WHAT IS TIME?

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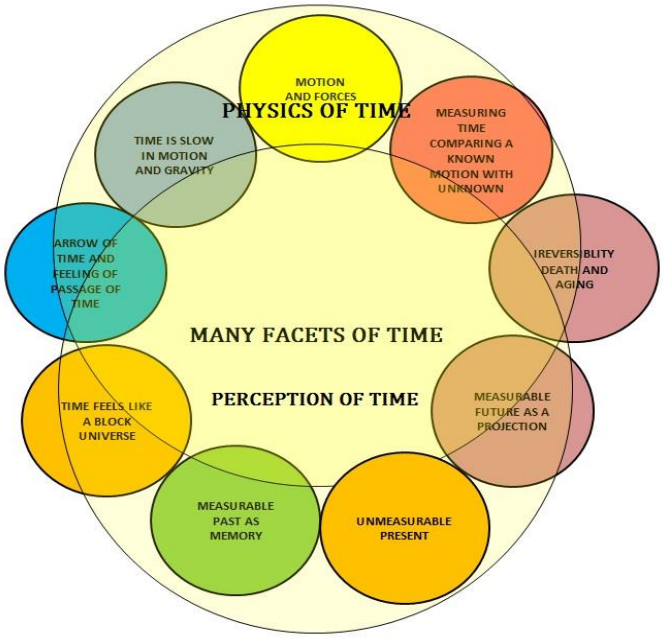

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There are many approaches toward understanding the phenomenon of time. We perceive time as past present and future. In physics time plays a major role in measurement of motion and forces. Einstein's relativity introduced the concept of slowing of time in motion and gravity.

WHAT ARE WE REALLY MEASURING?

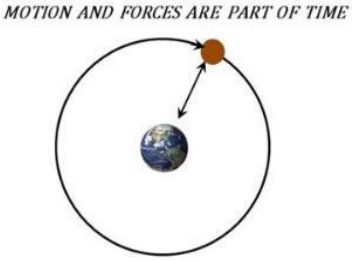
One of the earliest devices to measure time was the sundial which used suns motion as a standard of measurement for time. The use of units like seconds and minutes which are radial angle measurements in geometry point toward the original connection of time measurements to radial motion of astronomical objects across the sky. Once we started using accurate time keeping watches, clocks and digital devices capable of measuring time independent of the celestial connection time developed a life of its own. When we measure the speed of a car, we are just comparing its motion to the motion of the hands of the clock and also indirectly to the fractional motion of sun across the sky. We seem to be measuring speed with something abstract called time; in reality we are just comparing a known motion (of the sun) with an unknown motion of the car. Time is a way to compare or describe different kinds of motions like speed of light, how fast heart beats or how frequently earth spins around its axis. But these processes could be compared directly without making reference to time. Time may have no

independent existence it may be just a common unit of motion making the world that is filled with motion easier to describe.

TIME MOTION AND FORCES

Time is a real phenomenon a continuous change through which we live. Time becomes evident through motion. The cycles of sunrise sunsets, night and day, changing seasons, the movement of the celestial bodies are all indicative of continuous change. The aging process is a reminder that molecular motion and interactions are also at work and are a part of time. Time also involves presence of motion of particles like photon and the motion at the atomic level.

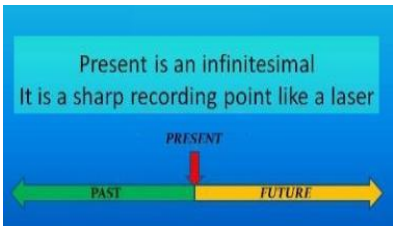
An important aspect of time that is commonly ignored is that forces also act in time.



Imagine two objects one moving in orbit around the other in space. Now suppose from our distant observation point of a fixed time we observe time to get slower in the area where these two objects are moving. We expect to see slower motion? We also should observe proportionally weaker (gravitational) force; otherwise the objects will get pulled together. If we observed faster time, we expect to see faster motion and stronger forces to keep the objects from flying apart. While with zero time motion will freeze and force will become zero. The increase or decrease in strength of forces is only in relation to our fixed time from where we are making the observation. From the point of view (time) of the orbiting objects neither motion nor force has changed. As this thought experiment also can be extended to particles held together by electromagnetic forces we can say that **time involves both motion and forces.**

PERCEPTION OF TIME: PAST PRESENT AND FUTURE

We perceive time as past present and future. **We relate events to places as well as time; this gives us a feeling that time is more like a place and gives support to the block universe view of time.** Present is the most real perception of time however almost all of what we perceive as the present is already past. The present is a fleeting moment; whatever is happening now (present) is confined to an infinitesimally narrow point on the time line which is being encroached upon by what we think of as the past and the future.



Present resembles the sharp point of a recording laser or needle; it may be the mental awareness of recording of memory as it is being inscribed into our brain. A person who goes to an event but falls asleep would have no recollection of it as if the event did not exist in his past. Unless we are consciously aware of an event it does not seem to enter our past memory. Unlike the present the past and future are measurable durations of time. Past historical events, a meeting, or a wedding reception, are all measurable durations or extensions in time, just like a recorded material on tape. **This similarity suggests that past is just a recorded memory, while future can be compared to an unrecorded tape.**

Historical events have in them the same time characteristic as stories that are just creations of human imagination. Both contain in them the time concepts of earlier, the later, the past the present and the future; **this again suggests that past really is similar to memory of events.** Future appears to be a projection created by our past experiences stored in our memory. **The fact that the present which gives us the most real feel of time cannot be measured while the inaccessible past and future can be measured as durations may suggests that the way we perceive time is an illusion.**

TIME AS A BLOCK UNIVERSE

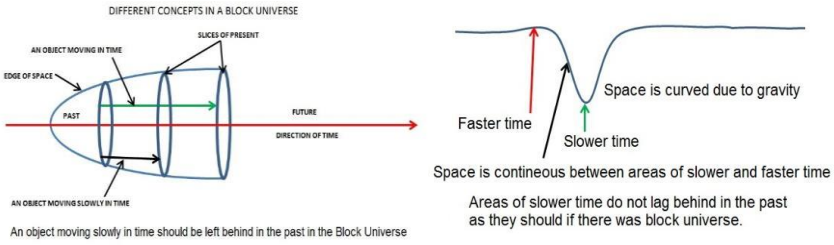
"People like us who believe in physics know that the distinction between the past,
the present and the future is only a stubbornly persistent illusion" Albert Einstein

Every event in time has a place like feeling to it, giving support to the block universe view of time in which time is fixed and laid out like a time-scape. In the block universe past, present and future exist together superimposed in different dimensions. This view of time suggests that dinosaurs are still alive and roaming the earth in other time dimensions; so are multiple copies of us and the whole universe. This view is reinforced by Einstein's General Relativity (GR) in which time extends as the fourth dimension from the past to the future. Lack of simultaneity in Einstein's SR and an interpretation of the Lorentz transformation equation also promote this view to explain the Andromeda paradox as an alternative reality existing in a different time dimension.

Time in the block universe is laid out as time-scape similar to landscape; future and past already exists and there is difficulty with the concept of free will. Even in the smallest duration of time in the block universe there should be infinite number of copies of everything including the whole universe. Block universe concept leads to some problems and paradoxes. It raises more questions and provides few answers. How do we explain the origin of universe as all parts of the block universe exist all the time? If there is a big bang in block universe then even now it exists. If time-scape is already laid out then what causes our consciousness to move through it and why we cannot willfully move it anywhere anytime?

If concept of block universe is correct then there should exist in time future civilizations millions or billions of years more technologically advanced then us. At least some of them should be capable of time travel. We should have seen some evidence for that, unless there is some law of the universe which prohibits time travel. Inherent to time travel are the time travel paradoxes including the grandfather paradox in which a person travels to the past and kills his grandfather thereby changing the future so that the time traveler would not exist and thus not travel to the past to kill his grandfather.

SLOWING TIME IN A BLOCK UNIVERSE



Theory of Relativity predicts slowing of time with motion and gravity. These predictions have been confirmed in particle accelerators as well as gravity experiments. Twin paradox discussions may have served as a distraction from obvious question that arises; if there is a block universe why particles and masses with slower time do not disappear into the past? In gravitational fields space is clearly continuous between areas of slower and faster time. Black holes with their intense gravity that bring time to a screeching halt do not disappear from our present into the past. Slowing of time without sliding into the past or the future suggests that time is a process and not a dimension. This may be a significant point against the block universe view of time when taken together with other aspects of time described above.

MOTION FORCES AND ARROW OF TIME

Arrow requires two points in time that can exist only in the block universe. Arrow assumes that the two points' between past present or future exist, it also assumes that time only involves motion. Presence of forces as a part of time changes this equation as it provides the necessary gradient for the direction in time. There is also a statistical touch to this argument; smashing a glass with a hammer means application of force at one point while to assemble it back in reverse would require coordinated application of multiple tiny forces in a reverse and continuous manner which is statistically unlikely. Similarly throwing a stone into a pond creates ripples which then travel to the edge of the pond. To reverse this would require simultaneous application of multiple tiny forces at the edge of the pond to produce multiple synchronized waves moving backward to the area of splash where the stone pushed up by the ground at the bottom of the pond will be waiting to be thrown out into the hand of the thrower; a statistical impossibility.

Time presents to us in numerous ways which possibly creates difficulty in understanding this phenomenon. We are immersed in time yet we do not fully understand it. We know that time is closely linked to motion as well as forces. Theory of relativity introduced the concept of slowing of time with motion and gravity. This breakthrough could have led to further progress in understanding of time and possibly the cause of time however almost 100 years have passed without substantial progress. ISST could possibly taking a lead in solving the riddle of time by encouraging ideas that are not necessarily mainstream.