Solving the Mystery of Space and Time by Using Animacentric Relativity Principle

Stanislav Tregub

www.stanislavtregub.com

Current mainstream theories of physics use relativity principles that are based on the notion of space and time as some overarching framework for all things and events. Whether they consider it to be fixed (Newtonian relativity) or curving (Einsteinian relativity), they depend on this background as its metrics determine the result of calculations. The outcome depends upon what variables are put 'by hand' to conform with observations. Thus, what they call predictions are in fact post hoc explanations. There is another major problem: proclaimed space-time fabric should be everywhere, but cannot be found anywhere. Thus, explanations are based on the dogma about an intangible entity. We have to face the sad truth: leading theories are belief systems, rather than scientific models, and do not have a real predictive and explanatory power. This paper is a short introduction to an alternative background-independent relativity principle that resolves the contradictions and takes the notions of space and time back to the realm of science.

Keywords: space, time, reference frame, relativity, mind, model of reality.

The concepts of time and space have occupied the minds of people from time immemorial. The views on this matter can be divided into two categories.

Substantialism considers space and time as entities. It says that space is a kind of global container in which all objects are located, and time is a container of events. The Greek philosopher Democritus is usually considered to be the founder of the substantialism. But all ancient myths that associated space and time with gods (transcendental entities) can be called substantialism. Polytheists attributed these concepts to different gods. For example, the ancient Greeks considered time to be the god Chronos, who gives birth to everything and eats his children. Monotheists combined everything in one and only God. For example, Isaac Newton described space and time as independent from each other and unchanging containers for everything that exists, and he considered the source of both substances to be one God. Thus, his theory was an absolutistic substantialism within monotheism.

Another point of view is relationalism that says that space is relations between objects, and time is the dynamic sequence of their states. The philosophy of time as a measure of changes was developed by Aristotle. Immanuel Kant moved the source of time from God to the inner world of the cognizing subject. He argued that time does not belong to the objects themselves, but only to the subject who measures things and their changes. Gottfried Leibniz, who was Newton's opponent in many issues, was a relationalist.

The crucial dividing question: are space and time actual entities or just our concepts by which we define the measurement of all entities and their states?

To describe the objects and their dynamics, we can invent an abstract coordinate system that would be a frame of reference with axes where we put space points as coordinate values. We can add a time axis with specific units that would be the sampling rate at which we take

measures of the change, or we can use a clock ticking with some rate as a conventional agreement for all the observers. We should not forget that each observer is a reference point too, and external physical markers (position for the origin of the coordinate system frame or frequency of the clock) should be convenient for all the observers if we want to agree on our measurements.

To distinguish observer and external frames they are called an observational frame of reference and the coordinate system. If the frame of reference is stationary or moving at a constant speed it is called inertial. Theoretically, if various frames are inertial there is no difference between their measurements of external signals. This is usually called Galilean invariance which postulates that the laws of motion are the same in all inertial frames. Galileo Galilei described this principle in 1632 using the example of a ship moving at a constant speed on a smooth sea without rocking, which makes it equivalent to a stationary frame of reference for observers on it.

The state of the observational frame can be looked at from two perspectives: the movement of the observer and the parameters of his measuring apparatus. The example with the ship shows nicely that in reality there are no inertial frames: the ship's speed cannot be absolutely constant, and no sea is absolutely smooth. To add to the dilemma, no measuring equipment is absolutely stable. That is why the issue of "rods and clocks" has been one of the main ones: stability of measuring the distance between objects (space) and the distance between our sampling moments (time) is vital for the accuracy of our orientation in this world. In reality, we can make reference frames only less non-inertial so that to make our measurements with greater precision.

By the way, the accuracy of the onboard clock and minimizing the influence of the movement of the ship and other factors was the main problem, without which a purposeful journey across the ocean was practically impossible. The loss of the spatial landmark of the coastline and the transition to orientation by the stars required maximum accuracy and reliability from the device that created the measure of the movement duration. It took centuries to create sufficiently reliable mechanical clocks. The example with the ship shows that the inertial frame of reference was and remains a kind of dream, since it could be an ideal measure of everything. It was this dream that gave birth to the absolutistic substantialism.

In formulating his laws of motion, Newton made assumptions that made calculations easier but were an abstraction from reality. His first law speaks of a body at rest or in motion at a constant speed in a straight line. For these abstractions to become real there has to be a universal and fixed frame of reference. Thus, the need for abstractly perfect motion or rest gave birth to the main abstraction: Newton introduced the notion of absolute space and time as a universal frame of reference (background) for all measurements. This was the foundation of classical mechanics.

But how could such an abstraction provide for success in actual measurements and predictions of movements? The answer is simple: for a lack of an absolute frame, his practical calculations were based upon the real and more or less stable frames. Thus, the millennia-old tradition of navigation by the stars was incorporated into the new scientific framework and the relative stability of visible stars was used as a substitute for proclaimed absolute but invisible space. The same goes for time. For obvious reasons, instead of an intangible absolute and uniform time Newton used the usual reference frame of the clocks with a ticking frequency adjusted to the Earth rotation period as the measure of time. Replacing an abstract reference system with a real stellar and terrestrial one does not undermine Newton's mechanics, but only shows that invented entities space and time do not help in any way. For real measurements, we need real rods and clocks.

The relativity principle introduced by Albert Einstein implies observers moving at various speeds and producing different measurements but still assumes the existence of distinguished

frames that are uniform and allow for the equivalent expression of all measurements. The dream of an ideal continued to move the thought of physicists. But the contradiction appeared: on the one hand, observational frames of reference vary; on the other hand, the model insists that there should be inertial frames where all rules ("laws") are the same. To escape from this conundrum, something had to be inserted into the model that will be an absolute measure for all.

Einstein was an absolutist despite the fact that he abolished the static nature of Newton's space and time. He chose the speed of light which is the fastest one for all observers and made an absolute and a universal reference out of it. That is why the whole theoretical construct depends upon the physically and logically absurd postulate that the speed of light does not depend upon the movement of the observer. Just for the sake of saving the idea of abstract inertial frames, this postulate was added by Einstein to the physically valid postulate about the independence of the speed of light wave from the speed of the emitting source.

As the speed of light is so fast that currently no observer (living or artificial measuring apparatus) can catch up to it at the level of a noticeable difference between observers, they are all relatively uniform in comparison to light. The speed becomes a universal and absolute reference while in itself being the result of spatial and temporal measurements that are both relative. Theory of relativity produced an absolute.

Despite all the differences between Newtonian and Einsteinian models, they both keep the main abstraction: the existence of transcendent entities of space and time. Absolutistic substantialism continues to dominate the mainstream of theoretical physics. But is it substantially grounded?

The author of the book with the provocative name "The End of Time," Julian Barbour wrote: "What is time? Curiously, physicists have tended not to ask this question, preferring to leave it to philosophers. The reason is probably the colossal and dominating influence of Isaac Newton and Albert Einstein … They both take time as given. It is a building block on a par with space, a primary substance … Few people are aware that there is such a deep issue and crisis about the nature of time at the heart of general relativity … My own belief is that the idea is based on an incorrect notion of time. It is a mythical beast invoked in vain to solve a titanic struggle … I think that the whole problem of time and its arrow can — paradoxically — be formulated more precisely and transparently in a context in which time does not exist at all … Roughly, the idea is that physics should be built up using verbs, not nouns … The important thing is to get away from the idea that time is something. Time does not exist. All that exists are things that change" (Barbour, 1999).

The concept of a space-time grid existing out there as framework for all things is an ancient myth based on a lack of knowledge about the actual processes and an error of objectification that creates mythical entities out of physical processes. If we call something with a noun, it does not mean that a phenomenon is an object. It could be a process, that should be described by verbs. Calling the flow of events and our measuring of this flow with a noun "time" and thinking it is some entity is the same as thinking that the flow of the river is not a process but an entity Flow that sits in the river. When the idea that time as a substance is a "mythical beast" really settles in the minds, then the question of whether it is fixed as in Newton's model or curved as in Einstein's will disappear by itself. Time, as a measurement process, has no geometric form.

We can abolish the abstract entity Time at any time as it is redundant. When it comes to the practical measurement of change, we do not need any "substance of time." We only need a clock to count moments as discrete measures of a continual process. In addition, the concept of time as some entity is an objectification error: the process of measuring changes was taken for an object that curves, flows, flies, runs, and so on. If initially there is a concept about the presence of the object Time, then various theories will arise that will remain in the vicious

circle of looking for the Snark. It is worth recalling here that Lewis Carroll's humorous poem "The Hunting of the Snark" is an example of nonsense literature and describes the journey of an incredible team of nine people and a beaver in search of a fictional creature.

This world is full of processes. Of course, processes happen with things. But if we take a process for a thing, we hunt for a non-existent Snark. In the case of defining space and time as objects, the inevitable problem arose: these objects seem to be everywhere and nowhere. Their existence cannot be verified empirically. Here we see the usual path of creating a religious point of view: something is declared as existing but outside of any possible verification. We can describe it any way we want, write complex tensor equations of its geometry, and draw pictures of its imaginary curvatures. But that does not get us anywhere because we are stuck in the same paradox: this thing is everywhere and nowhere; it should be there somewhere, but we cannot touch it with our empirical testing methods.

Therefore, the only confirmation that adherents of Einstein's theory could come up with was the observation of clock readings under various conditions and at various speeds. The acceleration or deceleration of the clock for them became evidence of the curvature of the substance of time. A technical device that creates oscillations of a certain frequency to measure the dynamics of events began to be perceived as a messenger of the Space-Time fabric.

If it is some substance, it's form can have positive and negative curvature. This leads to the idea that it is possible to travel to the future or past by riding along the curves. The idea of time travel and hope for eternal life were combined in a myth that if we manage to move at the speed of light, we will get into a loop of space-time fabric and stay young forever. Einstein acknowledged that the whole idea was based on his childhood vision, where he straddled a beam of light and merged with infinity.

The concept was illustrated by a thought experiment called "twin paradox" where one of the two identical twins makes a journey into space in a rocket and returns home to find that the twin who remained on Earth has aged more. Another paradox hinted at inconsistencies in the idea of time travel. The "grandfather paradox" plot is the following: a person travels to the past and kills his grandfather before the conception of his father or mother; this prevents his existence, so he cannot be traveling anywhere in the first place. There was a heated discussion among physicists and a lot of mystical hype among the public.

But the absurdity of the idea of time travel in the literal sense as movement through some substance in different directions is not in the paradoxical murders of one's ancestors. The initial premise about time as a substance is based on an objectification error and is fundamentally wrong. If we get rid of the objectification error, we come to the sober conclusion that the movement of time, as the measurement of signals' dynamics, is a "one-way ticket." Change can be measured only in one direction: in the order of change.

If some signal is periodic and returns to the previous state, it is still a change registered by the observer in one direction. In this sense, our ancient ancestors, who thought that the Sun dies and is reborn every day, were right in their way. Even the seemingly constant and ideally periodic signal contains change. Indeed, one cannot enter any river twice: neither a water flow nor a flow of time.

The idea that time is not an object, but a process of measurement is relatively easy to grasp, though it breaks the millennia-old tradition. But concerning the concept of space, bewilderment may arise. If there is no space as a special substance, where does everything exist? Maybe there is some absolute entity Space as the container of everything? This is quite intuitive as we can imagine some empty box that we fill with stuff.

But the question arises. If we put the stuff out of this box, what will remain? The obvious answer is a box. But then this box must have its own substantiality. If space is something, it cannot be nothing. If it is everywhere, it has to be somewhere in particular too. As the question gets no answer, the concept of all-encompassing space becomes an idea of an entity

transcendent to matter. Thus, it is impossible to find it by definition: it is immaterial; it is everywhere and nowhere. These are the attributes of God. But to escape the obvious analogy, space is called the "background" in physics.

As in background-dependent theories space is taken for some separate thing from all other things, the obvious question about its forms and states arises. Some say that General Relativity is background-independent, as, contrary to Newton's model, it has no fixed framework. But it is essentially a substantialist model, which assumes the existence of the space-time fabric as a kind of substance and even explains the phenomena of the world by the state of this substance. Whether the background is fixed or curved does not make a difference. If the theory suggests its existence, it depends on the background. The truly background-independent theory does not need any transcendent framework to explain things.

In his book "The trouble with physics," Lee Smolin wrote: "Might there be a deeper theory in which we don't have to make any prior assumption about the number of spatial dimensions? In such a theory, the three dimensions might come out as the solution to some dynamical law. Perhaps, in such a theory, the number of spatial dimensions could even change in time. If we could invent such a theory, it might explain to us why our universe has three dimensions. This would constitute progress, for something that previously was simply assumed would finally be explained … Meanwhile, the search for a single, unique, unified theory of nature has led to the conjecture of an infinite number of theories, none of which can be written down in any detail. And if consistent, they lead to an infinite number of possible universes. On top of this, all the versions we can study in any detail disagree with observation … Those who believe the conjectures find themselves in a very different intellectual universe from those who insist on believing only what the actual evidence supports. The very fact that such a vast divergence of views persists in a legitimate field of science is in itself an indication that something is badly amiss … We need a theory about what makes up space, a background-independent theory" (Smolin, 2006).

Obviously, the problem is a serious one as it concerns the foundation of any physical theory. The way out is to change the concept of space and time that will reconcile our intellectual universe (model of reality) with the actual evidence (reality). Might we suggest to ourselves that our abstract ideas about the existence of space and time as some substance out there everywhere and nowhere could just be wrong? Might relationism be a solution?

But it is not enough to say that space and time are just relations of things and their changes. If we get rid of the notion of some transcendent grid with a particular number of axes and a specific configuration, we should find another reference frame. If we say that there is no absolute for relating things of the world and their dynamics, we should look for another relativity principle. Negation does not help. If we look for a background-independent theory, we should say what makes up space and time.

Now here is an old idea we might use: the source of space and time is the cognizing subject. Stemming from this foundation we can say that space is how the observer measures objects (length, height, depth, curvature) and their relations (distance, occlusion, perspective) and time is a measurement of dynamics (change, motion, duration, sequence). It means that the initial observational frame of reference is the Mind. We can call it the *animacentric relativity principle* (from Latin animus — mind).

There are several conclusions that can be drawn from this principle. First, there are no ideal and absolute observational frames of reference. Second, measurements are different for observers with various parameters and vary for one observational frame when its parameters change. Third, there are no distinguished frames of reference that dictate all laws, but individual observers can agree on mutual external "rods and clocks" so that they can reconcile their individual measurements. Fourth, there are only relatively stable coordinate systems that can be used for spatial and temporal measurements.

So, if Aristotle, Kant, Leibnitz and other classical relationists were right that the Mind is the source of measurements, we find ourselves looking at the ontological question that is even deeper than the problem of space and time: what is the Mind?

Barbour came to the same conclusion: "The discussion prompts the question of how our sense of the passage of time arises. Before we can begin to answer this, we have to think about another mystery — consciousness itself. How does brute inanimate matter become conscious, or rather self-conscious? No one has any idea. Consciousness and matter are as different as chalk and cheese. Nothing in the material world gives a clue as to how parts of it (our brains) become conscious. However, there is increasing evidence that certain mental states and activities are correlated with certain physical states in different specific regions of the brain. This makes it natural to assume, as was done long ago, that there is psychophysical parallelism: conscious states somehow reflect physical states in the brain" (Barbour, 1999).

The hypothesis that the psyche comes from the physical states of the brain is indeed quite old but it needs development. And here we have to be careful with our metaphors. Matter and Mind are not different as chalk and cheese (objects). They are different as a river and a flow: one is a substance and the other one is a process in the substance. Once we get rid of the objectification error, we can say how "brute inanimate matter becomes conscious" and how exactly the physical states of the brain create mental states.

This may sound surprising, but any theory of physics should deal with the concept of the Mind as it is a physical process. We can put it the other way around: any theory of the Mind should deal with physical phenomena as it is one of them. Or better still: any unified theory of nature should include the model of Matter and Mind. Does anything in the material world give us a clue about how the brain produces mental states, i.e., how matter becomes conscious? Contrary to Barbour's negative statement, the answer to the question is Yes.

The concept called "Symphony of Matter and Mind" contains two models, Theory of Energy Harmony and Teleological Transduction Theory, that aim to be a unified theory of nature (Tregub, 2021a,b,c,d,e,f,g,h). The first model deals with the universal mechanism that is responsible for all fundamental interactions and the creation of structures of matter. The second explains physics, physiology and technology that create our mind as a process in the brain.

The models do not create an intellectual universe where one has to choose: either believe the conjectures or believe what actual evidence supports. They do not postulate entities that are not subject to empirical testing. In fact, there is no need to use the verb "believe," as these models are not belief systems. Not a single hypothesis within these models contradicts any actual evidence. On the contrary, they are based on a huge amount of evidence accumulated within various fields of knowledge. They return physics to the legitimate field of science where theories abide by the basic principle: only verifiable and potentially refutable conjectures should be proposed by a model.

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