# WITH CLOCKS WE MEASURE FREQUENCY, VELOCITY AND NUMERICAL ORDER OF CHANGE

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"Time - the time that we know through clocks and calendars - was invented".
Albert Einstein
http://www.britannica.com/clockworks/article.html

Abstract

The universe is in a continuous change. A change n gets transformed into a change n+1, the change n+1 into a change n+2 and so on. Clocks measure a frequency, velocity and numerical order of change. Changes do not occur in time, changes occur in space only. Time is not a part of space. In the space there is no past and no future. Past and future belong to the inner time that is a result of neuronal activity of the brain.

Key words: change, time, space, space-time, time dilatation, inner time, observer

## Introduction

Clocks measure a frequency $\gamma(s^{-1})$, velocity v $(ms^{-1})$ and numerical order $n...n+1...n+2...$ of changes that occur in a space. We experience stream of changes in a linear concept of the inner time that is based in neuronal activity of the brain.
Research done in 2003 introduces idea that part of the brain is creating time: "The brain is the "local" creator of time, space, and space-time as our special maps of the reality we "observe" and participate in" (1).
Research done in 2005 shows that consequent experience of changes in a "past-present-future" perspective is a result of neuronal dynamics in certain areas of the brain (2).
Time is not a part of space in which change occurs. The fundamental arena in which changes occur is the space. With clocks we do not measure time, we measure frequency, velocity and numerical order of change in space. Space-time is mathematical model merely.
A growing number of modern researchers are challenging the view that space-time is the fundamental arena of the universe. They point out that the mathematical model of space-time does not correspond to the physical reality, and propose a "timeless space" as the arena instead. One recent paper on the subject is: "A New Geometric Framework for the Foundations of Quantum Theory and the Role Played by Gravity:Since quantum theory is inherently blind to the existence of such state-space geometries, the analysis here suggests that attempts to formulate unified theories of physics within a conventional quantum-theoretic framework are misguided, and that a successful quantum theory of gravity should unify the causal non-Euclidean geometry of space time with the atemporal fractal geometry of state space (3).
Another recent paper says: "We illustrate our proposal using a toy model where we show how the Lorentzian signature and Nordstroem gravity (a diffeomorphisms invariant scalar gravity theory) can emerge from a timeless non-dynamical space" (4).
Julian Barbour says in The Nature of Time: "I will not claim that time can be definitely banished from physics; the universe might be infinite, and black holes present some problems for the time picture. Nevertheless, I think it is entirely possible, indeed likely, that time as such plays no role in the universe"(5).

Time definitely does not play any role in the universe. With clocks we do not measure time; we measure frequency, velocity and numerical order of change that run in space. There is no time as a physical reality. Space itself is timeless. The only time that exists is inner time that is based on neuronal dynamics of the brain.

Ernst Mach said: “It is utterly beyond our power to measure the changes of things by time. Quite the contrary, time is an abstraction, at which we arrive by means of the changes of things”. Mach is right. Clocks are man-made inventions and time is an abstraction of the mind. In physical equations symbol “t” means “clock tick”, not more and not less. And clocks “tick” in space only, not in space-time.

In physics numerical order of change is represented by a straight infinite line composed of real numbers. Since the real numbers are a continuum also changes are a continuum. Transformation of the change n into n+1, n+1 into n+2 is an unbroken continuous process. Number zero represents the present moment in which we measure changes. Changes that have happened are represented by the real numbers to the left from zero and changes that will happen are represented by real numbers to the right from zero.

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As we experience changes through linear concept of inner time we are not aware that changes run in the space only and not in time. With clocks we measure frequency, velocity and numerical order of changes running in space.

changes occurring in the space - perception – processing of the inner time - experience

In today physics still stream of change is understood run in time as a physical reality although there is no experimental data for such interpretation. Experimental data confirm that changes run in space only and with clocks we measure their frequency, velocity and numerical order. Smallest unit of numerical order is “Planck time” and largest is “one year”.

## Materials and Methods

We perceive changes that occur in the universe through our eyes. Then the information about the changes is processed by the brain into the inner time, and finally becomes our experience. Between the perception and the experience there is processing through the inner time that creates a distortion of perception. However, once we become aware of the inner time, we can experience changes directly as they occur. This direct experience gives a scientist an objective view of the physical world.

This direct experience is essential for the further development of physics. The direct experience can be achieved by observing a pendulum. For the first few minutes you will experience the pendulum moving in space and time. After closing your eyes to envisage an image of the pendulum moving in your mind's eye, you become aware of the inner time in which you experience pendulum motion. You experience the change directly as it occurs in space.

An observer is a constituent part of a scientific experiment. In the indirect (temporal) experience the observer is captured within the inner time. He experiences timeless space through inner time as a present moment. In the direct (atemporal) experience the observer is

fully aware of the inner time and experiences changes directly as they occur in a timeless space. He experiences timeless space directly as a fundamental physical reality in which changes occur.

INDIRECT TEMPORAL EXPERIENCE
change – perception - processing through the inner time - temporal experience of the observer

DIRECT ATEMPORAL EXPERIENCE
change - perception (eyes) - atemporal experience of the observer

## Discussion

With discovery of inner time, a new interpretation of relativity emerges. The universe is a timeless phenomenon where changes exist "before" and "after" only in a sense of a numerical order. Experimental physics confirms that changes occur in the present moment in the timeless space only and not in space-time that is only a mathematical model. In a faster inertial system that moves in the timeless space the speed of change is slower than in a slower inertial system. With stronger gravity the speed of change is slower than with weaker gravity. The so-called "time-dilatation" means that the speed of change slows down, including the speed of clocks.

Recent research indicates that some change happens in zero time. Timeless quantum communication is a real phenomenon: *"We show how continuous-variable systems can allow the direct communication of messages with an acceptable degree of privacy. This is possible by combining a suitable phase-space encoding of the plain message with real-time checks of the quantum communication channel. The resulting protocol works properly when a small amount of noise affects the quantum channel. If this noise is non-tolerable, the protocol stops leaving a limited amount of information to a potential eavesdropper"* (6). What is meant here is that information does not move through space-time, but through the timeless space, an immediate medium for identifiable quanta.

The Einstein-Podolsky-Rosen (EPR) experiment similarly reminds us that physical space is a timeless environment. There is no discernible signal in the form of a photon travelling between A and B. The time of information transfer between A and B is essentially zero. We might infer that A and B are extended entities. The timeless space represents an immediate communication medium between the quanta A and B (7).

The timeless physical space as an "immediate information medium" resolves the causality problem of the Fermi two-atom system: *"Let A and B be two atoms or, more generally, a 'source' and a 'detector' separated by some distance R. At t=0 A is in an excited state, B in its ground state, and no photons are present. A theorem is proved that in contrast to Einstein causality and finite signal velocity, the excitation probability of B is non-zero immediately after t=0. Implications are discussed"(8).* The excitation probability of B is non-zero because the space in which atoms exist is an "immediate medium of excitation".

It can be said that certain physical phenomena are timeless, since no measurable time (no run of clocks) elapses for them to happen. For example in the article entitled *Attosecond Ionization and Tunneling Delay Time Measurements in Helium* by Eckle et al, a conclusion is drawn that *"an electron can tunnel through the potential barrier of a He atom in practically no time"* (9).

In similar vein, a recent arxiv paper depicts a system of diagrams to represent various elements of a quantum circuit, in a form which makes no reference to time (10).

Quantum gravity describes space as granular. Space is made out of quanta of space volume of Planck (11).

What is meant here is that the quantum space is an immediate medium for information (I) and energy (E) transfer. At Planck size (IE), transfers are immediate; at photon size, they move at the light speed; at larger scales they move at the speed lower than the light speed.
Gravity is not an energy transfer from an object A to an object B, gravity is a result of dynamics between mass and quantum space. Existence of certain mass in a given volume of space changes the quantum structure of space and this generates gravity. In the General Theory of Relativity structural change of quantum space is described by curvature of space. Quantum space itself is timeless. Gravity is immediate.

Understanding of time here confirms a vision of Einstein and Gödel who considered the universe to be a timeless phenomenon (12). “Back in time” and “forward in time” exists only as a numerical order of changes. Hypothetical “travelling in time” in spaceships is out of question; one can travel in space only. With clocks we measure speed and numerical order of motion of a spaceship in space.

Research of J. J. Halliwell on quantum cosmology develops cosmological models where there is no no physical time coordinate at all: “The decoherent histories approach is a particularly useful approach to quantum theory especially when time enters in a non-trivial way, or indeed, when there is no physical time coordinate at all, as is the case in quantum cosmology. Here, attempts to apply the decoherent histories approach to quantum cosmology are described” (13).

## Conclusion

In today’s physics the conviction still prevails that time is a part of space and so a fundamental physical reality in which change occurs. Most physicists are still experiencing changes through the linear inner time. They “project” the inner time into the physical reality and so their experience is temporal. Temporal experience is an obstacle for deeper understanding of immediate quantum phenomena for which clock run is zero. Physicists who know only the temporal experience are convinced that no change can happen without clocks run.
Once a physicist is aware of the inner time he experiences changes directly as they occur in space. This atemporal experience confirms that time is not a part of physical world; with clocks we do not measure time, we measure frequency, velocity and numerical order of changes that occur in the space. Atemporal experience will ensure development of new scientific models that will be closer to the real nature of the universe.

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