International Scholars Journals

African Journal of Philosophy and Religious Studies ISSN 1621-4587 Vol. 4 (2), pp. 001-003, February, 2018.
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Review

In what way are related psychological time and physical time?

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Accepted 06 January, 2018

Recent neurological research shows that, psychological time "past-present -future" is a result of neuronal dynamics of the brain. Through the psychological time we experience motion in the universe. Puzzle with time in physics is that in the universe we can perceive only motion and not time. Here, it is proposed that physical time t is run of clocks. Fourth coordinate $X4 = i * c * t$ is spatial too. $X4$ is composed out of imaginary number i, light speed c and number t that is indicating "thick" of clocks in space. Precisely, time t is not fourth dimension of the space, time t is a third component of the fourth dimension of space. Fourth dimension is not temporal, forth dimension is spatial too. Clocks run in space only and not in time. There is no physical time behind run of clocks. Clock/time is a measuring system for physical events.

Key words: Psychological time, physical time, run of clocks, numerical order, frequency, velocity, light speed.

INTRODUCTION

Recent research has shown that, inner linear time has its basis in neuronal activity of the brain: "The brain is the 'local' creator of time, space and space-time as our special maps of reality we 'observe' and participate in" (Catalin et al., 2005). "Time is a fundamental dimension of life. It is crucial for decisions about quantity, speed of movement and rate of return, as well as for motor control in walking, speech, playing or appreciating music, and participating in sports. Traditionally, the way in which time is perceived, represented and estimated has been explained using a pacemaker–accumulator model that is not only straightforward, but also surprisingly powerful in explaining behavioral and biological data. However, recent advances have challenged this traditional view. It is now proposed that, the brain represents time in a distributed manner and tells the time by detecting the coincidental activation of different neural populations (Hitchcock, 2003).

Linear time "past- present-future" is psychological time. Physical time is run of clocks in a space. Motion that we experience through psychological time happens in space that is timeless; past, present and future do not exist in space. There is no physical time existing behind run of clocks. Time as a run of clocks in space implies that, the duration of a material change has no existence on its own. Duration of material change is result of measurement with clocks. This implies that, universe is timeless, time is not part of the universe; time/clock is a measuring device for motion in timeless space. Basic unit of time "Planck time" t_p is calculated on the light speed c : Planck time is

$$t_p = \frac{c}{l_p},$$

Where l_p is a Planck distance $\ell_P = \sqrt{\frac{\hbar G}{c^3}} \approx 1.616252(81) \times 10^{-35}$ meters. G is gravitational constant and is the reduced Planck constant.

Planck time t_p is the basic unity for measuring physical events. Time t we obtain with clocks is not a part of space; time/clock run is a reference system to measure physical events, that is, material change. In Lorentz transformation time t and t' are running of clocks for two observers Q and Q' (Amrit, 2009).

$$\begin{bmatrix} ct' \\ x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} \gamma & -\beta\gamma & 0 & 0 \\ -\beta\gamma & \gamma & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} ct \\ x \\ y \\ z \end{bmatrix}.$$

Where $\beta = \frac{v}{c} = \frac{\|\vec{v}\|}{c}$ and $\gamma = \frac{1}{\sqrt{1-\beta^2}}$.

According to formalism $d = v * t$ forth coordinates ct' and ct is spatial too.

Theory of Relativity shows that, speed of clocks is relative to the speed of inertial system and strength of gravitational field. Clocks run slower in faster inertial system and stronger gravity field. Research here shows that, there is no physical time beyond run of clocks. Clock/time is a reference system for measuring frequency, velocity and numerical order t_0 , t_1 , t_2 .....t_n of physical events. Physical events have none of its own duration. Duration is result of measurement with clocks.

Timeless physical phenomena

For certain physical events time t is zero, since no measurable time (no run of clocks) elapses for them to happen. For example, in the article Attosecond Ionization and Tunneling Delay Time Measurements in Helium by Eckle and others, a conclusion is drawn that, an electron can tunnel through the potential barrier of a He atom in practically no time: “It is well established that, electrons can escape from atoms through tunneling under the influence of strong laser fields, but the timing of the process has been controversial and far too rapid to probe in detail. We used attosecond angular streaking to place an upper limit of 34 attoseconds and an intensity-averaged upper limit of 12 attoseconds on the tunneling delay time in strong field ionization of a helium atom. The ionization field derives from 5.5-femtosecond-long near-infrared laser pulses with peak intensities ranging from 2.3 x 10^{14} - 3.5 x 10^{14} watts per square centimeter (corresponding to a Keldysh parameter variation from 1.45 - 1.17, associated with the onset of efficient tunneling). The technique relies on establishing an absolute reference point in the laboratory frame by elliptical polarization of the laser pulse, from which field-induced momentum shifts to the emergent electron can be assigned to a temporal delay on the basis of the known oscillation of the field vector” (Eckle , 2008).

Also in EPR experiment elapsed time for quantum entanglement is zero. EPR does not happen in space and time, EPR happens in space only. Here, physical space in which particles exist is being considered as direct information medium between entangled quanta (Fiscaletti, 2008). 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” (Gerhard, 1994). The excitation probability of B is non-zero because the physical space in which atoms exist is “immediate information medium” of excitation.

The idea of a timeless universe was already discussed by Einstein and Gödel in the second part of last century. In 1949, Gödel postulated a theorem that stated: “In any universe described by the theory of relativity, time cannot exist” (Yourgrau, 2006). In 1908, the English philosopher John McTaggart Ellis said "It will be convenient to begin our enquiry by asking whether anything that is in existent can possess the characteristic of being in time. I shall endeavor to prove that, it cannot" (Sorli, 2005). Mc Taggart is right. Nothing can possess the characteristic of being in time because physical time is run of clocks. Space-time where time is fourth coordinate of space is not fundamental arena of the universe. Universe itself is timeless and time/clock is a measuring device.

Indirect and direct experience

Common scientific experience of material change, that is, motion in timeless universe is indirect through psychological time. Motion - perception - mind processing in a frame of linear time - experience. In common scientific experience, observer is not aware of impact of psychological time on his experience. He experiences motion happening in time, he is not aware that, motion runs in timeless space only and time is his frame of experience. With rising awareness of psychological time observer develops direct experience. He experiences motion as it runs in timeless space Sorli, 2005.

Indirect experience is analytic, direct experience is synthetic. In indirect experience one experiences timeless space as the present moment. In direct experience one experiences timeless space as the eternal present moment. He is aware that eternity is now. He understands that physical events have no duration neuronal dynamics of the brain that creates linear time including. Physical events are timeless. Physical time enters into existence with measurement. This understanding is a bridge between scientific and mystical experience of the universe.

CONCLUSION

Psychological time is a mind frame in which we experience physical events. Physical events run in space only and not in time. Clock/time is a reference system to measure them. Physical time is not part of the space; physical time is run of clocks in space. Space itself is timeless in the sense that, time is not part of the space. Space-time is not fundamental arena of the universe; space-time is merely a mathematical model. Some physical events happen in time t zero, they are immediate.

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