

Dialectical-Ontological Modeling of Primordial Generating Process ↔ Understand $\lambda\acute{o}\gamma\omicron\varsigma$ ↔ Δ ↔ Logos & Count Quickly ↔ Ontological (Cosmic, Structural) Memory

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March 05, 2020

Undecidability ↔ Uncomputability ↔ Unpredictability ↔ ...

To find a way to answer these dialectical questions, let us first recall “Mathematics as Metaphor” by Yuri Manin [1] and Victor Vasnetsov's painting “Knight at the Crossroads”[2]. In a Russian fairy tale it is said: “The Prophetic Stone lies on the ruin of the road, and on it there is an inscription: “If you go to the right, you lose, you will save yourself; if you go to the left, you will lose yourself, you will save the horse; if you go straight, you will lose yourself and the horse...”

But this is an even more difficult existential trialectic task → choosing a life path....

Fundamental Science is undergoing an acute conceptual-paradigmatic crisis of philosophical foundations, manifested as a crisis of understanding [3,4], crisis of interpretation and representation [5], loss of certainty [6], trouble with physics [7], and a methodological crisis [8]. The roots of the crisis lie in the initial cognitive attitudes of the “Second Archimedean revolution”. Today, Fundamental Science rested in understanding the nature of the “laws of nature”, fundamental constants, space, time, number, information, consciousness.

Fundamental Science rested in the “first-beginning”, in the “first-process”, in the “first-structure”, in “cogito ergo sum”. The modern crisis is not only a crisis of the philosophical foundations of Fundamental Science, but there is a comprehensive crisis of knowledge, transforming by the beginning of the 21st century into a planetary existential crisis, which has exacerbated the question of the existence of Humanity and life on Earth.

July 18, 2018 “SCIENTIFIC AMERICAN” published an extremely topical article by Carlo Rovelli: “*Physics Needs Philosophy / Philosophy Needs Physics*”.[9] Carlo Rovelli outlined a list of topics currently discussed in theoretical physics. First two of them: *What is space? What is time?* It can be noted that most of the issues relate to the field of philosophical ontology. And this list is not complete... The first question on the list is about *understanding space*. Obviously, here it is necessary to recall the philosophical testament of Paul Florensky: “We repeat: worldunderstanding is spaceunderstanding.”[10]

Long-standing problems are also in the philosophical foundation of the “Queen of Sciences” - Mathematics, which has been undergoing a crisis of foundations for more than a hundred years. [6] And obviously, we also need the second article: “*Mathematics Needs Philosophy / Philosophy Needs Mathematics*.” If the first two crises in mathematics were successfully overcome, the third crisis is a deep onto- gnoseological crisis, which mathematicians, as the philosopher S. Cherepanov notes, tried to overcome by inadequate methods.[11] A century of fuss and zero results! [12]

The first thirty-year stage of the age-old epic of solving the problem of justification of mathematics was completed by Kurt Goedel's research in mathematical logic. Goedel's conclusions have a broader application than criticism of formalism. The theorems revealed the limitations of the approaches of the Hilbert program. Closing the problem of the justification of mathematics on mathematics itself, formalism replaced the question of the truth of its statements with the requirement of consistency.[13] Mathematicians, logicians, and philosophers give very different, sometimes even polar, estimates of the historical significance of Goedel's theorem. Bertrand Russell assessed the results of Goedel's logical discoveries: “Contrary to popular misconception, Goedel's incompleteness theorems do not imply that certain truths will remain forever unknown. Furthermore, it does not follow from these theorems that human cognition is limited in any way. No, theorems only show the weaknesses and shortcomings of formal systems.”[13]

Those. we can conclude: Gödel's theorems reflect the fundamental feature of knowledge - openness and incompleteness of the cognition process, and on the other hand, the ontognoseological inferiority of formal systems.

Computational Mathematics: Paradigm Crisis

Due to the unsolved problem of justification of Mathematics, paradigm problems in Computational mathematics have arisen. Mathematician, expert in the field of artificial intelligence Alexander Narin'yani in the article "Mathematics XXI - a radical paradigm shift. Model, not an Algorithm" notes: "Computational mathematics is in a deepening crisis, becoming increasingly inadequate in the context of growing demands for practice. At the moment, Computational mathematics has no conceptual ideas for breaking this impasse...»[15]

A. Narin'yani notes the main reason for this situation: "The hegemony of the **Algorithm** over the **Model**. If the **Algorithm** answers the question "HOW", then the **Model** answers the question "WHAT". It is strange to deal with the first question without answering the second. It follows that the model should play a key role in Computational mathematics when solving real problems.»[15] Analyzing the "natural line of development of mathematics" A.Narin'yani sums up: "This natural line of development began to deviate with the advent of the Algorithm and the expansion of its role in solving applied problems. Now, with the end of the Algorithm era and the return to the Model paradigm, the basic content role of mathematics is restored, and it again becomes a "meta-knowledge technology".[15]

A.Narin'yani is the author and developer of the concept of "Subdefinite mathematics / Mathematics of underdeterminacy", the theory, method and technology of "Subdefinite models".[16]

Another example that is important for finding answers to problematic questions *Undecidability* ↔ *Uncomputability* ↔ *Unpredictability* is the creative path of Nikolai Brusentsov (1925 - 2014), researcher, philosopher, inventor of the "Setun" ternary computer (1958), based on the ternary number system, author of the scientific concepts of "Three-Digit Dialectical Logic" and "Ternary Informatics".

N.Brusentsov notes in "From Aristotle to Computers": "The currently accepted science of intelligence - Logic (whether it is traditional or mathematical embodied in computers) - is essentially two-valued. The conclusions in it are exhausted by a discrete double - "yes", "no", and other modalities are axiomatically cut off by the "law of the excluded third". This logic is extremely simple conceptually and technically, therefore, it reigned supreme in the world of computers, "arranging" it in its own way, not corresponding to how the natural world is functioning and arranged.»[17]

For the first time in the history of world computer science, Brusentsov introduces the fundamental concept of "trits", instead of the "bits" accepted in binary computer science.[18].

There is still hope that "three-digit dialectical logic", the ternary system of calculus and "qutrits" will be used in future quantum computers... This is a common problem for Mathematics, Physics, and Philosophy. General problem of cognition.

So, the mentioned conceptual problems in Computational mathematics are the result of the unsolved problem of the "foundations of mathematics". What is the main cause of the crisis of the foundations of mathematics, the unsolvability of this "problem of the century" - problem №1 for cognition? What is the inadequacy of all mathematics justification programs? Obviously, it is necessary to agree with the conclusion of the philosopher Dmitry Bukin: "Crisis of the foundations of mathematics is, first of all, the crisis of ontology... The way out of this crisis state should be sought not so much in improving the methods of mathematics itself, but in updating the cognitive means of ontology, which do not deny the classical paradigm, but can go beyond it. In this sense, dialectics is a historically proven method of understanding the existence of a mathematical object in its development and its relationship with objective reality."[19]

Thus, the crisis of ontology gives rise to a crisis of the foundations of Mathematics. Dialectics should come to the rescue. But which Dialectics exactly?

It's time to return ↔ Into Dialectics

Dialectics (in the broad sense and in our understanding) is a universal theory and method of knowing of the world as a whole. To overcome the crisis in the philosophical basis of Mathematics, we need new, extremely deep dialectic and ontological ideas aimed at overcoming the age-old crisis in the foundations of mathematics, and therefore knowledge in general.

It is important for this to conduct an analysis of the understanding of dialectics over 2.5 thousand years of the development of philosophy in order to select the most promising, comprehensive dialectic and ontological ideas that will make it possible to overcome the modern crisis in cognition. Before this philosophical analysis, let us once again comprehend all the world histories of mathematics, all calculus systems, starting with the Ancient of Egypt and Babylon. Here it is important to rethink the whole depth of the philosophical conclusions of E. Husserl in "Origin of Geometry". [20]

Heraclitus defined dialectics as the doctrine of the eternal becoming and variability of being. The thought of changes, characteristic of the very first Greek philosophers, in Heraclitus takes the form of universal thought, i.e. philosophical idea. Everything is changing, and constantly changing: "Everything flows, everything changes." [21] The concept of "opposites" in Heraclitus is translated as "warring", "diverging", "contradiction", "opposition", "diversity". The leading category of Heraclitus's dialectic is the "Logos" - the single law of the Cosmos. The "Logos" of Heraclitus is a dialectical Logos. The universal variability of things was understood by Heraclitus as the result of constant movement and transformation, the becoming of one from the other. This is a universal dialectic, where the identical and different is an integral characteristic of the whole. [22]

The starting point of the Pythagorean dialectic is also the idea of opposites. The mixing of opposites develops into their merging, fusion into a single entity. The result of the "mixing" of opposites — the unlimited and the limit — is simultaneously the material world of things and the ideal world of numbers. At the same time, the limit and the unlimited, acting as even and odd, respectively, "mutually mixed", give an "even-odd" number, i.e., "one" that represents the starting point for any calculus. Ion of Chios outlined a peculiar way of developing Pythagorean dialectics by introducing triads instead of pairs of opposites, in which the original opposites are synthesized. These triads have the form: limit, boundless, and harmony; odd, even, and even-odd number. Ion of Chios concludes: "The Beginning of my speech: everything is three, and there is nothing greater or less than these three." This is a approach to the problem of synthesis as one of the most complex and important for dialectics. [22]

The Eleat school (Xenophanes, Parmenides, Zeno) not only contrasted unity and multiplicity, the mental and sensual world, but also pointed out the distinction between entity and phenomenon. And if Heraclitus makes eternal motion the principle of matter, then the Eleatic doctrine, in its negative reaction to the heraclitic dialectic, focuses on the eternity and immutability of truly existing being, reducing the multiplicity of moving bodies to the level of apparent and simple visibility. [23]

The dialectic of Plato as the "logos of eidos", as the conceivable structure of the world, was isolated from sensory diversity and contrasted with this diversity. The dialectical thought of Plato solves a twofold problem: the relationship of the One, that is, the Ideas of the world and the Many, that is, the world itself. Plato recognized not only the unity of opposites in the form of "mixing", but put forward the idea of the need for their mediation. Plato unfolds the dialectic of concepts - being and non-being, tone and other, unity and multitude, rest and movement, infinite and limit. As a result, the first system of dialectically related categories appears in the history of philosophy. The dialectic of Plato is the science of finding the principle of every thing and of this principle itself. [22] The dialectic of Plato is embodied in the "Platonic solids" and the motto of the Academy: «Let no one ignorant of geometry enter here!»

The dialectic of Aristotle is, on the one hand, a science, and on the other - a method of achieving true knowledge. Aristotle comes to dialectic results: recognition of the internally contradictory nature of time, the dialectics of discontinuous and continuous in the interpretation of space,

mathematical objects - points, lines, etc.[24] Aristotle has two different logics: the early dialectical logic of "Topics" and the formal syllogistic logic of "First Analytics".[25]

Deep dialectic ideas of Nikolay Kuzansky, especially the principle of "coincidence of opposites" - "coincidence of maximum and minimum" are especially important for modern rethinking.[26]

Dialectical constructions are clearly traced in the cosmogony of Descartes and his "Cogito ergo sum". In the philosophy of Spinoza - the dialectic of thinking and matter, freedom and necessity.[27]

The dialectic of Leibniz - in the relationship between entity and phenomena, one and many, universal and individual, infinite and finite, active and passive, continuous and discrete. Natural uniformity limits the infinite multiplicity of diversity and systematically organizes it.[28] The key dialectic idea of Leibniz is the identity of structure and substance, while substance is a condition for the possibility of structure, and structure is a substance.[29]

I.Kant, in his doctrine of the antinomies of pure reason, pointed out that dialectical contradictions must be distinguished from logical contradictions. Dialectics is a way of exposing the errors of the human mind in its striving for true knowledge. Dialectics in the understanding of I. Kant is a "natural and inevitable" characteristic of the existence of pure mind.[30].

The dialectics of G.Hegel incorporates dialectical ideas, starting with Plato, and presents them as a branched doctrine of dialectical categories and method. For our research and modeling of the philosophical basis of Nature and knowledge, the Hegelian dialectic of existence, its dialectical "triad": "Being — Nothing — Becoming", its modern scientific interpretation and representation in a mathematical Symbol, is primarily important. One important dialectical principal for Hegel is the transition from quantity to quality, which he terms the Measure. The measure is the qualitative quantum, the quantum is the existence of quantity.[31]

Alfred N.Whitehead's process philosophy is dialectical from beginning to end. Whitehead has a dialectic of the law of formation of the Universe, in which the subject is completely immersed. Whitehead reformulates atomism so that it loses all connection with the mechanistic interpretation of reality. The interpretation of nature as a living organism converges with the opposite-the mechanical view, reinterpreted in terms of atomism.[32] A. Whitehead came to a very important metaphysical conclusion: "Mathematical physics translates Heraclitus' saying, "All things flow," into "*All things become, all things are vectors.*"[33] It was the breakthrough of metaphysics to mathematics and physics at the same time - breakthrough to new knowledge.

Alexey Losev (1893-1988) defined dialectics as the logical construction of being considered in its Eidos. [34] For Losev, dialectics is the only method capable of "embracing reality as a whole, with the rhythm of reality itself, woven from contradiction, like life itself".[35]. For Losev, dialectics is a science and "the only possible philosophical realism": for it, phenomena contain a semantic regularity and principle, and essences and meanings are manifested. Dialectics is the form and rhythm of life, the meaning of life, its skeleton. Scheme, Topos, Eidos, and Symbol are the four necessary faces in which the named entity is represented.[35] In the work "Dialectical foundations of mathematics" Losev defines the metaphysics of number and time: "Number is the meaning of time, and time is the life of numbers." [36]. A.Losev introduces a new concept "hyletic number". Losev builds the doctrine of the hyletic number on the basis of hyletic logic, elements of which were first described by him in "Music as a subject of logic".[37]

Thus, the analysis of the development of Dialectics, the main dialectic and ontological ideas for 2.5 thousand years of development of philosophy provides an opportunity to develop the ideas of process metaphysics and to solve the problem of the "foundations of mathematics", and hence knowledge in general. Without solving this fundamental problem, taking into account the current state of computational mathematics and the development of computer technology, it is not possible to find an exact answer to dialectic questions: «*Decidability ↔ Undecidability*», «*Computability ↔ Uncomputability*», «*Predictability ↔ Unpredictability*»...

Deep mind ↔ Dialectic of Logos & Eidos ↔ Coincidence of opposites ↔ Ontological basification of knowledge

To overcome the crisis in the philosophical basis of Fundamental Science, especially Mathematics- "language of Nature" and Physics, to help the paradigm of the part (atomistic, mechanistic), must come the paradigm of the whole (holistic), which requires new, deeper, ontogenesiological and methodological ideas, extremely generalizing images and concepts, deepening the methodologies of axiomatization and geometrization, allowing to "compress", structure and represent the accumulated knowledge in images-constructs, semantically deepen and expand the process metaphysics with its development into constructive metaphysics and ontology of the holistic process of generating new and new meanings and structures (material-ideal).

The solution to the problem of the "foundations of Mathematics", and therefore knowledge in general, is the solution to the problem of modeling (constructing) the ontological basis of knowledge - the ontological model of the primordial generating process, "first-process". The ontological basis of knowledge is the ontological framework (border), the ontological carcass and the ontological foundation. Modeling (construction) of the ontological basis of knowledge is *based on the idea* of a comprehensive conceptual-figurative synthesis of accumulated knowledge and is understood as an "ontological basis of knowledge": ontological justification + ontological substantiation. The concept of "basification" is taken from geology: a hypothetical process of transforming the granite layers of the earth's crust into basalt.

The method of construction the ontological basis of knowledge is dialectical-ontological modeling of the primordial generating process of the Universe being as an eternal holistic process of generation new and new meanings and structures (material-ideal). Epistemological "beacons" in the construction are the philosophical testaments of Nikolai Kuzansky: "A *part is not known without knowing the whole, since a part is measured by the whole.*"[38]

Pavel Florensky: "We repeat: *worldunderstanding is spaceunderstanding*"[10] and mathematics Alexander Zenkin (1937-2006): "the truth should be drawn ..." [39]

The essence of the **method of dialectical-ontological modeling (construction)** of the knowledge basis: Ontology goes through Physics, its basic concepts and essential problems → to Mathematics, and Mathematics in the opposite direction → to Ontology. Mathematical objects - point, vector, equilateral triangle receive the ultimate ontological interpretation. The ontological triad ("being-nothing-becoming") and the methodological triad ("thesis-antithesis-synthesis") receive a physical interpretation and mathematical representation. Modeling is based on dialectical onto-logics.

The ontological basis of knowledge - the **model of the primordial generating process**-is based on *one Axiom* (the basic generating First Axiom, Meta-Axiom) and *one Principle* (the basic generating First Principle, the "Principle of principles"). The First Axiom of the dialectical-ontological construction, reflecting the law-making nature (Universum), the founding center of the concentration of faith and knowledge → "In the Beginning was the Logos ..." / *Ἐν ἀρχῇ ἦν ὁ λόγος ...* ", where "Logos" is "the single law of all things," "the law of laws," "meta-law". For centuries, cognition has gone from the "Logos" in two directions → to the Absolute - Creator and Nature. The primary principle of dialectical-ontological construction is suggested by Nature and Tradition - the *ontological Principle of triunity*. The principle of triunity substantiates all other principles of cognition as a continuous process at all its levels.

Concretizing concepts, constructs, metaphors, epistemological principles, mind-conclusions, and mathematical objects that clarify the methodology for constructing a model of the primordial generating process, its ontological structure (material-ideal): "comprehensive conceptual - figurative synthesis", "generating structure", "heavenly triangle"(Plato), "matter"- "nurse, receptacle"(Plato) that from which all forms are born", "matter"- "Proteus of nature", "first entity = form", "absolute (unconditional, limit) forms of existence of matter (absolute states)", "vector → "carrier of being", "vector (bivector) of the absolute state of matter", "flow ↔ source of matter", "ontological path", "ultimate transition", "ontological structure of space", "point with the germ of vector", "order ↔ chaos", "limit ↔ infinite", "even ↔ odd", "material ↔ ideal", "quantitative

quantum", "ontological symmetry \leftrightarrow asymmetry", "understanding = "grasping structure", "time before the beginning of time", "thing \rightarrow vector", "cogito ergo sum" \leftrightarrow "vector (bivector) of consciousness", "meaning/sense \rightarrow vector", "meaning \rightarrow foundation of being", "increment», "ontological invariant", "mother structures/les structures-mères" (Bourbaki) "topos-place of "coincidence of opposites", "measure = qualitative quantity", "proportionality / justice", "primary cycle", "rhythm \leftrightarrow arrhythmia", "harmony \leftrightarrow disharmony", "primordial (initial) structural tension", "intention", "attractor and generator of meanings/senses", "emergence", "absolute (natural) coordinate system".

The ontological "heavenly triangle" of three vectors (bivectors) represents the Logos as a measure of any sensory thing-process. Here the Logos coincides with Eidos and Measure. Vectors (bivectors) represent the absolute (limit, extreme) forms of the existence of matter (absolute, limit states): absolute rest (linear state) + absolute motion (circular, vortex state) + absolute becoming (wave state as transfer of states), vertices of an equilateral triangle - points of coincidence of the maxima and minima of the absolute (limit) states of matter.

The symbol of basic ideality, built on the basis of dialectic-ontological construction (basic ontological construct) - three centered, non-intersecting invariants of the "heavenly triangle", representing the three absolute states of matter and their ontological paths, is the symbol of the *primordial (absolute) generating structure, synthetic the model of the ontological basis of knowledge and the Universum as an eternal holistic process of generation of meanings and structures, a symbol of "eternally existing" - "9-top star" ("star of justice")*.

Triune (absolute, ontological) space is the limit value (existential-extremum) of the absolute forms of the existence of matter (absolute states = ontological framework): linear state (absolute continuum) + vortex state (absolute discretuum) + wave state (absolute dis-continuum) = triune (ontological, absolute) field. Its eidos (ultimate geo-geometric images-ideas): "cube" + "sphere" + "cylinder" represent the absolute (natural) coordinate system of the Universum being as an eternal holistic process of generation of meanings and structures (ontological carcass of knowledge). The triune (absolute, ontological) space of the first process of creation ("time before the beginning of time") has nine gnoseological dimensions: three "linear" + three "vortex" + three "wave"es. The dialectic ontology of the absolute forms of the existence of matter bases the status, hierarchy, numerical certainty of fundamental constants and the *linear- wave-vortex language of being* of the Universum.

The idea and model of the primordial generating process, its ontological structure directs thinking to the need for the introduction of superconcept, super super category \rightarrow **ontological (cosmic, structural) memory**, the "soul of matter", measure as a qualitative quantity of absolute forms of existence of matter (absolute states). Ontological memory is that which generates, preserves, develops, transforms, strengthens everything — that which substantiates the causal, semantic, and eidetic determinism of the Universum existence (other Greek: "entelechia + nus"). The birth of a new structure, an actual entity, is the event of the birth of the "arrow of time" (linear), representing the structural "vertical" (hierarchy) of the existence of the Universum (past \rightarrow present \rightarrow future). Ontological time is the triunity of cyclical (time of formation of the structural "horizontal" of being), linear (time of formation of the structural "vertical" of being, hierarchical, "arrow of time") and wave time (time of becoming). Time is a multivalent phenomenon of ontological (cosmic, structural) memory, which bases the quantitative (rhythmic, ordinal) certainty of the Universum as an eternal holistic process of generation of meanings and structures. The birth of "arrow of time" is the birth of light. Consciousness is absolute attractor and generator of meanings, univalent phenomenon of ontological (cosmic, structural) memory, which bases the qualitative determinacy of the existence of the Universum, which manifests itself at a certain level of the Universum being. Meaning is the universal foundation of the existence of the Universum as holistic directed process of generation of structures (material-ideal).

The final model of the primordial generating process and its ontological structure as a universal ontological basis of knowledge (ontological framework, carcass, foundation) and at the same time "model of the self-aware Universe" [40], structures and systematizes the accumulated

knowledge, defines the ontological “boundary of knowledge” and the ontological structure of the “Beginning”, deepens and expands the methodology of scientific research, bases the limiting ontological foundations of the “General theory of measure”, “General number theory”, “Vector theory of Everything”, gives a new heuristic for solving problems in the philosophical basis of Fundamental Science, it forms a coherent scientific picture of the world's Information age. The compressed result of dialectics-ontological modeling (construction), a comprehensive basic ontological concept-construct, model of basic Ideality→ “Space-MatterMemory-Time” [S-MM-T]. Simplicity of Complexity. This is model of basic Ideality, “ideal formation”, which E. Husserl spoke about the need to build in "Origin of Geometry"[20] I recall the extremely relevant philosophical testament of John Archibald Wheeler:

“Philosophy is too important to be left to the philosophers” [41]

Conclusions

- 1.Undecidability↔Uncomputability↔Unpredictability↔Uncertainty↔Underdetermination↔ Understanding↔Dialectics of Logos & Eidos ↔ Dialectics of Model & Algorithm ↔ Computing machines ↔ Philosophy of Common Sense... But can “Artificial Intelligence” understand the "coincidence of ontological opposites"?
- 2.The ontological basification of Mathematics (knowledge) is problem №1 for Science and Philosophy.
- 3.To develop and support all areas of Mathematics, primarily Computational Mathematics, Computer engineering on various numerical and logical systems and promoting topical ideas.
- 4.Ontological (cosmic, structural) memory is the superconcept-attractor, super category, the substantial semantic core of the scientific picture of the world of the nuclear-ecological-information age.
5. Existential and intellectual tension increases: LOGOS vs. “Big bang”... → The return of the lost Certainty in the philosophical foundations of Science.
6. The time has come for the Big Conceptual-Paradigm revolution in the philosophical basis of knowledge, the time of the Big Ontological coup. Time to restore justice in the philosophical basis of Science. First in the philosophical foundations of Mathematics , then in the philosophical foundations of Physics, and gradually, step by step, in the philosophical basis of the "LifeWorld" of Global Society , in the dialogue of Humanity and Nature. Science and Humanity need Philosophy, “mother of all sciences”, to overcome the crisis of understanding and mutual understanding in an era of increasing existential threats and risks. Right now dialectics is needed: "Je pense, donc je suis" ↔ “Nous pensons, donc nous existons."
7. The UN and UNESCO should help all countries to introduce the subject "Philosophy" in school education from the 1st grade: "Philosophy for children".[42]

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