gravity or unification in the 30-odd (very odd) years since it was stillborn. Go seek some string-theory "results" on quantum gravity: there aren't any. There is no even partially successful theory of quantum gravity, and, again, the mainstream often or usually admits that. There can't be a successful theory of quantum gravity without a successful unified field equation, and they don't have one of those. I have several, but they don't have even one.

As usual, all the math on the W-D equation page at Wikipedia (and other sites) is misdirection. Rather than attempt to supply the reader with the simplest math possible, and assign all the functions and variables, they do the opposite, plopping down the math in its most opaque form and failing to tell you what anything stands for. I will told the equations are what they are: physicists can't water this stuff down for a general audience. But I have shown in hundreds of papers that this claim is false. These equations in GR and QED are purposely opaque, needlessly dense, and criminally complicated. They

don't want you unwinding them, because if you did you would see they are all bombast. I have unwound dozens of famous mainstream equations line by line, including most of the canonical ones, so I know what I am talking about. It isn't even worth going through the W-D equation line for line, since the mainstream is good enough to leave the clues for us in the few sentences beyond the equations—like this one:

Because the concept of a universal time coordinate seems unphysical, and at odds with the principles of general relativity, the action is evaluated around a 3-metric which we take as the boundary of the classes of four-metrics and on which a certain configuration of matter fields exists.

From that alone you should be able to tell you are being snowed. How, *exactly*, does a universal time coordinate seem unphysical? To me, it seems **extremely** physical, because without it, all events in a 3-metric would be stacked right on top of another, being simultaneous. If you aren't distinguishing these events by a time variable, how are you distinguishing them? The answer: you aren't. Wheeler, Dewitt, and all their witless followers have to come back in later and try to distinguish all events, which they normally do with a disguised distance variable—one which is really time but which they refuse to call time.

I will be told that this Wiki author just means that *universal* time seems unphysical and un-Relativistic. But the equation isn't just ditching universal time, it is ditching Relativistic time as well. They admit that. That is what the 3-metric is telling us. No time. So are they telling us that Relativistic time is also at odds with the principles of Relativity? That would be a curious assertion, wouldn't it, given that Einstein wrote General Relativity with a time variable in it. They might as well claim that Relativistic *length* is at odds with the principles of Relativity.

Then they tell us their selected 3-metric "is a boundary of the classes of 4-metrics." What? **That has no physical meaning.** None. It is equivalent to saying that timelessness is a boundary to various times. But timelessness can't be a boundary to time, in any way, since—as a matter of fact—the universe is either described by time or it isn't. It can't be both ways.

If you don't see what I mean, ask yourself this: can the universe contain both lengths and no-lengths? Can it contain both velocities and no-velocities? Can it contain both forces and no-forces? No. Those ideas obviously have no meaning. They are just jactation. Well, the same can be said for time and no-time. To have no-time bounding time, you have to have time and no-time existing *at the same time*. Otherwise, one cannot act as a boundary to the other.

I will be told that "being a boundary" is just a mathematical term, one used all the time to indicate a certain mathematical relationship. Yes, and that is my point. The statement above has a possible (squishy) mathematical interpretation, by which a 3-metric can be said to bound 4-metrics; but once you assign time to your fourth metric, that math cannot be physically assigned to any possible universe.

All this "bounding of classes of metrics" is just a fancy and unnecessary way of saying that they are tossing the time variable to see if it helps them see a way to unify. It didn't. They want you to think that their only problem was bringing time back in later, so that the Wheeler-Dewitt equation would match both data and experience. But that wasn't the main problem. The main problem was that tossing the time variable didn't help them unify at all. They didn't unify a damn thing, with or without the time variable, and that is because they misunderstood the problem from the beginning. They needed to unify charge and gravity, and the t-variable in Relativity had nothing to do with that. As I have shown, they needed to understand that the Lagrangian was already unified, and since they have never

understood that, they were never even on the path to unification. They were just off beating the bushes.

Which brings us to the second reason you are seeing these articles. This is the deeper, uglier reason. As we have just seen, the mundane reason has to do with selling the theories of certain physicists. These guys like Barbour have connections to the magazines, for various non-scientific reasons, so those foolish enough to read these magazines have to hear about their pathetic ideas over and over. We may assume that in some cases, these promoted physicists are either from wealthy families or have married into them. In other words, physics works like everything else, being mainly a playground of the privileged. That is what I meant by mundane. But in other cases—perhaps the majority of cases now—it is even worse than that. These physicists aren't promoted mainly to advance careers, but *to advance programs and programming.* In other words, these physicists are basically agents or spooks. Although I used Barbour as an example of the first category, I suspect him of also being involved in the second category. I suspect this because Barbour's main function would seem to be misdirection.

His theories are so threadbare and absurd, they don't really qualify as science. His main function appears to be to manufacture one side of yet another fake debate. As with so much other mainstream science, Barbour's theories exist as part of a pretend and meaningless agon, and this agon is created to divert you away from any real science, knowledge, or wisdom. You are being channeled away from any real information, supplied only with these promoted debates. Think of the Hawking/Penrose debates, as perhaps the ultimate example. We have also looked at the Susskind/Smolin debates in my paper on the Anthropic Principle. Well, Lee Smolin is also acting the foil to Barbour, since he has taken the high-profile position that time is real. As a matter of the history of physics, that will be seen as about as important as taking the position that cheese is real, but this is where we are in the Modern world. This is what you are offered as physics.

I have recently shown my readers how awful it has all become, since we now know Hawking is an impostor. He has been a manufactured entity *in toto* since at least 1985, which would make his famous book *A Brief History of Time* a forgery. Well, once you understand what Hawking is, you can begin to understand what these other guys are. In fact, we have direct links to Hawking in the current question, since one of the guys selling or debating the illusion of time is George Ellis. Many of these newest articles on time and dark matter are about Ellis, including one in the current *Discover.* Well, according to the history we are sold, Ellis co-wrote a book called *The Large Scale Structure of Space-Time* in 1973. Guess who his co-author was? Stephen Hawking. At Wikipedia, we are told the book "debuted at a strategic moment in the history of General Relativity Theory." Really? 1973 was a strategic moment in the history of GR? Hardly.

But study that curious wording. Notice they don't say "a pivotal moment," or an "important moment," or a "crucial moment." They use the word "strategic." What kind of *strategy* was involved, I wonder.

What they should have said is that the book appeared at a strategic moment in the history of *confounding* GR, and physics in general. That would be more accurate.

To see what I mean, just study the subtitle to the current article about Ellis. The title is "*Is the Future already Written?*" The subtitle is, "A conscientious cosmologist rejects Einstein's notion that time is an illusion and the future is set." Already, we are being misdirected, since Einstein never claimed that time was an illusion or that the future was set. We see this sort of misdirection all the time from these

mainstream mags, who are always claiming Einstein believed something he never believed. Many times they simply invert his actual beliefs, ignoring what he said and wrote. They are doing it again here. Einstein believed that the idea of absolute time was a physical mistake, but that does not mean he believed time was an illusion. Time being relative to the situation and time being an illusion are two different theories, and Einstein promoted only the first. Remember, this is exactly why we were told Julian Barbour is so "radical." In that article on Barbour, the author at *Discover* told us Barbour was going far beyond Einstein. Einstein still connected time to his four-vector and treated it as real, we are told. Whereas Barbour is bravely proposing time is an illusion.

Do you see the contradiction? In the article on Barbour, Einstein is being sold as a fuddy-duddy for thinking time was real and assignable to the field. But in the same magazine a few months later, we are told Einstein thought time was an illusion, setting up Ellis for the score. It can't be both ways.

I will be told that Einstein said this:

> For us believing physicists the distinction between past, present, and future is only a stubbornly persistent illusion.

That proves me wrong, right? No. That sentence doesn't imply that time is an illusion. What he must mean, in context, is that there is *no distinction* between future time and past time, since time in both cases is just a signifier of an event. No events happen in the future or past: all happen in the present, by definition. Therefore, as events, they are all the same. No distinction.

We know he cannot have believed time was an illusion in the sense that Barbour or Ellis intends, because Einstein believed in (a sort of) cause and effect.* That is what his species of determinism is about. It isn't about the "future being set." It is about present events being the result of prior events. But obviously, you can't have this sort of determinism without time. As soon as you have "previous" or "prior" events, you have time. You could only maintain time as an illusion if you could make some sort of convincing argument for simultaneous events determining one another. No one—including Einstein—has ever begun to do that, since it is illogical.

You see, the ugly truth is these authors don't care about truth or about history or about Einstein or about GR. They don't care about consistency. They don't care about making sense. They only care about stirring your brain into mush. They tell you these boldly contradictory things *on purpose*. They are creating confusion. The entire world has been subsumed within the CIA's old CHAOS program, and they want you too confused to do anything (except that which you are told). So they sell you this constant stream of bald and obvious contradictions, which no sane person could accept. And if you don't immediately accept it, they call *you* insane. Any normal person will crack under that kind of pressure, and that is precisely what they want. They want you to crack. They want your resistance to fall to nothing, so that you buy what you are told without questioning it. SHUT UP AND CALCULATE, which translates pretty easily to SHUT UP AND BUY.

We can see that Ellis is trafficking in this sort of misdirection from the first entry that comes up on a Google search for "George Ellis Time". It is a 2008 paper at ArXiv, titled *On the Flow of Time*. Here is the abstract:

> Current theoretical physics suggests the flow of time is an illusion: the entire universe just is, with no special meaning attached to the present time. This paper points out that this view, in essence represented by usual space-time diagrams, is based on time-reversible microphysical laws, which fail to

capture essential features of the time-irreversible nature of decoherence and the quantum measurement process, as well as macro-physical behaviour and the development of emergent complex systems, including life, which exist in the real universe. When these are taken into account, the unchanging block universe view of spacetime is best replaced by an evolving block universe which extends as time evolves, with the potential of the future continually becoming the certainty of the past; spacetime itself evolves, as do the entities within it. However this time evolution is not related to any preferred surfaces in spacetime; rather it is associated with the evolution of proper time along families of world lines. The default state of fundamental physics should not be taken to be a time irreversible evolution of physical states: it is an ongoing irreversible development of time itself.

Although it may seem to some of you at first glance that Ellis is taking the more sober position, he is actually just taking one of two equally ridiculous positions. More importantly, he is wasting your time asking you to read and take seriously this armchair philosophy, when real work is left to be done in physics. Please notice he is selling an "evolving" block universe instead of a normal block universe. If you want to look that up at Wikipedia or someplace, it is normally listed as "growing block universe." But both ideas are based upon what I believe is a *purposeful* misreading of Einstein's field equations. To gloss it for you, the block universe is the idea that all times exist in the same way, like lengths. We are told this is taken from Einstein's 4-metric, which, if you graph it, sits there on the page like a block. So we are supposed to believe that because the diagrammed t's and x's sit there on the page at the same time, all time is basically the same?

Is that it? That seems to be the general idea.

One again we have the conflating of the math with the reality. Modern physicists have been these extremely narrow little mathematicians, and if you imagine them sitting there with Coke-bottle glasses and uncombed hair and short-sleeved check shirts, you are not far off. Their ability to do anything but math is near-zero, so asking them to visualize anything or deal with any concepts is like asking porpoises to climb trees. We see that immediately when we look at these contemporary physics-philosophies, which are so naïve it passes belief. Not only have these guys apparently never taken a philosophy or logic course, they have apparently never left the house. This is why their mentors were so flummoxed by Karl Popper. Popper could actually *think* about physical spaces without overheating, and this just sent everyone in physics scurrying.

Anyone who knows anything about philosophy (and most who know nothing about it) will see that the block universe [AKA eternalism] is not even worth discussing. It is clear that time is *not* just another dimension like length, neither operationally, ontologically, epistemologically, metaphysically, nor any other way. So claiming that it is can only seem idiotic. This is just as clear in Relativity as it was before, so there is no good argument for linking Relativity and eternalism. But for some reason, Ellis takes the theory seriously: so seriously that he only tweaks it bit in his own theory of an evolving block universe. In the growing block universe, the past exists just like the present. And again, it does so mainly because someone thought Einstein implied it. That seems to be good enough. But this theory is just as idiotic as the block universe it competes with. In the same way, most of the primary arguments seem to revert to the form of the math for clues. This is idiotic because the form of the math tells us nothing about the reality. You are supposed to match math to the reality, not the reality to the math, remember? Looking to the math for clues about reality is simply perverse.

So although someone like Ellis leads you into the problem on the right track, he quickly misdirects you. He appears to be sober because he is admitting that time is irreversible, that it evolves or progresses,

and so on. All true. So why does he only take you halfway back to sanity? Please ask yourself that. Why would he lead with the irreversibility of time, but then divert you into a variation of the old block universe? Is the problem really that hard? Is the question really that intractable? No. The past *cannot* exist in the same way as the present, and Einstein's field equations have absolutely nothing to do with it one way or another. The past doesn't exist at all, by the same definition of "exist".

To put it baldly, the present *exists*, the past *existed*.

These guys don't even know how to use verb tenses, apparently.

Actually, as I said, I think most of these tenured philosophers and physicists are just pretending to be dense. I suspect they are paid to create diversions. No one who has existed in the world for more than a few minutes can seriously argue that the past and the present exist in the same way, or that the past exists at all. The whole thing is definitional. It isn't a question of ontology or epistemology or metaphysics or anything else. What I mean is, this whole question can be decided by the standing definitions of the words. By definition, the past is that class of events *that no longer exist*. If an event is still existing, it isn't part of the past. Therefore, it is a contradiction to claim that the past exists. If it exists, it isn't the past.

Like the rest of these guys, Ellis has never done a line of real physics in his life. He is paid to be a high-profile manufacturer of debate, by which you are forever diverted from anything resembling real physics. Like Hawking, Ellis has collected a lot of big prizes into piles and published reams of blather, but he has never solved a single important physical problem. No, like the rest of these guys, his job is not to solve problems, it is to *manufacture them*. The more problems they can manufacture and debate on the edge of a black hole or in the first seconds of the universe or at the center of singularity or a million miles down a wormhole, the less likely it is you will remember to ask them about any real problems. For example, these magazines they publish in have only a limited number of pages. If all the articles are about time travel and backward causality and black holes and universal expansion and virtual particles, then there is no room for articles on real physical problems, like why the Moon is so bright, why Venus has no magnetic field, why the proton is 1821 times larger than the electron, why the noble gasses are noble, and so on.

Ask yourself when was the last time any physicist actually solved a problem in a sensible way. To dodge this question, physicists now claim that physics has evolved beyond sensible answers. Everything is so complex now that no straightforward answers are available. And most sub-fields of physics trumpet their insensibility, expecting you to buy that as a form of progress. The physicists admit this now, and have for decades. It isn't just that the equations are long and difficult, which might be expected in a complex world. No, it is that "Nature no longer makes sense." They sell you that line in your first day in a quantum mechanics course, and demand you buy it.

Unfortunately, I have now proven it isn't true. I have made sense of many or most of their most difficult embedded problems, usually doing it with fairly simple math. I have gone into the old equations, picking them apart line-by-line, showing they are indeed full to bursting with fudges, feints, and plain-old errors. I have then corrected those errors, showing how those corrections solve these longstanding problems like unification, superposition, the Galactic Rotation Problem, the vacuum catastrophe, dark matter, and many many *many* more. If these magazines are so interested in publishing independent radicals, why have they never published any of my papers? For that matter, why have they never published anything by anyone that was truly independent or radical?

I will tell you: *because that isn't their function*. The function of all these magazines is misdirection. The assignment is to pretend to do science, while not doing any. The assignment is to make stars out of a bunch of phony scientists who have never done any real science. The assignment is to report on the awards these people have allegedly won and to give them a place to grandstand and blow smoke and post phony research and phony equations. And, as we see every month, their assignment is also to post a huge amount of contradictory theories, reports, claims, and accounts of history, so that you can't remember which way is up.

Part of this last assignment is redefining words out from under you, so that you feel like you are standing on quicksand. Just when you think you have a grip on some physical term, they throw out its old meaning and create a new one that is just the opposite. This isn't an accident and it isn't a sign of progress. It is the purposeful denial of firm ground, so that you have no position from which to attack them or question them.

[As a short aside, I wish to point out that once again physics is taking the place of religion. This is precisely the role religion served in the past (or at least when it was promoted by the State). All the major religions of the world have been used to stir people's minds into mush via a mountain of vicious contradictions. They have been used to break people and to force them into positions of resignation, deference, or outright slavery. Science is simply borrowing very old priestly playbooks as it runs these new gambits. Like the religions, they have created a massive lingo, an endless literature, and a manufactured hierarchy of fake gurus. Rather than answer questions sensibly, these gurus create personal cults and demand worship, brainwashing their followers rather than charming them with reason and logic. The PR campaign of new science is so vast, so well-funded, and so ubiquitous it makes the PR campaign of the Vatican look like a dog food commercial.]

In this current problem on time, they are misdirecting in many ways, but one of the main ways (that we haven't yet looked at) is by misdirecting you about how radical Einstein really was. In the article on Barbour, they try to make you think Einstein wasn't nearly radical enough. He didn't go far enough, we are assured, and it would have been better if he had loosened up his idea of time even further.

WRONG! Although in my many papers on Relativity I have shown that Einstein was mainly right about the usefulness of transforms in some problems, and right about the general form of the transforms, and right about GR seeming to curve the field and so on, he was wrong about a lot things, too, especially matters of interpretation. In nearly every case, his interpretation of his field and his equations was *too radical*. HE WENT TOO FAR. And even when he didn't go too far, those who came after him pushed him further, re-interpreting his fields and equations in ever more radical ways. So the last thing we need now is even squishier interpretations. The last thing we need is to start throwing out the few real physical hooks Einstein retained.

For example, although it can seem that time is speeding up or slowing down in measurements—making Einstein's equations basically true—time itself never speeds up or slows down. What I mean is, all local time is the same as all other local time. So your watch doesn't *really* speed up or slow down as you move faster or accelerate. It only *appears to* for a distant observer. Relativity doesn't concern time. It concerns *the measurement of time*.

That is the old definition of Relativity, and most times Einstein understood that—since the old definition was his. Many times, modern physicists *still* understand that. Whenever you see Feynman talking about *proper time*, for instance, he is talking about what I am calling local time here. All proper

time must be equivalent, or the Relativity transforms couldn't possibly work. The measurement of time must speed up or slow down *relative* to something, and that something is local time. Logically, you cannot have relative time without local time. See my papers for much more on that.

This means that not only is time *not* an illusion, time isn't even relative. Again, only *the measurement of time* is relative. Time and the measurement of time are two different things and two different concepts. So the idea that time is relative is already too radical and too squishy. To say it another way, the idea that time is relative is false.

So time is not relative. It is also not an illusion. Yes, it is a *concept*, but that does not make it an illusion. Some of these contemporary guys claim that because time is just a function of motion or change, it is not real. But that is false. I agree that time is a function of motion and/or change. I have an old paper arguing that case very directly. But I would never argue that makes time an illusion.

An illusion is something you think is happening that isn't really happening. But since motion is really happening, time is also happening, *by definition*. It is real. It isn't something you can touch or see directly, but it is real nonetheless. Again, it is a concept, and as long as a concept describes something that is real, the concept is also real. Strictly speaking, we would say the concept is *true*, rather than *real*, but in neither case is the concept an illusion. The only concept you could say was an illusion would be a false concept—one that did *not* describe anything physical.

To see this, it helps to look at the equation for motion or velocity, which of course is

$v = d/t$

From that, you see that time is defined by its relationship to *both* distance and motion. So, although time is a function of motion, it isn't *only* a function of motion. In other words, we can't just say that time is another word for motion. If that were so, we wouldn't need two letters to stand for time and velocity. One letter would do. The equation isn't

$v = t$

If we rewrite the first equation, we get

$t = d/v$

As you see, t and v aren't even in a direct proportion. They are in inverse proportion. The variable t goes in the numerator while the variable v goes in the denominator. Again, that should tell us that time isn't just another name for motion. Time depends on both motion and distance, and that equation tells us exactly how.

If time were an illusion, that equation wouldn't work, ever. In most cases, it does work. Which means that time is not an illusion. Time is a true concept.

In that linked paper, I say that time is just a second measurement of distance, one we use as a background during a measurement of motion. I will be told that time and distance must be the same thing, in that case. Which means time is an illusion.

No. Although time is operationally just a second measurement of distance, that in no way implies that

time is an illusion. If you say that time is an illusion, then you must be implying that that second measurement of distance is an illusion. It isn't. It is no more an illusion than any other measurement of distance.

I will then be told, "Well, the idea that time exists independently of distance or velocity is an illusion." Yes, that is true. Time is a concept that is *dependent* on distance and velocity, as the equation tells us. But, again, that does not imply time is an illusion. It does not imply the idea of time is an illusion. To be rigorous, these two sentences are **not** equivalent:

the idea that time exists independently of distance or velocity is an illusion
the idea of time is an illusion

The first sentence is true, the second sentence is false.

This sentence is also false:

The Galactic Rotation Problem can be solved by disconnecting the t-variable from GR, claiming it is an illusion, and allowing it to vary throughout the galaxy.

Not only is it false, it is internally inconsistent, as I have shown above. An illusion cannot vary throughout the galaxy. Sentences that are internally inconsistent are false, so we should know this theory is false even before we apply it to any galaxy. The theory is insensible, so there is no possibility it is true.

*I will be told that Einstein was a follower of Hume, and didn't believe in cause and effect. But again, that is only partially true. He was a Humean, and didn't believe that any effect could be deduced from any cause. In other words, the causal link could not be *proven*. But since Einstein also called himself a determinist, it would difficult for him to maintain that prior events didn't cause following events in some way. After all, that is the meaning of "determine." How can the past *determine* the future but not *cause* it? To my mind, *determine* is a stronger word even than *cause*. If A causes B, it leaves open the possibility that A could have also caused C or D. But if A determines B, then perhaps A could not determine anything but B. It might imply a one-to-one between A and B. This is the crux of determinism versus "a set future." They aren't the same thing, you see, although they are usually taken as equivalent. The real question is, "If A determines B, does that mean that B determines A?" In other words, is there a necessary one-to-one or not? I would say "not," but we don't know what Einstein thought. Even in his conversations with Karl Popper, I don't think the analysis ever got this pointed.