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ABOUT THE STRUCTURE OF GEOGRAPHICAL TIME

SUMMARY. The category of time as an intelligible notion (noumenon) in impermeable hierarchy is under investigation. The following category attributes are distinguished: linear, cyclic and scalar time. Linear time (arrow of time) represents contraposition of order to chaos; that is why time appears when orderliness happens, in causal eventful progression. For tangible objects, having the beginning and the end, “the arrow of time” turns to be a “life cycle”, consisting of a number of specific cycles. There exists in the world an infinity of crossing sequences, which form an event line. Intersections (junctions) make “fabric of time”, which is multidimensional, as in every junction the object appears in various attributes. “Fabric of time” is fixed in virtual inter-temporal space, the coordinates of which are set by “scalar time”, ordinary grades in the standard scalar time scale. Inter-temporal space is a substitute (surrogate) of real geographical space. It contains the components of ideal, astral, motivational scheme of things, as well as tools of inconsistent process synchronization and thus being a powerful means of control. Relativistic characteristics of time measuring scales, time velocity, rhythms and harmonics of geographical systems have been reviewed.

KEY WORDS. Noumenon, cyclic time, scalar time, inter-temporal space, rhythms and harmonics of geographical systems.

The subject matter of the present article is to investigate geographical time perceived as specific for our planet and for the objects located on it. Particularity of the used approach consists in consideration of “time” as of a **noumenon**, i.e. an intelligible notion as contrasted with its manifestations — phenomena and objects available for cognition through experience. Such distinction covers differences of “pure” and “practical” reason, noumenal and phenomenal world views.

Noumena were of the utmost interest in the ancient times and in the earlier period. It is known that Hermes (Thoth) carried on conversations with his own Nous, Plato placed noumena to the “world of ideas”, and Aristotle made a supposition that the truth laid beyond the limits of the nature, which actually laid the foundation for metaphysics. Alexandrian gnostics “handled” noumena, medieval scholastics — “universals”. Finally, I. Kant formulated a transcendental theory on categories, typical of knowledge (conscience) of every person a priori, drawing up his own moral law [1].

For lack of recent studies of noumena, let us turn to the works of **Thoth** (Hermes Trismegistus) which describe the following hierarchy: “Nous. Listen, my son, what God is and what the Universe is. God, Eternity, world, time, becoming. God creates

Eternity, Eternity creates the world, the world creates time, time determines becoming” [2]. The picture of the existing offered to Thoth by Nous is hierarchically organized: every lower notion of the hierarchy is the emanation of the higher notion. In this hierarchy time occupies a relatively low position. It should seem that time is linked with eternity, but it is originated by the world (the matter).

In the theory of Hermes eternity is regarded as the first emanation of God (the Absolute), the foundation of the world (the matter), creating time, and, in its turn, stipulating becoming (progress, life). The main attributes of eternity are complete stationarity, i.e. eternity is not time (anti-time), and perpetual duration. Like complete stationarity, eternity faces the absolute, so the perpetual duration faces the matter. The second attribute allows operating in the sphere of practical reason, and it brings forth “the arrow of time” or **linear time**. The latter is an abstraction of mind, since the linear time is infinite. Hegel considered denial of finitude as “stupid infinity”. “Such infinity is a stupid or negative infinity, since this is nothing else but the denial of the finite, which, however, reoccurs and, therefore, it is not removed; or, in other words such infinity expresses only a must of removal of the finite” [3].

Perpetual duration may be coiled. The eternity locked to a cycle is an attribute of the matter — a permanent **form**. But if the form develops, i.e. graduates, originating a row, a sequence of states, meaning that the cycle is open, it transforms into a **spiral**. The notion of **cyclic** (spiral) time is closer to practical reason than abstract linear time. The form undergoes a chain of cyclic states, each of which has the beginning and the end, but the end of one state is the beginning of another one. Stated differently, time is presented as a sequence of open cycles (states) characterized by the attributes expressed in practical categories. The notion of time as of a sequence of form’s conditions was introduced by Aristotile [4].

The beginning and the end of the form’s existence constitute a **period** of life (a life cycle) identified as becoming. This is the longest possible period for a form, comprising a great number of shorter periods. Each of the shorter periods comprises more periods etc. A concrete period is **now** — a time interval between the past and the future. Our task does not include characterization of a minimum period of “now” usually defined as “**an instant**” (a time quantum), which G. Whitrow focused on [5]. We should only note that “now” may be equal to a period from fractions of seconds to long time intervals. This is a subjective perception of a period variation depending on the position of a perceiving subject.

Another attribute of “now” is a subject’s location in relation to time. A subject always stays in “now” sequentially passing from one period to another one. Environment and “stage settings” change, but “now” does not. It is a point moving along the time helix, where every new instance is a consequence of the previous one enriched with **imprints**. Projection of a “now” state to the future (perspective) is based on the process of becoming in the past (retrospective) and numerous similarities of other homogeneous forms’ becoming. Immanent properties of a subject and external environment “chase” it along quite a definite path (a fate). The logical or causal analysis is a direct consequence of processing information imprints of a sequence.

Each period is a crossing of sequences forming the fabric of time, where a subject has a definite role. For example, throughout the day a student is a son (at home), a passenger (in transport), a student as such (in a classroom), a young man (at a party), and a son again, etc. The crossing sequences marginally depend on him. These sequences are integrated by him to a varying degree. The content of three lectures in biology, physics and geography to be attended at the University is determined by an educational standard, a curriculum and a training program, but not at all by the student's wish. Every period, in which the subject is present "now", has its own (external) rules and standards. It refers to physical entities as well.

Superficially, a sequence is one-dimensional, one-directional and evolutionary. The fabric of time is two-dimensional, and a cycled sequence forms a flat surface, while a helix forms a volume, i.e. it is three-dimensional. Crossings of the sequences (home, office, education, leisure, etc.) should be understood as occurring from different positions, since all of them are present in "now". Moreover, a subject has an option of choice called bifurcation [6], resulting in interchanging of one sequence by another one. It gives an impression of a volume or an inter-temporal space (ITS) poorly relating to a physical space. We are talking of an impression as far as time as a noumenon exists in mind, and perception of ITS as one-, two-, three— or multidimensional depends on the position of the observer.

Scalar time, characterized by a value or a mark on the face of a clock, by a day, a month or a year of the calendar, is the most important attribute of time. Scalar time performs at least two functions including measurements of inter-temporal space and synchronization of processes occurring in it. It organizes ITS. The major tasks of a manager is to set a goal (forecasting), to draw up sequence of activities (planning), to put into place the resources, to incentivize and control the process of implementation. Every task is connected with inter-temporal space.

The goal-setting is based on a wish or a necessity. But it is an astral world derived from the world of Plato's ideas as far as the wishes are reflections of ideas. The ideas are noumenal and one-dimensional, but their emanations (wishes) have attributes able to acquire quite concrete qualitative and quantitative values. They create a striving for an action or a motive, i.e. they transform into energy characteristics. Planning is a means of fulfillment of wishes — a domain of causal analysis, alignment of a sequence of steps (cycles) for achievement of an objective. The amount and quality of engaged resources determines the value of the initial impulse, etc. The environment of inter-temporal space resists because achievement of an objective crosses many other immanent sequences. Contacts may be positive, neutral or negative; they may enrich a subject or take away the energy causing corresponding emotions filling the astral field. In other words, inter-temporal space is a substitute of a real geographical space, in a familiar way replacing it at certain stages of ideas' implementation.

Subjectivity of time is mostly manifested in existence of **proper time** of a subject. A subject (an agent) acts as an active party of interactions, as a bearer of action, in contrast to an object being a target of the subject's thoughts or actions. Naturally, as an active party, the subject organizes the proper inter-temporal space. The "subject —

object” interaction system forms time-related classes of homogenous and non-homogenous contacts.

In homogenous systems time “flows” at similar velocities understood as a number of changes within a life cycle measured on a **standard scalar time scale (SSTS)**. L.N. Gumilev [7] suggested taking into account a number of events within a certain period of time, but events and changes should be in correlation. Every subject of the system is endowed with a certain number of potential changes in accordance with the system’s properties, but only part of the changes actualizes. It depends on specific features of the environment as well as on the condition that some qualitative changes take place by means of other qualities. In other words, the “subject — object” system of interaction is internally non-homogenous. It allows gradations and typologies to the extent of individualization. Individualization is a key term since every object of the system at the same time represents a subject, building its own inter-temporal space. Therefore, for example, for social systems, synchronization is the most important factor of organization. Although, it refers to other homogenous systems as well.

Velocity of changes has a time component. Velocity can be measured in relation to both inter-temporal space and common geographical space. In the first case, the process is mostly immanent; in the second case, it is a realistic actualized action. The influence of the subject’s inner condition on the velocity of processes’ behavior in the inter-temporal space is determined by such characteristics as weight, density, temperature and other, as well as by external parameters connected with the location.

A life cycle of biological objects in the inter-temporal space varies from seconds and minutes with microorganisms to hours and days with insects and to decades with the haematothermal. Direct correlation with weight and lack of correlation with density, close to the density of water, are evident. The range of the core temperature is limited by the temperature of albumin fibrillation on the top, whereas temperature reduction slows down the process until the condition of anabiosis is reached.

To a greater extent, extreme cases of life cycle lengths are observed with objects having both maximum concentration (density) of weight in unit volume, such as nucleons, and with the absence of it (photons). Nucleons “live” almost forever, from the moment of the “Big Bang”, as explained by modern physics. Photons, on the contrary, as energy clusters, bear changeless information represented by a wave of a certain length from the emission source to the target, transforming it as a result of reflection, etc. It is important for us that time in these elementary objects stands practically still; otherwise, the whole physical model of the universe falls in pieces.

Energy is a factor defining temperature of bodies, and, consequently, the velocity of their changes up to phase transitions. Time slows down when approaching the Kelvin zero point and it speeds up when moving away from it. Saturation with energy is an important factor of generation of material forms. “Normal conditions” of generation exist for each form (a combination, in the first place, of temperature and pressure with initial components), giving, in fact, a start to a life cycle. Duration of a life cycle is determined by both immanent properties of an object (a program) and by conditions of the environment. Location is important among the latter.

The most famous example is location of objects near big gravitational masses. The process of a body dropping to a galactic “black hole” is described as something happening with such slowdown of time that reaching of its surface seems a problem. Probably time runs much faster on the periphery of the Milky Way system. Temperature reduction and high linear velocity of peripheral objects resist faster time running. The Solar system keeps an intermediate position in the Galaxy, and its time is probably unique. On the whole, the problem of distribution of time characteristics in different points of the space is not investigated at all, but it is clear that in this respect the space is anisotropic. Thus, it is possible to make a particular conclusion on existence of extraterrestrial civilizations. We do not observe them since we live in different time reference systems.

In the conditions of the Earth, a standard scalar time scale, based on fundamental planetary characteristics, such as the cycle of rotation around own axis and around the sun, is an extremely convenient reference system including such modes as alternation of day and night, seasons, years, etc. They define the **rhythm** of life for different planetary material forms of organic and inorganic origin. Rhythms, peculiar for different forms, may create harmonic (complementary) combinations forming communities (hydrologic, geomorphic, biologic, ethnic, etc.). Harmony means nothing else but commensurability, in the first place, of life rhythms. Therefore, we may note that such sophisticated geographical systems as landscapes, ethnic groups, systems of migration of population and other systems are equipped with in-built clock able to adapt component parts. Thus, we can make a conclusion that emergence of geographical systems is based on rhythms, i.e. matching of frequency responses in harmonic components. Complementary harmonics adapt within a system, other harmonics are rejected by the system, and they are considered as antagonistic, disharmonious, bringing discord and menace to its integrity. A rhythm represents the basis of geographical systems’ organization.

Sinusoidal harmonic vibrations are characterized by wave-length and amplitude. Infrawaves with frequencies measured by vibrations per minute, day, year, century prevail in geographical systems. Life duration of an ethnic group measured by L.N. Gumilev is equal to about 1,500 years. These waves, for the most part, are inaccessible for direct physical measurement, but it does not mean that they either do not exist, or they are non-scientific. Amplitude is an energy characteristic of a wave. Unlike simple harmonic vibrations the amplitude of geographical systems’ subsystems is time-dependent. Change of the wave-length and amplitude in a particular system of a geographical system causes misbalance by blocking it with emergent properties, or leads to its transformation. Probably this is the way the evolution goes on.

The harmony in geographical systems is reached through harmonics, the main frequencies, which may be divided into quanta like octaves in musical instruments. The main harmonics of the standard scalar time scale are well known periods of time: a day, a week, a month, a year, etc. They comprise a certain event line — a period with a different wave-length — with mathematical precision. These heterogeneous periods are linked with main harmonics and synchronized with them. The mismatch-

ing periods — “noises” — drop out and dissolve in the space, which is external for geographical systems.

The present review allows making the following **conclusions**.

Time is a subjective notion based on a standard scalar time scale, functioning only in the “Earth” reference system for a “human” observer. Following from the general theory of relativity another time is characteristic of other reference systems [8].

As an intelligible notion (a noumenon), time is an emanation of the “Eternity” including “non-time”. “Non-time” is a more general characteristic of the eternity corresponding to the notion of “chaos” missing causality and lacking well-defined sequences. Causality is manifested only in the matter. The forms of the matter are created through directionality or “the arrow of time”. The latter, in the opinion of G. Nikolis, I. Prigozhin, I. Stengers and S. Hawking [6], [8], [9], distinguishes chaos from order.

“Arrow of time” represents a pure and simple sequence of events. Each event is an independent period folded into an open cycle. Openness means transition to the next event; otherwise, an object would remain permanently linked to one event. In relation to tangible objects, having the beginning and the end, “the arrow of time” evolves into “a life cycle”. Time becomes cyclic at any interval.

There exists in the world an unlimited number of crossing sequences that form an event line. The crossings (nodes) shape “the fabric of time”, which is multidimensional, as in every node the object reveals various attributes.

The position of “now” is formally basic and one-dimensional (scalar). However, its link with past events, planning of the future and correlation with other crossing and non-crossing sequences make it two-, three— and multidimensional. “Fabric of time” is fixed in the virtual inter-temporal space, the coordinates of which are set by “scalar time”, ordinary marks on the standard scalar time scale. The inter-temporal space is a surrogate of the real geographical space. Substitution of the last inter-temporal space stipulates planning mistakes due to incomplete information.

Scalar time is the most powerful means of synchronization of events, and therefore, of management in terms of its function. Naturalness and absolute restriction of the inter-temporal space create an energy potential, similar to a potential created by natural resources.

Time is a component of a physical value known as velocity. In the real space the velocity acts as a space dimension and time dimension ratio. In the virtual inter-temporal space it acts as a number of events occurring per unit of time. A life cycle is described by the second ratio (a program), but it is implemented in the real space. The length of a life cycle in real space depends on physical characteristics of an object and its location. Are objects of maximum density (nucleons), no weight (photons) and no energy (0°K) timeless and devoid of a program? The object’s location in the Milky Way system determines its unique scalar time scale; therefore some objects may be almost invisible for others.

The event line of an object in the course of quite an extended period is described by sinusoidal harmonic vibrations known as a rhythm. Alignment of homogenous and

non-homogenous complementary harmonics is described as a community acquiring the object's properties. In geography such objects comprise landscapes and territory-related forms of the society and production organization. The ability of time to be divided into quanta is based on concurrence of rhythms. It is relative and subjective for each community.

The present article is logically linked with the previously published work of the author [10].

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