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Temporal and timeless cognition in physics

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Abstract: In experimental and theoretical physics, we measure time as the duration of material changes that run into space. We have no scientific evidence that would be based on the elementary perception and would prove that clocks run in some physical time. Universal space is time-invariant, in the sense that time is not its fourth dimension. In time-invariant space, motion happens only in space and not in time. Time as duration enters existence as an emergent physical quantity and is the result of the observer's measurement. Linear time "past-present-future" is psychological time that runs only in the brain. Universal change runs in time-invariant space, in this sense the universe is timeless. Temporal cognition occurs in the frame of psychological time, and timeless cognition occurs without the impact of psychological time. © *2022 Physics Essays Publication.* [http://dx.doi.org/10.4006/0836-1398-35.3.305]

Résumé: En physique expérimentale et théorique, nous mesurons le temps comme la durée des changements matériels qui traversent l'espace. Nous n'avons aucune preuve scientifique qui serait basée sur la perception élémentaire et prouverait que les horloges fonctionnent dans un certain temps physique. L'espace universel est invariant dans le temps, en ce sens que le temps n'est pas sa quatrième dimension. Dans l'espace invariant dans le temps, le mouvement ne se produit que dans l'espace et non dans le temps. Le temps en tant que durée entre dans l'existence en tant que quantité physique émergente et est le résultat de la mesure de l'observateur. Le temps linéaire « passé-présent-futur » est un temps psychologique qui ne s'écoule que dans le cerveau. Le changement universel s'exécute dans un espace invariant dans le temps, en ce sens l'univers est intemporel. La cognition temporelle se produit dans le cadre du temps psychologique, et la cognition intemporelle se produit sans l'impact du temps psychologique.

Key words: Time; Space; Change; Motion; cognition.

I. INTRODUCTION

Material changes in the universe are the indisputable reality whose existence all physicists agree on. We observe changes in space only, never in time, and changes over time have never been observed and should be taken as an unprovable proposition. We, thus, propose a model that stipulates that changes occur only in space. In this model, time is the duration of the change that the observer measures with a clock. We must now ask whether the duration exists before being measured.

The answer is that we observe in the universe only the flow of changes, not their duration. Duration enters existence after the given flow of changes is compared with another flow of changes. Clocks are mechanisms that we use to compare all changes; they run only in space and do not measure some general cosmological time, which is nonexistent and a pure unproven theoretical proposition. Time as duration enters existence when measured by an observer. This confirms that the universe is utterly timeless; no trace of physical time exists in physical reality. Entropy increases only in space. A "thermodynamic arrow of time" does not exist in the universe. Time has no arrow and is not pointing anywhere.

The flow of changes is irreversible, change 2 occurs after change 1, and change 3 occurs after change 2. We interpret change 1 as the cause of change 2, but this is only our interpretation; an unprovable idea. In the universe, we only observe the flow of change that occurs in space. Universal space is time-invariant in the sense that time is not its fourth dimension, and that time does not exist in space as a real physical quantity.[1]

We experience the flow of change in time-invariant space through the linear psychological time "past-present-future" that is the result of the neuronal activity of the brain. Psychological time has its physical or better to say, biological origin in neuronal activity of the brain, we can call it "neuronal time." We experience the material change or motion of an object in time-invariant space through neuronal time. In physical reality, there is no trace of some physical time run, and the only running time is neuronal time. With our senses, we perceive only material change and motion running in space, and nobody is able to perceive the run of some physical time.[2] In Fig. 1, we see how neuronal time is incorporated in the process of cognition between perception in the eyes and the observer's experience of the world.

Equipped with this understanding of time, the real actual relation among time, causality, and entropy becomes indisputably clear: Time-invariant universal space has a so-called "timeless configuration."[3] The model of time-reversal symmetry (T-symmetry) has no physical correspondence with the physical world. Symmetry in time does not exist because

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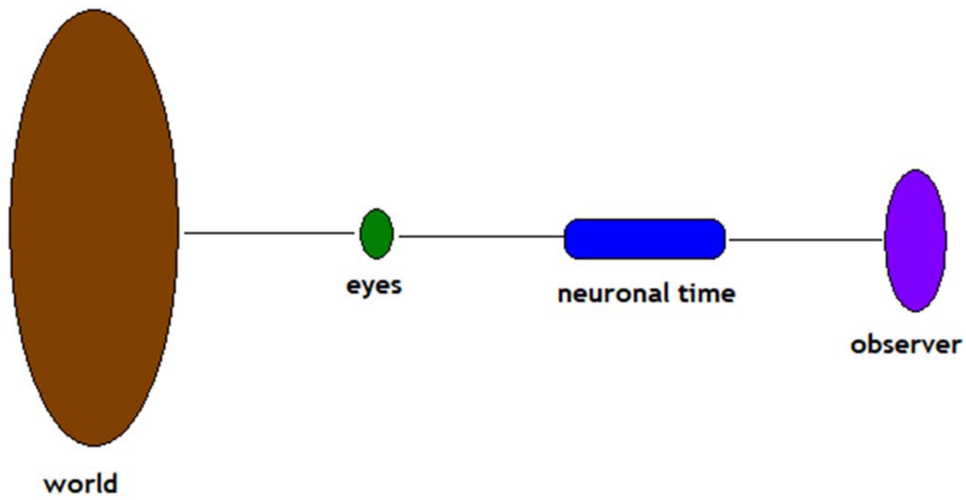

FIG. 1. (Color online) Temporal cognition where observer experiences the world through neuronal time.

no negative physical time $-t$ exists. The elapsed time t is neither positive nor negative. It is an absolute value.[4]

The increase in entropy in the universe is accepted by mainstream science and is based on astronomical observations. However, we propose herein that entropy does not increase in time because physical time does not exist in the universe. From this perspective, entropy and time are not physically related. The "thermodynamic arrow of time" is an empty term because time is not pointing anywhere. In addition, "cosmological time" is an empty term because time is not advancing in the universe, only changes are occurring, and their relative velocity depends on the variable energy density of the superfluid quantum space that is the physical origin of the universal space.[5] In principle, we can use increasing entropy as a clock, and we measure via the increase in entropy the duration of other changes that occur in space. However, we must understand that entropy does not increase over time and does not measure physical time because physical time does not exist.

In our model, causality is a concept (i.e., a model), and time, when measured by the observer, is created by the observer. Given this scenario, it makes sense to see time as a discrete entity that measures the numerical order of causality, where the change X always occurs before the change $X+1$. Time as the numerical order of change is discrete, and the fundamental unit of time is Planck time. Elapsed time that enters existence in the observer's measurement can be seen as a sum of Planck times.[6] That time is a discrete entity has also been suggested by recent research: "With the introduction herein of causality, time can only be reconstructed as a discrete entity that yields other consequences, from entropy to the evolution of the universe and many other findings, thereby opening more avenues for investigation. We invite the reader to participate in this journey."[7]

Recent research suggests that the flow of change and the flow of quanta embody the flow of time: "It is difficult to break the habit of thinking that time is not a dimension. Still, there is no universal axis along which to organize all events since events occur in relation to an observer. Time is relative. The passage of time that I experience matters to me, the one you sense matters to you. Greenwich mean time (GMT) serves to synchronize events globally, but it is just a local convention in the universe. For example, what took place on our neighbouring star, Proxima Centauri, about four years ago, is visible only here today. Time is not just what can be timed, so to speak, operational comparison. A running clock is also a system in a state of imbalance. The ticking is a series of events targeting balance; the flow of quanta embodies the flow of time."[8] In our model, this is true only in the sense that the so-called "fundamental time" is the numerical order of this flow of quanta that runs in time-invariant universal space. The fundamental unit of the numerical order of flowing quanta is Planck time. The duration of flowing quanta, which we call "emergent time," does not exist independently. Its existence requires measurement by the observer.[6]

Our model of time resolves the puzzle of the Einstein–-Podolsky–Rosen (EPR) experiment, whereby the transfer of information between two entangled particles is immediate, which is inconsistent with the theory of relativity: "In modern language, the EPR paradox, in its most elementary form, is concerned with two entangled particles with opposite spin. We do not know the spins of the individual particles, only that they are both created at time T1 with total spin equal to zero; once we measure the spin of one of the particles at time T2, we can immediately know the spin of the other particle, even if they are separated by a very large distance. So, it appears as though the influence of the measurement on the first particle instantaneously reaches the second particle, which contradicts the principles of the theory of relativity since such an influence should not be able to travel faster than light."[9] In the universe, times T1 and T2 do not exist; changes run in time-invariant space. Fundamental time is the sequential numerical order of events that occur in time-invariant universal space. When event $X+1$ occurs, event X no longer exists. When event $X+2$ occurs, event $X+1$ no longer exists. The only event that exists is the event that we perceive with our senses and measure with instruments. Fundamental time runs without requiring observation by an observer. However, without observation and measurement by the observer, fundamental time has no meaning. The numerical order of events (events that occur one after another)

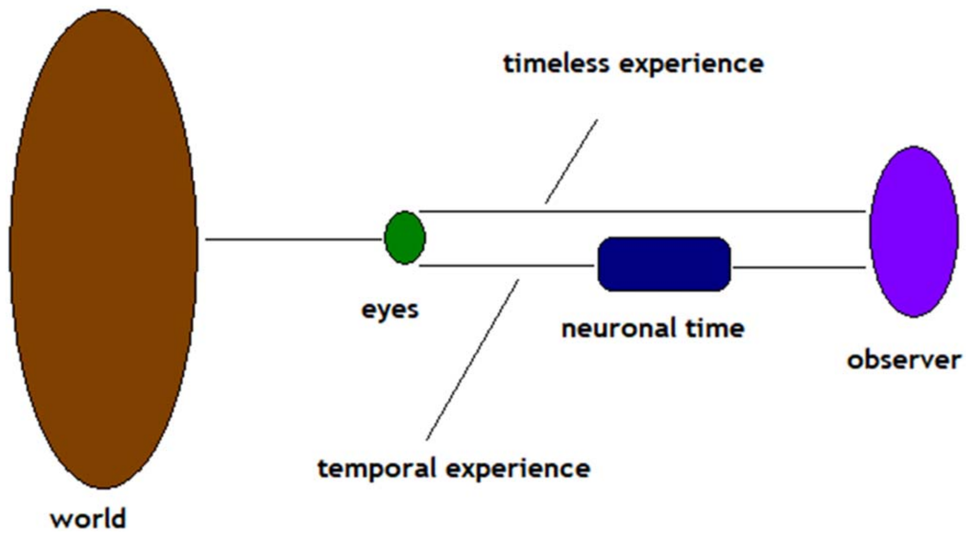

FIG. 2. (Color online) Temporal and timeless experience.

makes sense when being observed. When we measure it with the clock, in fact, we get the duration. In our model of relativity, there is no contradiction. The time-invariant universal space is the direct medium of EPR-type entanglement. Entanglement is an event that has no numerical order and so no duration.[6]

In our model, the universe is timeless in the sense that it does not run in some physical time, it runs only in time-invariant space, so past and future do not exist eternally as is proposed in a block universe: "Timelessness," as such, is not a new idea but was proposed in a specific form by Einstein. In a block universe, all of space and time exists eternally.[10] In our model, the universe is timeless in the sense that universal change occurs in time-invariant space. Einstein said: "For us believing physicists the distinction between past, present, and future only has the meaning of an illusion, though a persistent one."[11] Yet even Einstein despaired of understanding the flow of time and the meaning of *now*. Einstein's quandary was described as follows by Carnap: "Einstein said the problem of the Now worried him seriously. He explained that the experience of the Now means something special for man, something essentially different from the past and the future, but that this important difference does not and cannot occur within physics. That this experience cannot be grasped by science seemed to him a matter of painful but inevitable resignation. So, he concluded that there is something essential about the Now which is just outside the realm of science."[12] Our proposal to interpret Einstein's NOW is that, in physics, we experience time-invariant space as NOW, whereas time as duration enters existence only when measured by an observer. Einstein's cognition was timeless (direct), and he experienced the physical reality without the experiential impact of neuronal time (see Fig. 2).

II. TIMELESS COGNITION AND ADVANCES OF PHYSICS

The observer has ability to step out of the neuronal time. From the point of ontology, timeless cognition is higher than temporal cognition. It unveils the secret of the timeless nature of the physical world. In the physical world, only changes run, and time runs only in the human brain. This insight has immense potential for the development of science because temporal cognition is a kind of "illusion." Einstein has pointed out this fact, and still today science is locked in temporal cognition. Timeless cognition is confirming that human beings and physical objects can only move in space but not in time; you cannot move into the past or into the future. Time travel is categorically excluded.[4] In experimental physics, we measure time as a duration. This acknowledgment that duration is the result of the observer's measurement is a necessary step to develop theoretical physics.[2] No measurement means no duration in the universe, only material change and motion exist in time-invariant space.

Quantum teleportation can happen only in space but not in time. The idea of quantum teleportation also having a temporal aspect is questionable,[13] because it predicts the existence of some physical time for which no scientific evidence exists. In physics, the existence of physical time was and is an unproved proposition. Researchers have introduced the term "temporal entanglement," which seems to have no physical reality. Entanglement can only occur in space, so we can only consider "spatial entanglement" having in mind that space is time-invariant.

In physics, we experience the time-invariant property of universal space as NOW. All physical reality that exists does so in time-invariant superfluid quantum space. All the rest is the illusion to which Einstein was referring. What has happened, we experience as past, and what will happen, we experience as future. However, past and future have no physical existence.

In general relativity, "closed timeline curves" exist only as a mathematical model that has no actual physical correspondence. Time cannot be curved because it has no physical existence. In 2014, NASA measured that universal space has a Euclidean shape,[14] which means that the curvature of space in general relativity is a mathematical model of gravity that has no physical correspondence in the physical world. In general relativity, space curves because time cannot curve since it has no physical existence. Hawking's "chronology protection conjecture" excludes the possibility of the existence of closed timeline curves: "The laws of physics do not allow the appearance of closed timelike curves."[15] Our research confirms that the open timelike curves in general relativity are a mathematical model through which no motion is possible. Not only on the macro level is the motion of a physical object restricted to space but, on a quantum level, particles can move only in space. For example, a photon moves in space whereas time is the duration of its motion. The idea that "the photon does not experience time" is extended to the macro level. In addition, massive objects do not experience time. Only humans experience time when time is measured by clocks. The universe is utterly timeless, time-invariant.

Closed timeline curves were developed by Gödel back in 1949[16] and allowed time travel into the past, so one can travel into the past and kill one's grandfather, thereby making one's birth impossible. Gödel was already aware of this ramification in 1949, so he postulated: "In any universe described by the theory of relativity, time cannot exist."[17] Although the basic equation of special relativity shows time is not the fourth dimension of space ($X_4 = ict \rightarrow X_4 \neq t$), this idea persists to this day in scientific thought.

In today's physics, it is widely accepted that we measure with clocks the passage of some physical time that runs in space. The rate of the time depends on the curvature of space; the more space is curved, the slower is the passage of physical time. NASA research has confirmed that universal space has no actual physical curvature but has a Euclidean shape.[14] Clocks run slower in the areas of universal space where gravity is stronger, and their rate is valid for all observers.[5] An advanced understanding of the metrology of time is that clocks are mechanisms that allow an observer to define the duration of observed material change. Duration as such is the result of the measurement, and it is "made" by the observer. This view was proposed by Ernst Mach back in 1883: "It is utterly beyond our power to measure the changes of things by time … time is an abstraction at which we arrive by means of the changes of things; made because we are not restricted to any one definite measure, all being interconnected."[18]

In 2009, Barbour suggested that time plays no role in the universe: "It is not only Newton's laws that can be obtained in this timeless way. There is an interpretation of Einstein's general relativity in which it and time arise in much the same way. I will not claim that time can definitely be banished from physics; the universe may be infinite, and black holes present some problems for the timeless picture. Nevertheless, I think it is entirely possible—indeed likely—that time as such plays no role in the universe."[19]

Our research confirms that time cannot play a role in the universe, because it has no physical existence, which is consistent with Rovelli, who is denying the existence of physical time.[20,21] The open question to be answered is that, if physical time does not exist, what do we measure with clocks? Our research proposal is thus "Time as duration is the result of measurement." In the metrology of time, the observer is the cardinal element: No measurement means no time.

This insight constitutes a paradigm shift in physics. Linear time in the sense of "past-present-future" only occurs in the human brain. We experience a flow of material changes in the frame of psychological time that has its physical basis in the neuronal activity of the brain. We "project" linear psychological time (past-present-future) into the physical reality, yet such time does not exist.[2]

Space-time, where time is the fourth dimension of space, was considered one of the biggest achievements of 20th-century physics. However, Einstein's view on space and time seems not to have been well understood until today. Einstein interwove space and time into a four-dimensional continuum where space and time merged. In his view, the fourth dimension X_4 of space-time is not temporal but spatial. This four-dimensional continuum was given the improper name "spacetime," which has caused a century-long long misconception. In Einstein's four-dimensional continuum, time exists only as the duration of photon motion when measured by the observer.

III. CONCLUSIONS

In today's physics, the prevailing view is that time as duration is a fundamental physical reality existing independently of the observer. However, a minority of physicists deny the existence of physical time. This article argues that the minority seems to be correct and that time enters existence only upon being measured by an observer. Thus, time as a duration is an emergent physical reality that requires measurement by an observer. Introducing this model of time based on elementary perception into cognitive science will bring new generations of students more adequate experience of the universe and life. The ontological jump from temporal to timeless experience is essential for advanced cognition of the world.

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