Exploration

Time and its Relationship to Consciousness An Overview

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Abstract

Time is one of the most fascinating and fundamental concepts in human life. Yet the physical meaning of time is far from understood. Subjective experience of time is equally intriguing and mysterious. Time may be considered an illusion according to modern physics, but its psychological impact cannot be denied. This current paper explores the conception of time in many diverse contemporary fields such as physics, psychology, psychoanalysis, phenomenology, and anthropology. Disorders of time perception and neurophysiology of time is discussed. The idea of time as the creation of conscious mind is considered.

Keywords: Time, relationship, consciousness, illusion, mystery, creation.

Introduction

The Oxford English dictionary defines time as: 'the successive states of the universe regarded as a whole in which every state is either before or after every other duration, indefinitely continued existence, the progress of which this is viewed as affecting persons and things' (*Oxford Combined Dictionary*, 1982). As expected this definition sheds little light on the nature of time, but inadvertently makes things more confusing by introducing other concepts such as duration. The human mind has always been fascinated by the mystery of time. Humans have reflected on the nature, origin, and flow of time from antiquity and continue to refine their understanding of time. They have used religion, mythology, philosophy, mathematics, and science to unravel the mysteries of time.

Almost every culture has a myth about the creation and time. In Greek mythology, Chronos is the keeper of time. He comes from nothingness called Chaos, before which time did not exist. He helps avenge his mother Gaia (Earth) from his father Uranus (the Sky) for having her bear too many children. Chronos makes a sickle and cuts off the genitalia of his father when he comes to visit Gaia. This may reflect the pain and suffering human beings have always associated with time. Even though we may feel that we can influence what happens in time, we cannot influence the way that time itself progresses on. As the twelfth century Persian mathematician and poet Omar Khayyam wrote: "The Moving Finger writes: and, having writ, Moves on: nor all thy Piety nor Wit, Shall lure it back to cancel half a Line, Nor all thy Tears washout a Word of it."

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Yet, despite the centrality of time in our life, time may not be a fundamental element of the universe. It appears that time is a way we have learned to organize the universe. As Ernest Mach (1960), the famous Austrian physicist and philosopher put it, "Time is an abstraction at which we arrive by means of the changes of things."

This conception of time may appear surprising and counter-intuitive to everyday life; however, a number of developments in many diverse fields tend to support this conclusion. This paper presents an overview of our changing understanding of time and its implications for mental health and related fields.

Notion of Time in Physics

In his Principia, Newton defined time as "absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration." He further noted "relative, apparent, and common time, is some sensible and external measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year". (Poincare, 1898). Thus, even in classical mechanics, we can only measure the relative time and that only through some measure of change and motion. In fact, it is mathematically possible to derive Newton's laws of motion in a time independent fashion. However, at least theoretically it is possible to have a cosmic time and simultaneity in the universe in the framework of classical physics. In contrast, there is no notion of absolute time in general relativity. In fact, there is no absolute notion. All physical predictions have to be formulated as relations between physical quantities. Herman Minkowsi (1908) famously predicted the destruction of idea of time: "Henceforth, space by itself, and time by itself, is doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality".

This task was taken up by Einstein who abolished any sense of universal time through his theory of general relativity. When his lifelong friend Besso died, Einstein wrote a letter to Besso's family, saying that although Besso had preceded him in death, it was of no consequence,"for men who have knowledge of physics know that the separation between past, present, and future is only an illusion, although a convincing one."

This points towards his idea of time as a "mere illusion" adopted by modern physics. Time becomes even more counter-intuitive in quantum mechanics, where time may simply be indeterminate in the quantum superposition phase events and there is even a possibility that quantum information may be sent "backwards in time", as exemplified by Aharonov's "dual vector" theory (Aharonov & Bohm, 1958). This effect that has been experimentally verified in the the most common case, called Aharonov-Bohm solenoid, that knowledge of the classical electromagnetic field acting *locally* on a particle is not sufficient to predict the quantum-mechanical behavior.

More interestingly, all laws of fundamental physics (i.e., the Dirac equation, Schrödinger's equation, Maxwell's equations, Einstein's field equations of gravity, Feynman diagrams) are time reversible (Barbour, 1999). This is to say that at the most fundamental level, there is no preference for one direction in time (future) over the other

direction (past). Physics provides no objective reason to believe that our present is in any way special, or more real than any other instant of time.

However, at the macro level, the laws of physics, chemistry, and biology are irreversible. This is most clearly exemplified in the second law of thermodynamics that states the levels of entropy (disorder) increase in the universe as a whole. Thus, the arrow of time flows from the direction of less order to more disorder. However, even the second law of thermodynamic does not always guarantee a progression from the past to future. If we look closely, it is the entropy of any closed system (and the whole universe can be considered a closed system) that increases in the direction of disorder *on average*. For a single system, the entropy can either increase or decrease, thus the orientation of time is not absolute and for small systems (such as neuro-chemical processes) it may become nebulous and difficult to resolve.

In quantum mechanics, if we take the universe as a whole then the progression of its wave function (containing all information about the geometry and matter content of the universe) can be represented by Wheeler-de Witt equation. It is quite perplexing to note that Wheeler-de Witt equation is necessarily time independent (de Witt, 1967). This has led prominent physicists (such as Julian Barbour and Carlo Rovelli) to conclude that time is an illusion and only emerges as a convenient tool of organization at a secondary level. Surprisingly this conclusion harkens back to similar insights gained from a number of other fields.

Notion of Time in Psychoanalysis

Freud emphasized the timelessness of unconscious processes. He showed how unconscious ignores time and temporal progression. For example, in dreams and fantasy where past, present, and future are united in one representation, he showed that certain aspects of psychopathology are also essentially atemporal. In a note added in 1907 to *The Psychopathology of Everyday Life* (1901), concerning the indestructibility of memory traces, Freud wrote that "the unconscious is completely atemporal." In his essay on the metapsychology of the unconscious, he further noted that the processes of the unconscious system are “timeless, i.e. they are not ordered temporally, are not altered by the passage of time; they have no reference to time at all.”

Yet Freud struggled to reconcile his notion of unconscious time with his Kantian and Newtonian view of the psyche. He wrote, "If the philosophers maintain that the concepts of time and space are the necessary forms of our thinking, forethought tells us that the individual masters the world by means of two systems, one of which functions only in terms of time and the other only in terms of space." He believed that temporal dimension is accessible to us only as a function of acts of consciousness. Since these acts in turn depend on rapid, periodic, and discontinuous impulses from the unconscious-preconscious system, Freud believed that perception of time itself is discontinuous. He wrote, “I further had a suspicion that this discontinuous method of functioning of the system lies at the bottom of the origin of the concept of time” (Freud, 1925).

Time in Anthropology

Time is considered relative in anthropology in the tradition of Durkheim. Durkheim attempted a sociological explanation of all fundamental categories of human thought, especially the central concepts of time and space. He claimed that these concepts are social creations not merely transmitted by society. He pointed out that the social organization of the primitive community is the model for the primitive's spatial organization of his surrounding world. Similarly, temporal divisions into days, weeks, months, and years correspond to periodical recurrences of rites, feasts, and ceremonies. He wrote (1915): "A calendar expresses the rhythm of the collective activities, while at the same time its function is to assure their regularities."

Perception of time differs across cultures. In the Judeo-Christian culture time is perceived as having a 'linear' form (i.e., past–present–future). We believe that the past is 'behind us', the future is 'in front us', and the present time is 'where we are now'. This concept of time is based on the notion that time is linear and unidirectional. As Geertz (1973) pointed out, our awareness of ourselves and others as growing, developing and ageing beings across the life span is a major source of our perception of time as linear in nature.

Other cultures do not perceive time as a linear and uniform phenomenon and their time calendars consist of multiple and simultaneously existing time categories. These categories may include 'practical time', 'social time', 'religious time', etc. Many indigenous cultures do not perceive time as linear and describe it as having a 'circular' or 'cyclic' form. Time is perceived as 'static' and the individual person is believed to be 'in the centre of time' (i.e., surrounded by concentric 'time circles'). Life events are placed in time along and across the 'time circles' according to their relative importance to the individual and his or her respective community. For example, more important events are placed closer to the individual and are perceived as being closer in time; unimportant or irrelevant are placed in peripheral time circles, although they may have happened more recently according to linear concept time.

In a study of concept of time in aboriginal Australians, Janca and Bullen (2003) showed that the Aboriginal view of time differs from the Judeo-Christian linear approach in a number of ways. For Aboriginal people, time is multidimensional and can be described "as a pond you can swim through – up, down, around." In the aboriginal concept of time, it could not be viewed as purely functional groups of seconds, minutes and hours. Aboriginal people saw time as "being around you at every moment. You can't pull time apart or separate it". This conception of time is decidedly at odds with the psychological arrow of time that is considered to be a universal human perception.

Phenomenology of Time

In 1927, Heidegger published his critically important *Being and Time*, in which he attempted to use the phenomenological method to interpret the meaning of human existence (Clark, 2001). Of special interest was his emphasis on the way that past, present, and future aspects coexist and interpenetrate. This theory offered an alternative to the scientific conception of time as a serial order of three phases of past, present, and future, each of which can be isolated from another, and all of which are merely arbitrary

linguistic notations for qualitatively similar segments of a continuous series of measurable bits.

Husserl refined this notion of phenomenological time further. Using his phenomenological methods, Husserl analyzed time in his *Lectures on the Phenomenology of Internal Time Consciousness* (1928/1964). Husserl distinguishes between objective time in the world, inner time of experience, and a deeper consciousness of inner time. He argued that the deep time consciousness permits experience to have a temporal character, and provides the ultimate context for the identity of the ego as a temporally extended being. He used the perception of music as an example in his investigation. Though there are multiple disjointed notes in a piece of music, our mind perceives them as a smooth progression. If we were to become aware of all the notes at once, it would be a cacophony and not a symphony. Similarly, we organize separable units of experiential entities in the continuous modalities of past, present, and future.

Merleau-Ponty (in Matthews, 2002) sets aside the conception of a 'chronometric' time. He traces time to memory or rather forgetting of the memory. Using the Heraclitus metaphor that one cannot step in the same river twice, he envisioned time as a river but this river is not coming from the past, passing through the present, and going to the future. Instead the river is static but we are moving in it. He explains that his apparent flow of time is a product of our "surreptitiously putting into the river a witness of its course". It is only by considering ourselves as separate and distinct from the rest of the universe, that we perceive time as changing. In other words, we forget to place ourselves and our connections into the picture. Thus, objective time itself may be explained by the subjective experience of time.

Neurophysiology of Time Perception

Unlike for senses of sight, sound, touch and smell, there are no sensory organs to perceive duration. How then are intervals, durations, and sequences coded in the brain? Despite its importance to behavioral sciences, the neural bases of time perception remain a mystery.

Much of what we know about time perception in the brain emerges from psychophysical experiments. One class of studies involves ways in which time perception distorts: for example, during brief, dangerous events, such as car accidents and robberies, many people report that events pass in slow motion as if time slowed down. Other studies have been able to quantify distorted time judgments during rapid eye movements (Eagleman, 2005; Morrone et al., 2005) or after adaptation to flickering or moving stimulation (Kanai & Verstraten, 2005).

Several empirical studies have related disorders of temporal experience to abnormal psychological functioning in schizophrenia, depression and anxiety. Unspecified breakdown in the 'biological clock' has been proposed as a mechanism for disordered time perception (Prabhu et al., 1969).

In a series of experiments done since 1950s, Libet (e.g., 1979) was able to demonstrate a "backward causation" in the brain. Libet found that the awareness of the decision of a motor action in his study subjects came about 200 ms before the motor action had started as evidenced by EEG readings. Thus it appears that in the brain there may be a mechanism to transfer the information "backwards in time," so that we act first but later on may retroactively "decide on the action."

Conclusions: Consciousness and Time

Consciousness like time is difficult to define. What St. Augustine remarked about time can be equally true of consciousness, that when no one asked him, he knew what time was; however when someone asked him, he did not (in Smart, 1972). One of the key features of consciousness is what seems to be temporal synchrony — in contrast to the idea that our conscious perceptions are non-synchronized (Dennett, 1991). In fact at any given time nervous system is bombarded by a wide variety of visual, auditory and tactile input. What we perceive as the external reality is in fact the organization and interpretation of this sensory data and is one of the fundamental aspects of consciousness. As Julian Barbour has argued time may be a collage of haphazardly arranged moments whose continuity is an illusion of memory. Thus, it seems that time is a creation of consciousness.

Henri Bergson attributed time to the innermost dimension of consciousness. Andrei Linde used the insight by Kluza and Klein about the possibility of large extra dimensions to develop a theory of consciousness, according to this view consciousness has a special extra dimension or "brane" in the super-string theory, thus the ordinary space time becomes a part of the "hyperspace" organized by consciousness (Smythies, 2003).

Similar ideas are expounded by Penrose and Hameroff. In their Orchestrated Objective Reduction (Orch-OR) model, Hameroff (1996) conceptualizes consciousness as successsive quantum superposition of the tubulin protein conformations in the brain. He proposes that with each conscious moment, "a new organization of Planck scale geometry is selected irreversibly". This leads to apparent illusion of time. Thus without consciousness, there would be no time.

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