

Human's Delusion of Time

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Abstract- Time intrigued humankind for thousands of years. From the beginning of its consciousness, mankind has some "idea", "feeling" or "vision" of Time.

Something ever happens around a man. The Sun rises and falls to/from the horizon. The Moon moves through the stars. The rivers run to the oceans, and a falling leaf followed a river stream to disappear forever; and even human lives follow the flow of Time to be vanished from the memories of the next generations.

Gradually for thousands of years humankind comes back again and again to the concept of Time in a desperate attempt to find the answer on the most fundamental question: what is time? Many other questions related to the concept of time have a strong connection to that question.

This work is dedicated to finding the right answer on that question and digs deeper in some aspects of Z-Theory published recently. Hence the investigation begins in the mist of first steps of Earth's civilizations their believe systems and theology.

Index Terms- Philosophy; Time; Physics; Delusion; Innate idea; Humankind; Z-Theory.

I. INTRODUCTION

From its childhood humankind has an interest in number of things which they believed to be real. Those were basic properties of the world. In the Age of the Prehistoric gods, mankind made a connection between each observable phenomena and some god who was responsible for a number of events.

Ancient civilizations of Greece and Rome had a lot of gods. Each of them had his own power and used it by his/her wish. They ever appeared in legends as entities that looked like humans with excellent physical and mental condition. Their behavior looked like behavior of humans. For example, many of them got angry in case of abuse or disobedience from the other gods. They felt in love with each other and grew their children as a new generation of the gods. Humans did similar things creating families and growing their children.

Each god had his/her personal responsibility for some events and ruled human lives that way. For example, Zeus was worshiped as the Chief god for the other gods. He had an incredible ability to throw lightning from the Sky to the Earth to condemn the humans or punish them for disobedience. Poseidon was a god of the sea, and he was a god of water. He has a symbol of his power – the Trident that he ever holds in his hand. Many other gods were worshiped in Ancient Greece and Rome and among them was one single god with unique duty who cares of Time. That was *Chronos*. He was usually portrayed through an old, wise man with a long, grey beard. That depiction coincides with human imagination about the passage of Time. They believed that wisdom comes mostly to men with a grey beard.

II. ANCIENT PEOPLE AND THEIR IMAGINATION OF TIME

This example shows that. Human's vision of Time has deep roots in human philosophy and theology. Even Ancient people saw that, something changes in their everyday life. Something *was done* yesterday something *has to be done* today, and something *will be done* tomorrow. Language, as well as the human mind, possessed categories of the past, present and future. Whole life of the ancient people was divided on some periods as days, months and years. Some days were dedicated for work, and the other days were dedicated to rest or celebration of holidays in honor of the gods. A *calendar* was invented in ancient time.

"Greek calendar is any of a variety of *dating systems* used by the several city-states in the time of classical Greece and differing in the names of their months and in times of beginning the year. Each of these calendars attempted to combine in a single system the lunar year of 12 cycles of phases of the moon, totaling about 354 days, and the solar year of about 365 days. Generally, three extra months were intercalated in every period of eight solar years. This practice, which was adequate to keep the calendar roughly in step with the seasons, seems to have been in force as early as the *8th century BC*. Months, each of which contained either 30 or 29 days, began with the new moon. The Greek calendar that has been most studied, the Athenian, customarily began its year with the first new moon after the *summer solstice*"¹

That ancient Greece calendar incorporated few key features. Those are notions of a year, a month and a day. Each notion associated with the calendar has perfect relation to a celestial body and its observable behavior. Obviously, ancient people were able to use only observation with a naked eye, and used only easily observable properties of the celestial bodies to keep their calendar in some *synchronization* with celestial events and seasons of the Earth.

Moreover, we have to remember that. According cosmology of ancient Greek the Earth was the motionless center of the Universe. That point of view was not under question for an exceptionally long time. Same point of view permitted two main celestial bodies rotating around the Earth. Those were the Sun and the Moon. Duration of one complete revolution of the Sun around the statically located Earth appeared for ancient people as a day. That was a fundamental property of the Heavens. Hence duration of revolution of any other celestial body around the Earth they understood in connection with duration of a day. In other words, *any other duration* was comparable with duration of one complete revolution of the Sun around the Earth.

Even today we can see result of that ancient people point of view. Their calendar consisted 365 days in one solar year. Hence *duration* of one year was 365 times greater than the *duration* of a day. Each month consisted 30 or 29 days and shows that *duration*

¹ **Greek calendar.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

of a month was 29 or 30 times greater than the *duration* of a day. Consequently *each period* of calendar's circle can be shown as the number of days as soon as the sum of *duration* of those days becomes equal for the *duration* of any given circle of a celestial event.

That method had one serious problem. Visible periods of celestial bodies revolutions around the Earth are not exactly match *summarizing duration* of days. Hence, whole method has imbedded *precision problem*. That problem requires additional activity from humans to adjust the calendar (from time to time) and put into consideration additional periods with more or less *additional durations* to keep that calendar usable and suitable for the seasons.

Invention of calendar followed one more practical reason. That was idea of unification of relation between days. Notion of a day has not any controversy, but a relationship between days has such controversy in notions as "yesterday" and "tomorrow". Unlike the notion of "today", notions of "yesterday" and "tomorrow" have relative meaning because they point ever to the relationship between days. Hence present day is ever referred to as "today", but following question arises as soon as we describe a notion of "today". What is tomorrow? It ever seems as hallucination because "tomorrow" becomes "today" each day. They should ask, "Are we living in a yesterday's tomorrow or we living in tomorrow's yesterday???!?"

Calendar has an answer on such questions and many other questions become answerable by means of calendar application. We can make easily imagination of the following situation in Ancient Greece. A young athlete from Athens goes to his teacher and asks him easy question "What day is today?" The old-aged man with a long beard made his response to the younger one. "Today is the fifth day of the Ianuários²". The young athlete was satisfied with that answer because he knows that today is the fifth day of the Ianuários. Hence yesterday *was* the fourth day of the Ianuários and tomorrow *will be* sixth day of the Ianuários.

Using that way each day with an appropriate number in calendar possessed *unique* relation to *any other day*. In that case, only number of current day becomes significant because knowledge of that number and name of the current month gave the possibility for people to make any calculation in number of days for or after any other *date*. Calculation of current day number, as well as examination of location of the celestial bodies responsible for calendar, became the responsibility of the calendar keepers. Usually, in ancient societies, only high priests were able to make calculations of days for calendar. They were also responsible for the declaration of right day for any celebration of each god and days for launch of significant activity of the community (harvesting for example).

Hence, any activity of humans to maintain calendar needs artificial process of calculation. Easy observable events of the nearest celestial bodies (the Sun and the Moon) provide information for such calculations. They used the easiest method of calculation to maintain calendar - *summarizing of natural numbers*. As a result, a calendar never used any fractional number (*even today*).

From the one hand, that happened because mathematics of ancient time was unable to make any deal with *fractional*

numbers. From the other hand, human society was unable to understand *fractional* relation between durations of celestial processes. For example, statement about duration of the year in fractional number of days looked strange to any ancient society (*as well as to a modern society*). That way led to fractional days and stood in contradiction with whole mathematics of natural numbers. Hence a calendar was created as a calculation system that was based on natural numbers and used celestial events as a start points for any calculation circle. Those calculations included *duration* of three basic circles as day, month and year. Obviously intimate connection between calendar and mathematics gave way for calendar creation *only after the invention of mathematics*.

That strategy was successful, because numbers gave way to make a mark on each day, and subsequently separated references from any given day to any other day. Thus, notion of date was invented as unique description of any given day in terms related to the nearest celestial event and subsequent calculation of additional duration. That duration appears as summarizing duration of the most noticeable circle of visible revolution of the Sun around the Earth. I mention here *Ancient point of view* on celestial mechanics. According to that point of view the Sun makes revolution around the Earth.

As any other physical process that process of revolution has some duration. Summarizing of that duration gives the possibility to compare calculation result (*that was duration itself of course*) with duration of any other event in the Heavens. Each key event that had a place in the Heavens stops circle of old calculation and starts new circle of calculation immediately. For example, event of New Moon appearance triggered new *circle of day calculation* that belong to a *new month (new moon circle)*. That system of observations and calculations gave way to use a notion of date as an unique combination of numbers that linked to each day. Hence mankind possessed a system to describe countless number of upcoming days in a comparatively easy and convenient way.

Each day in a year possessed its unique *identification* as a combination of a day number in a month and name of a month. Everything went well until the end of a year. A celestial event that triggers new circle of *day calculation* (usually summer solstice) puts the definition of a new year under question. In case of the moon, its phase changes continuously for each month and clearly visible for any observer. New Moon naturally separates behavior of that celestial body from wane to wax, but such a thing does not happen with a year. As soon as it was discovered, following question have raised immediately. What does happen with a year after the summer solstice? Does it wane as the Moon or wax again or simply disappear? Does a *New Year* carry any *unique property* that distinguish it from the *Old Year*? What is that property? Obviously celestial observation in Ancient times was unable to answer such fundamental question.

However, they have found *odd solution* for all those matters that was able to answer all questions about upcoming celestial years. They simply spread calculation for years themselves. In that case, years become calculable. As well as each day has its unique number in the calculation of a month, each year possess its unique number and become calculable (*distinguishable*) from any other year. Such separation could not be reached by *physical observation* and was replaced by *logical extension* of known calculation method.

² January

Hence notion of date was established as the unique combination of numbers. Number of days shows the *duration* between appearance of new moon and beginning of any given day. Name (number) of the month shows the *duration* in moon circles that have passed between the last summer solstice and the last appearance of New Moon, but number or year ever shows *only abstract number* that they used to distinguish one year from another one. It can be explained easily. There is not *any possible way* (even for today), to conduct *any physical experiment* that shows *the number of current year!*

There was not also (*and is not yet*) any noticeable celestial event (phenomenon) that can be used as point of origin for calculation of years. That incomparability between calculation of days and years caused a serious problem for anybody who ever try to create a calendar. Subsequently one more *odd solution* was developed for such matter. As soon as ancient people had strong imagination of the gods, those gods become responsible for zero point of years calculation. Hence *zero point* for beginning of years was associated with one old well known event described in legends or myths. Thus in Greek tradition god *Chronos* became responsible for a number of years between the current year and beginning of years as well as for continuous changes of days, months and years.

Different events in different countries were used as marks of *first years*. As a result, each calendar system has its own number of years between the current year and first one. For example, "Roman republican calendar was a dating system that evolved in Rome prior to the Christian era. *According to legend*, Romulus, the founder of Rome, instituted the calendar in about 738 BC"³ Hence current year according to the calendar has the number of 2750 (2012+738).

That way helped ancient people to use calendar with a deep connection between their live, myths and legends. From their point of view, there was something divine in passing days, months and years. There was nothing that can be hold instantly between days and months. Each season had magical power to rise vegetable or to blow winter winds. Each year has something beyond understanding of their mind *something* rules seasons and organizes each year the same way. Summer never appeared *before* spring and winter appeared only *after* autumn. That circle was so strong that people believe in divine power that kept that circle of years as well as a large circle of their lives. Events in a live of a man had same order beginning from the day of his/her born. Childhood was ever before adult years, and after that was senility, and once again senility and mature wisdom were never before childhood.

Obviously, young persons of ancient people asked the following question for their preceptors. What is responsible for inevitable circle of years and has enough power to rule the lives of people from their childhood to senility? The ancient sages have found an answer on that question that was comparable with an ancient point of view. According to their philosophy and believe system, that was divine power of the *Chronos*. That god rules everything and gives perfect place for each event in world order. That order exists eternally as well as power of any god.

Hence *Chronos*⁴ is responsible for each change in the world. It is divine power of that god to support each circle of changes and repeat them again and again in the endless circle of renovation.

One of those circles was the most noticeable *day circle* of change. That circle changed day and night. Same circle had divine connection to a year circle by relative duration of day and night during a year, but full duration of day and night was ever equal to the same value. Obviously that aspect of divine power intrigued ancient people. How it is possible to *Chronos* to keep that relationship between duration of day and night at each day of the year? That aspect seemed as the best indication of *Chronos'* divine power.

In ancient times, after many centuries from the beginning of astronomical observations, people had necessity to use something with minor duration than the duration of minimal observable period of celestial events - lesser than the duration of *a solar day*. Presumably it was the reason for developing a better condition for trade and human activity during a day. Calendar had enough power to organize human activity during a year, but it was useless to make a deal with any event that has duration *lesser than a day*.

That task had a serious problem. Ancient people have not any *suitable celestial event* to create connection between duration of that event and duration of a day. The only one possible way to reach a solution of the problem was that. They try to use some circle of well known *recurrent* celestial event and divides its duration to number of *stages*. The easiest way to achieve that goal was a creation of correlation between duration of solar day and duration of a new *artificial recurrent circle* of events. It was necessary because that event *must* happen again and again during a day and *must* be observable as a recurrent process. However, as soon as that event occurs again and again during a day, it must be *calculable*. Only some *set* of events happened from sunrise to *present stage of a day* gives information about current stage of duration of a given solar day.

Finally, their used duration of solar day and divided it to number of stages. Hence each stage possessed its number to be *distinguishable* from the other stages (they were numbered), and a link was established between duration of celestial day and duration of new *artificially made process*. That link involved relation between location of the Sun and location of shadow of an object. Almost every object can be used to indicate location of the Sun during whole celestial day because of unique connection between location of the Sun in the sky and casting a shadow of any object. Thus, motion of one celestial object in the sky became traceable by humans everywhere they like. Moreover, any devices that use that way stay *ever synchronized* to each other and have same readings ever *without any additional efforts* from the humans. Device that uses that principle of operation was called *sundial*.

"... early device was the *hemispherical sundial*, or *hemicycle*, attributed to the *Greek astronomer Aristarchus of Samos* about 280 BC. Made of stone or wood, the instrument consisted of a cubical block into which a hemispherical opening was cut; to this block a pointer or style was fixed with one end at the centre of the hemispherical space. The path traveled by the tip of the pointer's shadow during the day was, approximately, a

³ **Roman republican calendar.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

⁴ chrono- form relating to time. Origin: from Greek khronos 'time'

circular arc. The length and position of the arc varied according to the seasons, so an appropriate number of arcs was inscribed on the internal surface of the hemisphere. Each arc was divided into 12 *equal divisions*, and each day, reckoned from *sunrise to sunset*, therefore had 12 equal intervals, or “**hours**.” Because the length of the day varied according to the season, these hours likewise varied in length from season to season and even from day to day and were consequently known as *seasonal hours*. Aristarchus's sundial was widely used for *many centuries* and, according to the Arab astronomer al-Battānī (c. AD 858–929), was still in use in Muslim countries during the 10th century. The Babylonian astronomer Berosus (fl. c. 290 BC) invented a variant of this sundial by cutting away the part of the spherical surface south of the circular arc traced by the shadow tip on the longest day of the year.”⁵

Hence, from ancient Greeks' point of view Chronos by himself gives them right indication of *sundial* each day and was responsible to manage changes of sundial readings according to the current moment of a day. Looking back to an example with dialogue between an athlete and his master we can image next step in their conversation.

The wise bearded old-aged man a preceptor of the young athlete asked a question to him. “Aeolos⁶, what does Chronos *tell us* now?” Aeolos understood his preceptor and ran down the street from the gymnasium to the downtown where a large seasonal sundial was installed for general use. As soon as Aeolos reached the sundial he looked at its indication. The pointer cast shadow just to the seventh line drawn on the internal surface of the hemisphere according to the curve of current day. The athlete ran back to the gymnasium and told to his preceptor, “Master, there are seven hours left from the beginning of the day!” The old-aged man nodded. He understood that the young athletes have two extra hours to complete their exercises for today. As soon as Chronos tells the hour number nine all exercises in the gymnasium must be finished, and all athletes go to their homes until tomorrow. They have three extra hours to the time of sunset to complete their tasks at home until the Sun hides itself behind the horizon.

That way made no problem for ancient people in their understanding of Chronos. It was a god among many other gods worshiped in ancient Greece and Rome. Hence readings of a sundial had divine aspect for all ancient people and showed a direct link to the god who was responsible for every change in the world. In other words, question about the origin of Chronos made no sense for ancient mind because the question about the origin of a god was unrelated to the point of view that dominated in the ancient world.

III. MATTER OF WORDS

New people with a new mind have appeared in Europe after few centuries. They look toward ancient world as a source of some ideas that were useful even after many years of staying in limbo. Many words with Greece origin were again in use as well as ideas that they represent. Here, European civilization met one

powerful *mind-shift* that subsequently produced enormous impact on humankind in all following generations. It was a matter of words.

As soon as Greek words become in use again in new alphabets they make a connection with meaning of the other words. Many of them were translated and mistranslated according to different circumstances and purpose or usage of a given word. Word Chronos suffered the same fate of some misunderstanding and misusing. According contemporary sources we have the following information related to that word and number of the other words that are extremely close in the inscription to the first one.

Preposition chrono- has the following definition “chrono- [ˈkrɒnəʊ] form relating to *time* chronometry. Origin: from Greek *khronos* ‘time’”⁷.

“Anachronism is (from Greek *ana*, “back,” and *chronos*, “time”), neglect or falsification, intentional or not, of chronological relation. It is most frequently found in works of imagination that rest on a historical basis, in which appear details borrowed from a later age; *e.g.*, a clock in William Shakespeare's *Julius Caesar*, an attendant to the Pharaoh shod in tennis shoes in Cecil B. deMille's *The Ten Commandments*. Anachronisms originate in disregard of the different modes of life and thought that characterize different periods or in ignorance of the facts of history.”⁸

That way creates two different type of link to the same word with the same meaning. First link mentioned word *khronos* with “k” letter as its first character. Second link mentioned word *chronos* with “c” letter as its first character. One might ask “What is a matter with those inscriptions?” Everything should be well, but there is one serious problem. There were two totally different gods that can be easily mistaken by their names especially in *pronunciation*. Those are gods with names *chronos* and *kronos*!

“Cronus *also spelled Cronos, or Kronos* was, in ancient Greek religion, male deity who was worshiped by the pre-Hellenic population of Greece but probably was not widely worshiped by the Greeks themselves; he was later identified with the Roman god *Saturn*. Cronus' functions were connected with *agriculture*; in Attica his festival, the *Kronia*, *celebrated the harvest and resembled the Saturnalia*. In art he was depicted as an old man holding an implement, probably originally a sickle but interpreted as a *harpē*, or curved sword.

“In Greek mythology Cronus was the son of Uranus (Heaven) and Gaea (Earth), being the youngest of the 12 Titans. On the advice of his mother he castrated his father with a *harpē*, thus separating Heaven from Earth. He now became the king of the Titans, and took for his consort his sister Rhea; she bore by him Hestia, Demeter, Hera, Hades, and Poseidon, all of whom he swallowed because his own parents had warned that he would be overthrown by his own child. When Zeus was born, however, Rhea hid him in Crete and tricked Cronus into swallowing a stone instead. Zeus grew up, forced Cronus to disgorge his brothers and sisters, waged war on Cronus, and was victorious. After his defeat by Zeus, Cronus became, according to different

⁵ **sundial**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

⁶ That name means “quick-moving”

⁷ Source [4]

⁸ **anachronism**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

versions of his story, either a prisoner in Tartarus or king of the Golden Age.”⁹

Hence Cronos as well as Chronos was connected to a celestial process with one year duration. His (that god’s) relationship with agriculture gives us direct link between responsibility of that god and duration of a year because vegetation itself follows one year circle. For ancient people, it was the strongest circle of life in its native implementation. As it mentioned in the citation, “he was later identified with the Roman god *Saturn*”. Who was that god?

“**Saturn** Latin *Saturnus*, in Roman religion, the god of sowing or seed. The Romans equated him with the Greek agricultural deity Cronus. The remains of Saturn’s temple at Rome, eight columns of the pronaos (porch), still dominate the west end of the Forum at the foot of the Clivus Capitolinus. It served as the treasury (*aerarium Saturni*) of the Roman state. Saturn’s cult partner was the obscure goddess Lua, whose name is connected with *lues* (plague, or destruction); but he was also associated with Ops, another obscure goddess (perhaps of the earth’s fertility), the cult partner of Consus, probably a god of the storage bin.

“Saturn’s great festival, the *Saturnalia*, became the most popular of Roman festivals, and its influence is still felt in the celebration of Christmas and the Western world’s New Year. The *Saturnalia* was originally celebrated on December 17, but it was later extended to seven days. It was the merriest festival of the year: all work and business were suspended; slaves were given temporary freedom to say and to do what they liked; certain moral restrictions were eased; and presents were freely exchanged. The weekday Saturday (Latin *Saturni dies*) was named for Saturn.”¹⁰

Obviously Saturn had a link to the same circle of one year duration as well as his predecessor Cronus. Even modern day events based on one year circle are still valuable for modern people. Moreover, name of a week day, Saturday, means an event that happens ones in duration of each seven days - *duration of a week*.

As it clearly seen from the explanation and citations given above, all of the mentioned gods had *direct connections* to the duration of celestial phenomena as a day and a year (in general). Hence we have the following sequence of links to the duration of celestial events associated with a year: *Chronos, Cronus, Cronos, Kronos, khronos, Saturnus and Saturn*.

IV. NOTION OF TIME IN THE MIDDLE AGES

In the Middle Ages, such diversity of names related to the same property of celestial events (*duration*) needed creation of one common link that can be able to encompass all meanings of its predecessors. Moreover, it must be cleared from connection with ancient gods because such a link was undesirable for European population in Middle Ages. That happened because different God was worshiped in Middle Ages. Any attempt to

worship or even mention any name of another god (old, ancient etc.) became to *inexpiable sin* punishable by Catholic Church.

Notion of **Time** was born that way. It had a link to a recurrent processes and their duration but was free from any link to ancient gods and ancient theology. “*Time* Origin: Old English *tīma*, of *Germanic origin*; related to *tide*, which it *superseded* in *temporal senses*. The earliest of the current verb senses (dating from late Middle English) is ‘do (something) at a particular moment’”¹¹

In other words, earliest meaning of that word has reference to some action at the right moment. For example, they can say, “Hey! It is Time! (or it is high Tide!)”. So it is a right moment to set a sail and go out from the harbor because water is high and it is easy for a ship to do any maneuvers inside a harbor! Hence word “Time” have possessed its temporal senses *artificially* much later that the original meaning of that word, but the relationship between Chronos and Time still exist because both words have the link to recurrent physical processes. For instance, we can see following relation. Chronos was responsible for the duration of day circle in Ancient tradition. Time in its original meaning has relation for tide. What is tide?

“Tide is any of the cyclic deformations of one astronomical body caused by *the gravitational forces* exerted by others. The most familiar are the periodic variations in sea level on the Earth that correspond to changes in the relative positions of the Moon and the Sun.

“At the surface of the Earth the gravitational force of the Moon is about 2.2 times greater than that of the Sun. The tide-producing action of the Moon arises from the variations in its gravitational field over the surface of the Earth as compared with its strength at the Earth’s centre. The effect is that the water tends to *accumulate* on the parts of the Earth’s surface directly toward and directly opposite the Moon and to be *depleted* elsewhere. The regions of accumulation move over the surface as the position of the Moon varies relative to the Earth, mainly because of the Earth’s rotation but also because of the Moon’s orbital motion around the Earth. *There are approximately two high and two low tides per day at any given place*, but they occur at times that change from day to day; the average interval between consecutive high tides is 12 hours 25 minutes. The effect of the Sun is similar and additive to that of the Moon. Consequently, the tides of largest range or amplitude (spring tides) occur at New Moon, when the Moon and the Sun are in the same direction, and at Full Moon, when they are in opposite directions; the tides of smallest range (neap tides) occur at intermediate phases of the Moon.”¹²

Hence, “there are approximately two high and two low tides per day at any given place”. Therefore, sum of *duration* of two tides is approximately equal to the *duration* of one day. In other words, key circle of duration associated with *Time* and *Chronos* (duration of a day) has relation to each other (rate) as ½. I mean that *both circles* keep their *comparability* by *duration* because any *duration* is ever comparable with any other *duration* as a quantity that has *the same unit of measurement*. For instance,

⁹ Cronus. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

¹⁰ Saturn. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

¹¹ Source [4]

¹² tide. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

mass is ever comparable with mass length is comparable with length and so on.

V. GALILEO'S INFLUENCE

There was one man who lived and worked in Middle Ages but unlike the other people had an interest in the field of natural philosophy. His name was **Galileo Galilei**. According to the modern source we have the following information about that man.

“**Galileo** (born Feb. 15, 1564, Pisa [Italy], died Jan. 8, 1642, Arcetri, near Florence) *in full Galileo Galilei*, was Italian natural philosopher, astronomer, and mathematician who made *fundamental contributions* to the sciences of motion, astronomy, and strength of materials and to the development of *the scientific method*. His formulation of (circular) inertia, the law of falling bodies, and parabolic trajectories marked the beginning of a fundamental change in *the study of motion*. His insistence that the book of nature was written in the language of mathematics changed natural philosophy from a verbal, qualitative account to a *mathematical* one in which *experimentation* became a recognized method for discovering the *facts of nature*. Finally, his discoveries with the telescope revolutionized astronomy and paved the way for the acceptance of *the Copernican heliocentric system*, but his advocacy of that system eventually resulted in an *Inquisition process against him*.”¹³

The most famous experiment conducted by that person was an experiment with falling bodies. He used *clepsydra* to determine *duration* of each process of body fall. To make his point of view comparable with the experimentation, he used a device (*clepsydra*) to make measurement of duration of a body fall process. “**Clepsydra** also called **water clock** is an ancient device for measuring time by the gradual flow of water. One form, used by the North American Indians and some African peoples, consisted of a small boat or floating vessel that shipped water through a hole until it sank. In another form, the vessel was filled with water that was allowed to escape through a hole, and the time was read from graduated lines on the interior measuring the level of the remaining water. It may have been an invention of the Chaldeans of ancient Babylonia; specimens from Egypt date from the 14th century BC. The Romans invented a clepsydra consisting of a cylinder into which water dripped from a reservoir; a float provided readings against a scale on the cylinder wall. Clepsydres were used for many purposes, including timing the speeches of orators; as late as the 16th century, *Galileo* used a *mercury clepsydra* to time his experimental falling bodies.”¹⁴

Firs sentence of the citation mentioned above shows relation between the number of different notions: *time, water, clock, clepsydra, time measurement, flow of water*. What is the hash? That sentence makes perfect sense about how deep is going the *modern mess* in any attempt to explain anything that has reference to Time, but it is possible to remove all that trouble

using explanation given above about an attitude that rose steadily between the human mind and the surrounding world.

First of all, we need to understand that, clepsydra was a *physical device* that was used to indicate the *duration* of one physical process – gradually *flow of water* or running *water drops* from a reservoir. That process involved physical interaction between *the gravitational field* of the Earth and water remain in the reservoir. There is not *any other physical activity* involved in that process of interaction. It is well known that theory of gravitation was invented later and was described first hand only by Sir Isaac Newton (born December 25, 1642 [January 4, 1643, New Style], Woolsthorpe, Lincolnshire, England; died March 20 [March 31], 1727, London)¹⁵. Hence, Galileo died Jan. 8, 1642 and Sir Isaac Newton was born January 4, 1643 (about one year later). Obviously, Galileo was unable to perceive any concept of Newtonian gravitation. As a result, cause for water drops from the clepsydra's reservoir *was unknown for him*.

He has one more problem in his experiments. Sundials seemed useless for his research, because, unlike other people, that man liked to have measurements with duration significantly lesser than the duration of a day and even lesser than the duration of an hour. At the beginning of 17th century, such a device was still inaccessible. Hence, he used the only one kind of device that was relevant to his experiments and was able to demonstrate a physical process with *tiny duration* relatively to the *duration* of an hour. Moreover, he used clepsydra to determine the duration of a process of body fall without correlation between indication of the clepsydra and the city sundial (or any other sundial that was available for him). I mean that he made estimation only between *duration* of process of body fall and *duration* of physical process of clepsydra (that was connected to fall of the mercury drops). In other words, there was not any relationship between his experiments and location (or motion) of the Sun in the sky. More than that, there was not any *physical connection* between marks on a clepsydra's body and any phase of his experiment (the start and the stop moments of body fall).

Observing falling bodies, Galileo needed some units that were relevant to his experiments. He could use unit of length to determine the height of the tower that he used, but he needed one more unit that was comparable to the *duration* of body fall. The only acceptable tool for such measurement was a device that was able to make some events with regular intervals. They knew that device. It was sundial. The device produces a number of events during a day. Each event rises as soon as the pointer's shadow meets each hour mark, but Galileo's experiments were so fast that a sundial was useless for them. Hence, he had the only one way to achieve his goal by using different device that was able to generate events more frequently. Only clepsydra was able to do that.

The device can be used two ways. First way includes using of clepsydra with marks on its body (reservoir). As soon as a man opens a clepsydra, liquid begins to run out, and level of liquid falls down slowly. Obviously that process starts as soon as the measuring process begins. As soon as the measuring process was completed, a person stops liquid leaking from the clepsydra

¹³ **Galileo**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

¹⁴ **clepsydra**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

¹⁵ **Newton, Sir Isaac**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

and difference between first level and the last level of liquid shows *duration of fluid flow*.

That is the main aspect of understanding of that process. A clepsydra was able to determine only *duration of its own physical process* of fluid flow. ***That devise was not ever able to do direct measurement of duration of any other physical process.*** Thus, any of *so called measurement* should be done *only artificially* by synchronizing of moments of start and stop leaking, with first and the end point of other measuring physical process, *by human hands*.

Therefore, Galileo created method of measurement in which *human activity was involved*. It was unique method of measurement because other methods need not such activity from humans. For instance, a measurement of mass involves only *direct physical interaction* between an object with given property (mass) and *physical mechanism of physical measuring device*. In that case, a man needs only to put an object on a mass measuring device (on a scale) and see indication of that device. Moreover, indication of a measuring device keeps *constantly* as long as mass of the object *does not change*. In other words, a physical measuring device *makes physical interaction with a measuring property* of an object.

It was possible to use mass of leaking liquid to make estimation of rate of *duration*. They can make measurement of mass of some liquid that got out from a clepsydra in two experiments. Rate on those masses gives precise information about rate of duration of two processes. That is an *alternative way* of using clepsydra. For example, in case of Galileo's experiments two clepsydras produce out same mass of liquid for the *duration* of falling of two different objects (bodies) because both objects fall from same altitude and have the same acceleration equal to g .

Hence Galileo was responsible for implementation of measurement of *duration* in physical experiments, but that way had one serious problem. Galileo produced no explanation for correlation between *duration* of physical processes and the notion of *Time*. From the one hand, he used a clepsydra to determine the duration of fluid flow from that device. From the other hand, he makes estimation of duration of body fall. After each observation, he made a comparison between *duration* of body fall and *duration* of liquid flow from a clepsydra, but he *was unable to explain* which material property is responsible for interconnection between *durations* of two different physical processes. There is not *any physical interaction* between those processes in any case, but Galileo need something that meets his point of view on *experimentation*.

As a result, he needed some property that he cannot see or describe or put into experiment, but that property must be responsible for interaction between *durations* of two independent physical processes to make them comparable by their *durations*. He used the notion of Time as a link to that property. From his point of view, that property makes a connection between any duration of any physical process by means of some *invisible interaction*, making them comparable to each other, but that property itself remains hidden for humans and stays *undetectable* for any direct measurement. Thus, *greatest delusion* of physics was created at its first step. Saying generally it was *first misstep*.

Hence that person (as well as any other of his followers) was unable to conduct any experiment that supports the *idea of*

physical reality of Time. That way stays in disagreement with *his own statement* - "*experimentation* became a recognized method for discovering the *facts of nature*" (see above). In other words, he never conducted an experiment that shows *physical reality of Time*. It was a first step that brought word (Time) with questionable meaning in physics. Moreover, that word had not *any relation* to physical reality from the launch of *its usage in physics*.

As it mentioned above clepsydra was used widely in Middle Ages. Clepsydra appears as a devise with a constant flow of liquid or drops of liquid from the clepsydra's reservoir. Such devices were used for many years across Europe, and eventually flow of liquid from clepsydra was associated with some sort of "magical" property that all such devices share. As it mentioned above Galileo shared that *delusion* too. Any number of equally built clepsydras ever shows matching rate of flow from a device and the same rate of water level drop in a reservoir. There was not any analogue in the natural world for such process. Any clepsydra shows same rate of operation in a whole day and night at the top and the bottom of a tower inside and outside of a building and so on. Moreover, as soon as a clepsydra was put in a closed room under the ground, it shows the same *rate of operation* that was similar to any other identical clepsydra that remains on the surface of the Earth. Obviously such behavior of clepsydras seemed as some sort of *magic* for a people who lived in Middle Ages. What is that thing that keeps readings of an operating clepsydra ever equal to readings of any other twin operating clepsydra? That question overwhelmed those people.

Despite of such strangeness, operation of clepsydra is extremely easy. It uses only interaction between liquid in its reservoir and *gravitational field* of the Earth. Readings of two identical clepsydras were ever equal to each other because a clepsydra was ever used in an exceedingly thin layer relatively to the radius of the planet. That is modern point of view of course. For people living in the Middle Ages, the Earth was flat, and gravitation does not exist. Hence they have no chance to get a right answer on the question about the operation of clepsydra.

However, they produced some explanation for apparent facts. They believe that there is something (deep cause that cannot be reasonable for the human mind) that exists everywhere and causes the same readings for any of identically built clepsydras despite their location. In other words, all clepsydras were connected to each other by means of some sort of *interaction* that is *unnoticeable for a man*. That thing has the ability to penetrate everything without any trace of penetration and appears everywhere even in a closed room. It ever changes and flows, and that property causes change of reading of any clepsydra at the same rate. Constant flow of liquid from a clepsydra and flow of that thing looked for those people as *inevitable prove* for uniform flow of *that thing*. In other words, constant flow of fluid from a clepsydra *follows the movement of that thing*. As it can be easily understood "that thing" possessed unique *name* lately for short link to its distinguishing characteristic (*constant flow*). That name was TIME.

That was basis of *mind-shift* that I mentioned above. For the Ancient people, word "*Chronos*" has linked to a God. As a result, question about the real nature of Chronos had decided answer. *Chronos is one of the gods*, but word "*Time*" with its meaning originated in Middle Ages possessed *pointless link*. It was a link

to something that people were unable to understand. Hence they could not make *any definition for meaning of that word*. That is perfect evidence of their *incapability* to understand the meaning of that word. It was the greatest *failure* of the human mind.

That pointless connection with twisted meaning was inherited by science from Galileo's work. His example of calculation, where Time appears alongside with the *other physical properties of an objects*, leads to the foundation of mathematics that uses Time as one of *real property of the objects (processes)* and subsequently as *physical property of the Universe*. Obviously Galileo did not see any difference in the estimation of Time and any other property of an object in his experiments. He could determine the mass by a scale, volume by measurement using unit of length and subsequent calculation. Hence estimation of Time was natural to him. He had a device (clepsydra) that "tells" him information about the *passage of time* even if he had no idea about *the nature of that property*.

Personally, measurement of a property was *more notable* for Galileo than *knowledge* about the origin of measuring property. Moreover, he made a mistake taking all measurable properties as physical (real) properties of the objects involved to his experiments. Many years later Sir Isaac Newton used the same way in his famous work. He gave mathematical description of *gravitation*, but he never gives description or explanation of *physical origin* of that property. Hence *physical origin of gravitation* stays under question for many decades (*for today*).

That *delusion of Time* was lately imbedded in the body of growing science. Connection between measurement and physical property of an object become so strong that nobody was able to overcome that link. Obviously measurement has a strong relationship with mathematics because the calculation is impossible without measurement. That was one more aspect of science invented by Galileo. As soon as measurement system was involved in natural philosophy mathematical description of physical processes became possible. Hence measurement and calculation in science were spread widely following decades. And the most fundamental relation between research and calculation were realized in work named "*Philosophiae Naturalis Principia Mathematica*".¹⁶ Newton's *Philosophiae Naturalis Principia Mathematica (Mathematical Principles of Natural Philosophy)*, 1687, was one of the most important single works in the history of modern science.¹⁶ Obviously it supports Galileo's point of view on measurement of Time and calculation of physical processes that have reference to Time, but even Sir Isaac Newton as well as his predecessor Galileo never gave us *any satisfactory definition of Time!*

Gradually clepsydras become widely used in the Middle Ages. People try to make that device suitable for a wide usage. For example, they were able to create a big clepsydra to make it possible to indicate the passage of hours, but a big clepsydra had one big problem. As soon as they make big clepsydra, they try to use it, but before any usage of that device, it was necessary to calibrate clepsydra according to indication of some other device that shows the *duration* of some other process that was independent of readings of big clepsydra.

A sundial was the only one device that was able to produce such readings, but as it mentioned above a sundial was able to indicate only *seasonal hours*. (i.e. hours with different duration at different seasons). Moreover, *duration* of sun day has difference according to geographical latitude. For instance, duration of a day in North Italy is lesser in winter months and longer in summer months comparatively to the duration of same day in South Italy. As a result, a big clepsydra that was calibrated in Naples at summer months has incorrect indication in winter months. Moreover, a perfect clepsydra produced in *Venice* had false indication as soon as it was transported to *Reggio di Calabria (South Italy)*. A clepsydra becomes impractical with such behavior. It can not be used for measurement of *duration* that is longer than few hours.

Moreover, variable duration of an hour according indication of *seasonal hours* caused some difficulty too, and the worst thing was that sundials were unable to indicate hours at night. All those things led to the necessity of the invention of usable method to indicate hours with equal duration during the day and night. That was human decision that has the only one reason - human comfort and usable readings of that device at any moment of a day or night.

Ancient sundials indicate hours with *different* duration. According to their indication, each summer hour is longer than winter hour. I suppose that Galileo used clepsydra because of that inconsistency of sundial. If he used a sundial (or any other device based on indication of a sundial) each experiment with the *same duration* had *lesser measuring duration* in summer and *longer measuring duration* in winter. Obviously Galileo was unable to produce any accurate calculation for any experiment using such estimation of *duration*, but in common sense of the other people difference between duration of summer hours and winter hours raises no question because winter days have lesser duration than summer days. It was *obvious observation* for them.

To make correct estimation of his experiments he has to break the relationship between *variable duration* of sun hour and *constant duration* of some other process. Duration of that process must be independent of motion of the sun in the sky. And he found such process. That process appears as a result of interaction between gravity and liquid. Same process was measurable even at night because gravitational interaction between liquid and the Earth exist eternally. As soon as it was done, *logical link* between the notion of *Time* and *location of the Sun* in the sky was broken. Hence word "Time" and its implications become *more useless* than ever.

VI. LATE MIDDLE AGES

In late Middle Ages humankind continued experiments with mechanical devices. Some experiments were aimed to create a device that was able to provide mechanical process with *constant duration*. It was a next step in organized human life, but the creation of the device had one big problem. As soon as any device begins to count constant duration of any physical process, its indications become usable for everyday life. However, indication of that device becomes contrary to indication of *ancient seasonal hours* because indication of seasonal hours depends on duration of a *sun day*. Hence indications of any device that uses *constant duration process* and *seasonal hours*

¹⁶ Newton, Sir Isaac. (2008). Encyclopædia Britannica. *Encyclopædia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

were ever different. As soon as they use mechanical devices with *constant duration process* to estimation of *seasonal* “hours”, they have the following question. **How it is possible to make unification between readings of two devices that use different principle of action to make “right” estimation of “hours”?**

That was not easy question because humankind never faced such problem ever before. To find an answer on that question, they need to make some technology that was able to do unification between process with *ever changing duration* and mechanical process with *constant duration*. Moreover, mechanical device is operational at night. Hence many questions arise for “night hours”. What indication of “hours” must be at night? How many hours can be at night? Is the duration of “night hour” equal to the duration of “day hour”? (and so on...)

To produce mechanical device with *constant duration process* usable for indication of “hours” each hour must have the same duration as any other hour. Hence *duration* of a day was incomparable to estimation of that *duration*. They need to have different process in nature that has constant duration at day and night. That process was successfully found. It was the *duration* between any given noon and next noon. Despite of different angle between the horizon and the sun at noon of different days, *duration* between two subsequent noons is *ever constant*. Hence humankind turns again to celestial processes to create estimation of constant duration processes.

Moreover, celestial processes show one more useful aspect. Despite of different duration of days across a year, there are two specific days that have equal duration of day and night. Those are equinoxes. “Equinox is either of the two moments in the year when the Sun is exactly above the equator and day and night are of equal length; also, either of the two points in the sky where the ecliptic (the Sun’s annual pathway) and the celestial equator intersect. The vernal equinox, marking the beginning of spring in the Northern Hemisphere, occurs about *March 21*, when the Sun moves north across the celestial equator. The autumnal equinox falls about *September 23*, as the Sun crosses the celestial equator going south”¹⁷

If the duration of a day equal to the duration of a night at each equinox, then same number of “hours” can be used to estimation of *duration* for both processes. Moreover, *duration* of each hour becomes equal to the *duration* of any other hour at each equinox even for *seasonal hours*. Those combinations of durations become appropriate to be comparable with a device with *constant duration of mechanical process*. Hence *each mechanical device* can be calibrated with duration of *one “hour”* or *seasonal hour at the day of any equinox*. In that case, indication of mechanical device *must be adjusted* so as *duration* of twelve “hours” indication of that device becomes equal to the *duration* of a whole day of an equinox measured by *seasonal hours*. As a result, indication of another twelve “hours” becomes indication of *night “hours”* for that mechanical device and full *duration* between two subsequent noons becomes *twenty four hour duration*. Thus, standard duration and method of calculation for all hours during a day and a night was invented.

Everything went well, but that method of estimation and calculation for hours caused one more question. Ancient seasonal

hours begin its indication of hours as soon as the Sun rises above the horizon. Unlike seasonal hours, a device with *constant duration of mechanical process* begins its indication from noon. Hence variable difference in few hours appears between indication of *seasonal hours* and *a mechanical device*. They need to make one more step to find a solution of that matter, because mechanical device based on mechanical process with constant duration and was able to work at night it seems more useful than ancient seasonal hours. Thus, *mechanical device had priority*.

They had decision (*it was human discussion*) to begin calculation of “hours” each day from its noon. It was a *revolutionary* idea that stays in contrary with any previous human experience, to begin calculation of day hours from sunrise. To keep that system useful, they need to make estimation of noon (that is an event appears as soon as the sun crosses the celestial meridian). That procedure needs specific device and activity from the humans - *it was not as easy as estimation of beginning of sunrise*. Moreover, it led to recalibration of all sundials to make their indication equal to indication of mechanical devices. It was true innovation. However, new idea was widely accepted and gave way to the creation of clocks.

VII. MECHANICAL ESCAPEMENT CLOCKS

“The origin of the all-mechanical *escapement* clock is *unknown*; the first such devices may have been invented and used in monasteries to toll a bell that called the monks to prayers. The first mechanical clocks to which clear references exist were large, *weight-driven* machines fitted into towers and known today as *turret clocks*. These early devices struck only the *hours* and *did not have hands or a dial*.”

“The oldest surviving clock in England is that at *Salisbury Cathedral*, which dates from 1386. A clock erected at Rouen, France, in 1389 is still extant, and one built for *Wells Cathedral* in England is preserved in the *Science Museum* in London. The Salisbury clock strikes the hours, and those of Rouen and Wells also have *mechanisms* for chiming at the quarter hour. These clocks are large, iron-framed structures driven by *falling weights* attached to a cord wrapped around a drum and regulated by a mechanism known as a verge (or *crown wheel*) escapement. Their errors probably were as large as a half hour per day. The first domestic clocks were smaller wall-mounted versions of these large public clocks. They appeared late in the *14th century*, and few examples have survived; most of them, extremely austere in design, had no cases or means of protection from dust.”¹⁸

It was a very long way to make mechanical device suitable for such purpose. People needed to reject prevailing point of view that was in power for few centuries, and all those efforts were fruitless from a *physical point of view*. Humankind still uses identical *delusion* that was created by Galileo. That delusion includes the idea of *physical reality of Time* despite their manmade multiple reforms of devices that show the *duration* of different physical processes. Once again measurement device used interaction between *force of gravity* and *physical process*

¹⁷ **equinox.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

¹⁸ **clock.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

caused by that interaction (the clocks were driven by *falling weights*, see above). That principle shows some equality in operation of a clepsydra and a clock. In case of clepsydra it uses *interaction* between the gravitation field of the Earth and liquid in its reservoir. In case of early built mechanical clocks, they used *interaction with the same force* but used *weights instead of liquid*.

As it shown above those devices were regulated by *crown wheels*. Those wheels make physical processes with more or less constant circle of *duration*. Hence it was appropriate to create a device that was able to make an *indication* of more or less regular physical process. Despite of *obvious relationship* between “indication” of such clocks and their *internal recurrent mechanical process* (rotation of *crown wheel*) humans still believed in “*magical Time*” that causes indication of a clock and its ability to determine not only duration of internal mechanical process but direct measure of *Time itself*. It was immense *delusion*.

However, it was quite acceptable for the general population of 14th century, because according to the divine doctrine, the God have separated the light from darkness and created day and night. So the *duration* of the day as well as *duration* of the night had reference to his divine power. As a result any attempt to say anything against divine nature of day or night was prohibited by Catholic Church that was in full power that time.

“About 1450, clockmakers working *probably* in southern Germany or northern Italy began to make small clocks driven by a spring. These were the first portable timepieces, representing an important landmark in horology. The time-telling dials of these clocks usually had an hour hand only (minute hands did not generally appear until the 1650s) and were exposed to the air; there was normally no form of cover such as a glass until the 17th century, though the mechanism was enclosed, and the cases were made of brass.

“About 1581 *Galileo* noticed the characteristic timekeeping property of the pendulum. The Dutch astronomer and physicist *Christiaan Huygens* was responsible for the practical application of the pendulum as a *time controller* in clocks from 1656 onward. Huygens's invention brought about a great increase in the importance and extent of clock making. Clocks, weight-driven and with short pendulums, were encased in wood and made to hang on the wall, but these new eight-day wall clocks had very heavy weights, and many fell off weak plaster walls and were destroyed. The next step was to extend the case to the floor, and the *grandfather clock* was born. In 1670 the long, or seconds, pendulum was introduced by English clock makers with the anchor escapement.”¹⁹

Wait a minute! What is a *time controller* (see above)? What is it? How is it possible to make anything that controls *Time itself*?! That is another difficulty or disagreement. Any *mechanical controller* that can be implemented in a *mechanical device* is able only to control *mechanical processes* inside that device and **nothing more**! Hence, so called *time controller* is nothing more than a controlling device that creates mechanical process with more or less constant duration. This example clearly shows that *humans ever mistake any recurrent physical process*

with constant duration as Time itself. If they have a real time controller they can stop that controller and hold *every moving object* in its place like the Sun in the some point of the Sky, water stream in a river, birds flying in the sky and etc.

Obviously that is impossible. Hence so called *time controller* is nothing more than a *mechanical clock controller* that controls *mechanical operation* of a *mechanical clock*. The *duration* of any physical process is comparable to the *duration* of any other physical processes. As a result, we have plenty of them to make any possible physical device that calculates and indicates the duration of its *internal recurrent physical process*. In case of easiest mechanical clock its internal mechanism does that calculation mechanically. In other words it recalculate the number of revolution of a *crown wheel* to number of revolution of the hour hand or does any other activity like making sound and etc.

As it shown above, pendulum is another mechanical device that produces physical process with constant duration. The device can be useful to create another type of clock. Hence that is the *endless process of creation* of different kind of devices that are able to create and count their internal recurrent physical processes with constant duration (or near constant duration). That is cause and reason for great diversity of modern clocks from easiest pendulum clock to electronic and atomic clocks. However, in each clock counting mechanism of any kind keeps counting of *duration* of internal physical process. Hence so called “*timekeeping property*” means only *duration* property of *constant recurrent physical process* of any kind.

VIII. INNATE IDEA OF TIME

Here, appears dissection between *duration* as physical property of any *process* and abstract concept of Time as one of *innate idea*. “**Innate idea** in philosophy, an idea *allegedly inborn in the human mind*, as contrasted with those *received or compiled from experience*. The doctrine that at least certain ideas (e.g., those of God, infinity, substance) must be innate, because *no satisfactory empirical origin* of them could be conceived, flourished in the 17th century and found in *René Descartes* its most prominent exponent. The theory took many forms: some held that a newborn child has an explicit awareness of such ideas; others, more commonly, maintained that innate ideas have some *implicit form*, either as a tendency or as a *dormant capacity for their formulation*, which in either case would require favourable experiential conditions for their development.

“John Locke's vigorous criticism later in the century was directed against innate principles (supposed axioms, both theoretical and practical, implanted in the mind by nature) and the innate ideas claimed as the terms of the principles. But Locke's empiricism had difficulty with certain key concepts, such as substance, “which we neither have nor *can have by sensation or reflection*,” and cause, about which he largely anticipated David Hume's difficulties in the 18th century. Locke seems to have shared some of the assumptions of his opponents (e.g., that *if an idea is innate it cannot be wrong*) and to have sensed that the issue is one of logic (of the status of *a priori propositions*) and not of genetic psychology. Completing this distinction, the 18th-century philosopher *Immanuel Kant* replaced the doctrine of innate ideas with questions about *a priori concepts*, which he

¹⁹ **clock**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

characterized in terms not of their origin but of their *necessity as conditions of human experience of an objective world*. In the 20th century, Noam Chomsky argued the necessity for postulating innate ideas to explain the possibility of language.”²⁰

Summarizing quotation mentioned above we have some number of characteristics of any *innate idea*. It is ever “*allegedly inborn in the human mind*”, “*contrasted from experience*”; It has not any “*satisfactory empirical origin*”; It has “*dormant capacity for its formulation*”; It “*cannot be wrong*”.

All of those aspects we can see in the idea of *Time*. That idea meets *all requirements of innate idea* because even modern sources have not suitable definition of *Time*. For example, “*Time appears to be more puzzling than space because it seems to flow or pass or else people seem to advance through it*. But the passage or advance seems to be *unintelligible*. The question of how many seconds per second time flows (or one advances through it) is obviously an *absurd* one, for it suggests that the flow or advance comprises a rate of change with respect to something else—to a sort of *hypertime*. But if this *hypertime* itself flows, then a *hyper-hypertime is required*, and so on, *ad infinitum*. Again, if the world is thought of as spread out in space–time, it might be asked whether human consciousness advances up a *timelike* direction of this world and, if so, how fast; whether future events pop into existence as the “now” reaches them or are there all along; and how such changes in space–time can be represented, since time is already within the picture.”²¹

Such point of view produces *delusion* of reality of *Time*. Ancient people had their own way to hide delusion of innate ideas and make them compatible with the physical world. They created *depiction of innate ideas*. The best example of that way was a depiction of Chronos (the ancient god of *Time*) who “was usually portrayed through an old, wise man with a long, grey beard” (see above). As a result any concern about the nature of *Time* had easiest solution with answer: “Look! This is Chronos he rules the *Time* and he is *Time* itself!”

Until to now we have similar depiction of innate idea of *Time*. The same question is generally answered today the same way: “Look at the Clock. It shows *Time*!” Hence they usually mistake *changing indication* of a clock as a passage of *Time* itself. Moreover, *Time*, as innate idea, *cannot be wrong* (see above). That point of view caused implementation of *Time* in any area on knowledge and science even in physics as a *real property of Universe*.

IX. A DOUBLE DEVICE EXPERIMENT

To eliminate that *delusion*, we should conduct an easy thought experiment²². I call it *a double device experiment*. There are *two thermometers* (marked “A” and “B”) in one water tank filled with some water and *two fully operable clocks* (marked “A” and “B”) with pendulums on the same table. The table is exposed in the open air. A person (the experimenter and

observer) begins the experiment. The person sees indication of both thermometer and writes down their indication in the log. Suppose the thermometers show indication of 21 and 21.1 degree of centigrade. Obviously the little difference in their indication is caused by their *precision*.

The person turned his attention for two clocks. Both clocks operate properly and show similar indication eight o'clock precisely. The person writes down indication of both clocks as 8:00 AM. It raises first question here. The clocks have not any indication of noon or midnight. As a result there is not any way to make a decision about 8:00 AM and 8:00 PM by indication of a pendulum clock. Hence the person is unable to have that information by indication of those devices. However, he had the decision of AM. How it was possible? There is the only one way to make such determination. The person *must* look outside to make estimation of Sun location. In case of morning (i.e. the rising Sun) he makes a decision of AM (from the Latin *ante meridiem*, meaning "before midday") according to location of the Sun in the sky (before midday). Hence, estimation of a clock indication needs some extra activity from a person to be “correct”. Moreover, indication itself is not sufficient because any pendulum clock shows same indication *twice a day*. Obviously a person sitting in a room below ground level has no idea about right time because that person is *unable* to determine the location of the Sun in the sky and reach a conclusion about actual part of the day; is it before or after *midday*. Hence indication of a pendulum clock is *incomplete* at least relatively to day and night.

The experiment continues. The person withdraws the thermometer “B” from the water tank and puts it on the table. After 10 minutes of waiting both clocks show 8:10. The person takes indication of both thermometers and writes down that information to the log again. Thermometers “A” and “B” show 21 and 26 degree of centigrade accordingly. Why do two identical devices show different indications? The answer is extremely easy.

Both thermometers (as well as any other number of them) show matching *physical* property of a measuring thing. That is temperature. In case of the first stage of the experiment both thermometers show indication of thermal property of liquid in the same tank. That property has some measurable value as any other *physical* property of each thing. Both thermometers make measurement by means of *physical interaction* between *measuring property* of the water and the *same property* of they own. As a result thermal property of the water causes indication of both thermometers. Same indication of each thermometer (inside level of their precision) is caused by the same value of comparable measuring property of the water in the tank.

As soon as thermometer “B” was withdrawn from the tank physical interaction between the device and measuring property of the water in the tank *was broken* and that thermometer begins to determine property of thin layer of air on the table surface, because of the sun heat that property has a different value and the device immediately begins to change its indication. As soon as thermodynamic equilibrium was established between the thermometer and surrounding air, the device stops to change its indication, and it shows constant value of the measuring physical property.

²⁰ *innate idea*. (2008). Encyclopædia Britannica. *Encyclopædia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

²¹ *time*. (2008). Encyclopædia Britannica. *Encyclopædia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

²² *Gedankenexperiment* in German language

Ten minutes later when the clocks indicate 8:20 the person takes thermometer “B” from the table and puts it back to the water tank. After ten minutes of waiting he writes down information of temperature to the log again. It was 8:30 according indication of both clocks. Thermometers “A” and “B” show temperature of 23 and 23.1 degree of centigrade accordingly. Why the devices changed their indications?

That happened because the sun shining in the sky heats everything on the Earth surface. In case of the tank it warms by the sun rays and increases its temperature. That property changes same property of the water (*temperature*) in the tank, and it begins to increase its temperature too. Both thermometers have interaction with the same property of the water again. As a result both of them have similar indications (in level of their precision) but both indications have some difference from prior indication at 8:00 AM because measuring property has changed. Thermometers, as measuring devices, trace measuring *physical property* perfectly. Moreover, they need not any *additional activity from humans* to show correct indications.

After half-hour waiting the person began the next phase of the experiment. Both clocks show similar indication 9:00. The person understands that indication as 9:00 AM. He stops movement of the clock “B” pendulum. The clock stops its operation, and its indication was frozen at 9:00. What happened? Why does measurement of that device display static information? Does it a “static time” or any other phenomenon of “fixed time”? The person must ask that question because unlike a thermometer a clock is *stoppable*.

A thermometer is an *unstoppable* device. Its indications have relation only to *specific physical property* of any measuring thing. Indication of a thermometer changes following variation of that property. Hence a thermometer becomes an *unstoppable device* because it shows indication of measuring property (temperature) *ever* because of *physical interaction* between a device and a *measuring physical property*. As soon as a measuring property (temperature) exists eternally, a thermometer makes its measurement continuously *without* any additional activity *from humans*. Hence, nobody is able to stop operation of a thermometer. The only one possible method for that is *destruction* of the device.

Unlike a thermometer, a clock is a *stoppable* device. What does it mean? Does it possible to a human to *break* interaction between *so called “flow of time”* and a measuring device as a clock? Why does not “*flow of time*” interact with a stopped pendulum clock? Is Time so smart to avoid interaction with a clock in such a condition? How it is possible for Time to identify a stopped clock and avoid interaction with a device in such a condition? Is it smart enough? Obviously that is impossible for any physical property to be “intelligent or smart or avoidable” and etc. For instance, *nothing* that was put in any liquid is able to avoid interaction with temperature (*as physical property*) of that liquid. “Time” looks extremely *doubtful* that way.

The experiment goes further. After waiting for 15 minutes when clock “A” indicates 9:15 the man brings the clock “B” back to operation. He pushed the pendulum, and the arms of the clock run to live again. Everything goes well except of a *little problem*. Indication of clock “B” now shows 15 minutes left from indication of clock “A”. More than that, clock “B” shows no desire to *speed up* its indication to meet indication of clock

“A”. Why does it happen? If “right Time” at the moment of evaluation equals to 9:15, why does clock “B” do nothing to achieve that indication? It is “*right Time*”, and “*a right clock*” “must ever show right Time”! But it does not. *That is the greatest failure of a clock*. Clock “B” has never “right indication” again does not matter how many “time” the observer likes to wait.

The bemused observer starts next phase of the experiment. He stops waving of clock “A” pendulum. To his surprise clock “B” run out and difference between indications of two clocks began to decrease. What did happen? Does “flow of time” forget the existence of clock “A” to “flow” only through clock “B”? Does a jammed pendulum stop moving the clock “through time”? Does it possible to control so called “time flow” and “time itself” by a pendulum of a clock??? Astonished observer falls in the chair next to the table. He was unable to make any agreement with those questions. His mind was helpless to confront such questions.

After quarter an hour, indications of both clocks look similarly to each other. Both devices indicate 9:15. The observer pushed the pendulum of clock “A” and brings it back to operation. Everything looks well, but there is a *small problem* AGAIN. Despite of equal indication of clocks and their synchronous operation, the person understands that both clocks have 15 minutes left *from his imagination* of so called “right moment of Time”. *That is out of physics!* In the field of physics any measuring device indicates the current value or a measuring property (physical property of course). That value cannot be treated in teams of right and wrong *imagination* of an experimenter because each physical experiment must be independent of any *human influence*. For that reason, show of any illusionist is not a *physical experiment*.

Despite of that contradictory, the person waits for noon measuring position of the Sun in the sky by sextant²³ and checks indication of both clocks at noon (maximal right ascension of the Sun). As he suspected both clocks indicate “wrong time” because they indicate 11:45 instead of 12 o’clock. To change indication of both devices and make them comparable to his *imagination* of “the right moment of Time”, “flow of time” and many other ideas from his mind, the person changes indication of both clocks *manually*.

After that procedure, indication of both clocks coincides with the person’s *innate idea* of Time because both devices show 12 o’clock at noon. As any other innate idea “Time” cannot be wrong from the experimenter’s point of view. If any device contradict his point of view the device has “wrong indication” of absolute and ever right “Time”. Hence indication of that device must be changed *manually*. That is a perfect example of *innate idea* but the person does not realize that and continue comparison between *his imagination* and indication of physical device instead of correlation between indications of two different *physical devices* (disregarding his own imagination).

Double device experiment was finished, but the experimenter has not any idea of his *delusion*. Whole experiment and behavior of any number of clocks shows same answer on the

²³ That is an “Instrument for determining the angle between the horizon and a celestial body such as the Sun” from **sextant**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition*. Chicago: Encyclopædia Britannica.

old question. Nobody and nothing can make any measurement of any property that *never exists in the Universe*. Any number of clocks does not any synchronization to each other by themselves because there is nothing any property that propagates throughout the Universe and can be used to synchronization of any number of clocks (two or more). Unlike clocks, any other measuring device operates by means of *physical interaction* with a given *physical property of a thing* (object, substance, etc.) That interaction cannot be stopped. Moreover, it needs not any additional activity from humans. For instance, idea about using sextant to *improve indication of a thermometer looks odd even for a modern physicist*.

X. THE SOLUTION

Each clock, despite any principle of its operation, uses internal *physical process* and counting mechanism (in modern clocks). That mechanism recalculates duration of internal recurrent physical process of a device to indication of the *same device*. To make an indication of two or more number of clocks equal to each other each of them must have internal recurrent process with the same *duration*.

Otherwise, in case of different duration of that processes, the clocks must have different counting mechanisms to recalculate *duration* of their internal processes to the same *duration* that coincides with duration of some other process or so called “standard process”. Moreover, any clock needs some human activity for its synchronization with a clock that has “correct indication”. That is result of logical outgrowth of *innate idea of Time on indication of a physical device*. Hence so called “synchronization between clocks” means only synchronization between their indications and *human’s idea of absolute and ever correct Time*.

That matter was unknown for ancient people. They used the only one kind of “time displaying” device. It was *sundial*. That device, as described above, has behavior, as a measuring device, equivalent to behavior of thermometer. It needs not any additional activity from humans to keep “correct” indication. It operates ever and has correct indication ever because it uses direct interaction with physical property of *measuring process*. That is location of the Sun in the sky. It was the first idea of *ever correct Time*. Such precision cannot be reached in any other type of “time-indicating” device because all of them need (sooner or later) “*synchronization*” with location of the Sun in the sky!

Moreover, sundial, as well as a thermometer, was *unstoppable* in its operation. As soon as the Sun rises above the horizon a sundial begins its operation and *never stops it* until sunset. More than that, if anyone hides a sundial from the Sun rays by anything and removes that thing later, a sundial comes back to correct operation again as soon as the Sun illuminates a device. Any idea of “adjustment” of sundial indication *looks odd even for an ancient people*.

That ancient *delusion* still roots deep in the human mind and reaches its full prosperity in *time-dependent* core of human philosophy.

Retraction of that delusion from that core makes it *time-independent one*. That new *time-independent core* gives way for a new generation of scientific researches and *time-independent theories*. First step on that way was already done by publication

of Z-Theory²⁴ recent year. That theory uses *time-independent* core to make explanation and calculation for a number of well known facts, phenomena and observations. Many of them become explainable only in a *time-independent way*.

XI. THE ANSWERS

Now it is possible to give answers on some questions that intrigued humankind for centuries.

What is Time?

Logical Definition: Time is a logical link *in human mind* to any physical process that has *observable duration*.

Physical Definition: Time does not exist (and never existed) as a *physical property of the Universe*.

Mathematical Definition: Time means a *rate of durations* between any two *different physical processes*.

Philosophical Definition: Time is ancient *innate idea* of humankind.

Common Definition: Time is a link between indication of a clock and *duration of its own internal recurrent physical process*.

What is “Now”?

“Now” is a point in the Universe from where an observer (object, body, etc.) *makes interaction* with surrounding Universe.

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²⁴ Source [1]