

ARTIFICIAL INTELLIGENCE AND UNRESOLVED SCIENTIFIC PROBLEMS

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Abstract: *The connection of the AI problem with the group of actual unresolved scientific problems generated by latent fundamental crisis owing to general nonlegitimacy of modern Science is investigated. It is shown that such problems are solvable only jointly and their instrument is the part of AI. The legitimizing universal theory (model) of the World and the World phenomena on the basis of harmonious representations in which all the variety of the World can be essentially formally deduced from the most general properties of the World in the form of objective system of World definitions (concepts, abstracts) is developed. If such model was earlier used for a manual deduction of concepts, then the foundations for their formal generation are investigated in the given paper. The structure, components, development and comprehensive substantiation of such hypothetical model that already has a lot of theoretical and practical applications and prospects in many fields are considered.*

Keywords: *Uniform Formal Model of the World, Harmonious Information Cosmology, Science Legitimization, Harmonious Scientific Methodology, Harmonious Objective System of World Definitions, AI.*

ACM Classification Keywords: *H.0 Information systems – General*

Introduction. Actual Group of the United Scientific Problems

In the previous publications [Sosnitsky, 2008], [Sosnitsky, 2009] it was shown that Intelligence 1) has not been artificially created yet, 2) moreover, it has not even been defined, 3) cannot essentially be synthesized in the limits of modern Science, and 4) this problem is the consequence of existing fundamental drawbacks of Science. Though it is quite obvious and easily fills the entire observable World. The scheme of giving of an exact scientific definition of Intelligence has been shown and directions of its concretization from the position of the new concept of the Universe and harmonious information Cosmology were specified in those publications for the first time.

Taking into account that everybody has always dealt with the problems of thinking from the moment of Mankind appearance it is difficult to hope that at a certain moment a successful happy hacker, using the slackness of scientific authorities, can at last receive in some successful way the first full-fledged AI program as it was once with microcomputers. On the contrary, it is probably necessary to go carefully through all the steps of a complete way of difficult fundamental research and experimental developments that consistently improve scientific concepts and methodology up to the exhaustive knowledge of this phenomenon for this purpose. Every gap on this way essentially interferes with the achievement of full-fledged AI.

The last statement substantiates the purposeful order of scientific research. In the given paper the important organic connection of the problem of AI with the standing out group of fundamental unresolved scientific problems is investigated, each of which 1) also represents a pressing fundamental problem, 2) cannot be solved separately, 3) but only together with all the group, 4) their whole set forms an unprecedentedly difficult scientific barrier, 5) to overcome which some new radical ways must be applied.

This group, first of all, consists of the following problems (Fig. 1):

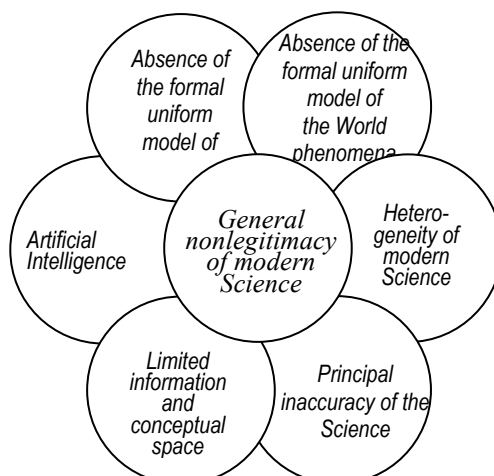


Figure 1. Actual Group of the United Scientific Problems

1. The absence of the uniform formal theory (model) of the World in modern Science. All the attempts of creation of such a theory have been unsuccessful so far. The last of them, synergy, observes new properties of Nature, but does not give the required model [Prigogine, 1990]. Therefore, the limited palliatives which do not meet the constantly growing requirements of Mankind— various fancies, folklore, mythologies, philology and philosophies are applied instead of them up to now. The expected theory must describe formally all the World as a whole, including its origin, organization, movement, purposes and the end which are projected then on the particular World phenomena. Concepts of formality and accuracy of the theory demand strict definitions, but we use the current general scientific ones so far.

2. The absence of the uniform formal theory of the World phenomena as the parts of the World. Intelligence is capable of working only with unified phenomena. Unification is reached by the restoration of both internal and external harmony of an abstract part of phenomena. The degree of formalization, unification, restoration and harmonization defines the degree of unity of the theory of phenomena. Its limit is the abstract of a phenomenon in the World Abstract Pyramid, and that abstract is deprived of all particular properties. Insufficient unification pulls phenomena apart in badly connected groups and destroys formalization up to zero, incapable to be processed in computers. Natural Intelligence is therefore unattainable because it uses independent but still unknown ways of internal formalization.

3. The heterogeneity of modern Science and division into insufficiently connected among themselves specialized sciences, each of which has to create its own internal instrument of formalization so that the results of sciences badly co-operate among themselves and that essentially limits Science development as a whole. And the more complex the branch is, the lower degree of formalization and lesser advance it makes, which is more supported by rather simple fields of Science for inanimate nature. Natural sciences and humanities are the first to be separated, and then the sciences inside these groups separate, etc. up to the outlooks of separate people. As a result of that against the background of high technologies Mankind produces bitter low-level conflicts inside and outside itself that are only capable of expanding in the specified conditions.

4. The limited information and conceptual space of Mankind. By definition the World is open well-written and completely cognizable book, which it is just necessary to be able to read. But human information remains a commodity and, therefore, a controllable resource. It is partially useful for information creation, but limits its consumption as a whole and contradicts the supreme laws of nature. The greatest obstacle is an insufficient universal system of concepts essentially limiting the perception of information by people, beginning with an inexact meaning of words even in the mother tongue and finishing with the last scientific reflections, the points of view, terminology, classifications and World outlooks. Today Science cannot move further only at the expense of some fields as it was not long ago but only together with many others that naturally leads to the above mentioned problems if an expert in a certain branch cannot receive the vitally important concepts of other branch and transfer his or her results to other fields. The typical example of the problem is that the papers of the author that can lead to important results do not get in existing scientific classifications for many years.

5. The inaccuracy of Science in principle. Each subject, including Mankind, always begins with zero and aspires to expand its constantly growing but finite knowledge of permanently changing infinite World as much as possible. The problem of the control of completeness and adequacy of knowledge to the World emerges as each deviation, even virtual, is negatively uncontrollable. Therefore, the certified theory of management of the World cognition, Science stabilization and evolution of the World models should be applied.

The specified seven problems, including AI and the nonlegitimacy of modern Science mentioned below, show that, in fact, for their solving it is necessary to reform all the established system of modern Science. In the next section it is shown that it is essentially completely illegitimate (inconsistent) in the sense that it has established itself.

The Problem of Definitions and General Nonlegitimacy of Modern Science

Definitions are the major fundamental part of Science, allowing to identify (the unique possession) and to classify (multiple possession) the World phenomena according to possession of some set properties in some functional (logic) dependence. Such a possession shows obligatory presence of some set of secondary properties in phenomena.

It is significant that this concept (the definition of definition) is impossible to explain precisely by classical Science because of indistinctness of initial concepts, for example, the concept of property. Therefore, we will consider only indisputable properties of definitions.

The definition (def e) of the World phenomenon (e) contains the left determinable part (in general case the classifier) and the right part- correctly constructed formula (f) from definitions of the constituent parts (def e1, def e2, ..):

$$\text{def } e = f (\text{def } e1: \text{not def } e1 (e, ..), \text{def } e2: \text{not def } e2 (e, ..), ..),$$

so that the defined definition must not be in the right part in any way in order to avoid non-determinable tautology.

The application of this scheme of definition to the initial definitions (def e1, def e2, ..) generates the infinite recursion of definitions back that cannot be finished in any way by modern Science because of the absence of this mechanism. Hence, all the existing definitions are essentially illegal and, hence, all the system of Science is nonlegitimate by definition that is modestly hushed up by its apologists.

It becomes legitimate while finding some substantiated initial definitions, which explains the liking for axiomatic methods of scientific research based on some randomly chosen axioms, the validity of which is not called in question because is not discussed. They have led to the problems mentioned above.

Harmonious Information Cosmology and Science Legitimization

Statement of a problem is an initial part of the research; the second part is indication of directions of its solution. The deadlock is eliminated by a radically new model of the World on the basis of the complete system of the ideally harmonized original concepts deduced forward from the only initial Nothing concept that has an exact analytical expression. All of them have exact legitimate definitions and solve fully all the group of the above mentioned problems, actually laying down the foundations of new scientific Reformation.

Nothing is unstable and disharmonizes into internally existing infinite World, generating all its variety, including the mechanism of reverse harmonization in Nothing. The World is divided into abstract parts and real parts, Space-Time-Matter Complexes appear, the concepts of harmony, copying, relation, existence, movement, cognition, etc. are defined, the purposes of general and universal harmonization appear and five classes of entities (harmonizers) depending on the degree of harmonization of the axis of Time are consistently formed. In fact, the mechanism of natural appearance and development of harmonizers from the initial class (inanimate nature) in the highest class (Nothing) is designated. Intelligence (Life) is the third (intermediate) class of harmonizers which is followed by the two more. The basic mechanisms of thinking in systems with Time are deduced. It is possible to show that for each set of properties of the environment-subject couple there are limiting procedures of harmonization. Harmony is the Super Law of movement of entities in their interconnection.

Mankind is the collective Intelligence copying the World in the form of Science (Fig. 2), satisfying the initial conditions of the 1) external to the World and 2) internal consistency and 3) availability for all the particular subjects. Science is the copy (Knowledge) of the World, part which is orientated to the reception of new Knowledge (Methodology).

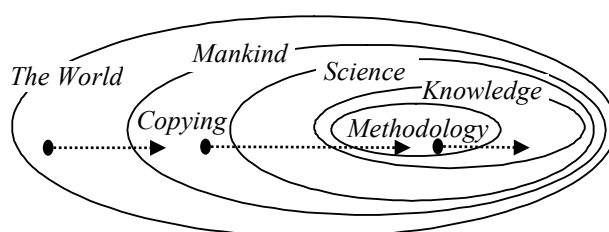


Figure 2. The World, Mankind and Science

Harmonious Decision of the Problem of Definitions

For the first time the harmonious World model has an exact initial concept and the mechanisms of deduction of all the derivative concepts up to the level of the Real World, which radically solves the problem of all the definitions and legitimizes Science for the first time.

Every World entity is a set of relations singled out by some other relation as a unit. At the real level they have seven types of components [Sosnitsky, 2008], [Sosnitsky, 2009]: 1-3) Space-Time-Matter (STM) Complex, 4) Relations (including enclosed entities), 5) Movement, 6) Laws, and 7) Purpose.

Every entity participates expressly or by implication in the infinite variety of internal and external incoming and outgoing relations, which can vary under the influence of the Time Complex. If there is sufficient harmonious potential, entities increase their motionless part (subject), and at the excess of neighbors' potential – set this part in motion and start searching for a better harmonious condition with the internal and external reorganization up to destruction and generation from its remnants of other more harmonious entities (process). Thus, the World is a branching set of temporarily existing harmoniously related and mutually turning processes with a gradually increasing subject part in the direction of general and complete Nothing harmony.

At every change of any relation a certain subject disappears and appears a new one, within the framework of which an exhaustive harmonization of external and internal relations take place up to its destruction by more harmonious neighbors. Such a subject (definition) defines basic harmonious properties of the corresponding process and centers all the entities of our World both abstract, and real ones (Fig. 3).

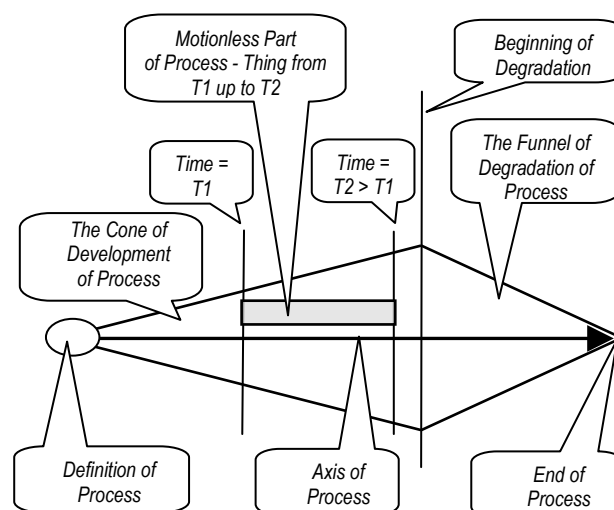


Figure 3. The General Structure of Processes in the Form of a Development-Degradation Cone

The difference of the harmonious system of definitions is their strict deductibility from the precisely defined initial Nothing concept. An objective pyramid of World definitions forming the required thesaurus originates from that. It is approximately represented by the subjective scientific system of definitions that was considered above.

The definitions that are above the Time-Complex are constant, those that are lower are divided into motionless (more high-level) and mobile (more low-level) parts. The motionless definitions define current properties (concepts and laws) of our World; however, there is a mechanism of their change.

Initial Principles of the Harmonic Theory

The formal World model must be deduced by the formal methodology from the level of the initial observing subject, the principles of which are substantiated in this section.

Absoluteness of the World

Absoluteness is the property of the uniqueness of the World and infinite plurality of all of its possible copies (Fig. 4). It follows from the definition of the World as a complete set of (directly and indirectly) related entities. All its copies are incomplete and different, but they are related through the only World original. It means that all logic deductions on different but correctly constructed copies can lead correctly to identical results like a conformity principle in modern physics [Feynman, 2005]. Strangely, but this condition is everywhere broken in modern Science based on axiomatic approaches [Chang, Keisler, 1990].

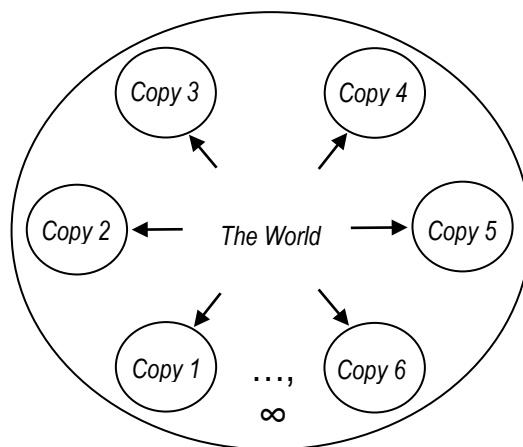


Figure 4. The Scheme of the Absoluteness of the World

Abstractness of the World

Abstractness means that our World has the abstract and real parts (Fig. 5). All the interactions take place in the real part, and the rules (laws) are established in the abstract part. The World is the process of a concretization of an initial Nothing abstract through the system of the Abstract Worlds (AW) in the Real World (RW) in the form of the World abstract pyramid (WAP). There is a mechanism of concretization of abstracts. The initial part of WAP is ideal, but beginning with the STM-Complex level the WAP becomes internally inconsistent and comes in the initial state of complete disharmonization (Chaos) with the subsequent harmonization under the control of WAP to the state of full Nothing harmony.

WAP is deduced from the only Nothing abstract in the form of a developing pyramid (a cone, etc., the names are allegorical) with final initial and infinite final parts. WAP has layers of relatively strongly related abstracts united in AW that have all the properties of the subWorlds. The abstracts are directly invisible at the real level, but there are mechanisms of their restoration from the observable real properties.

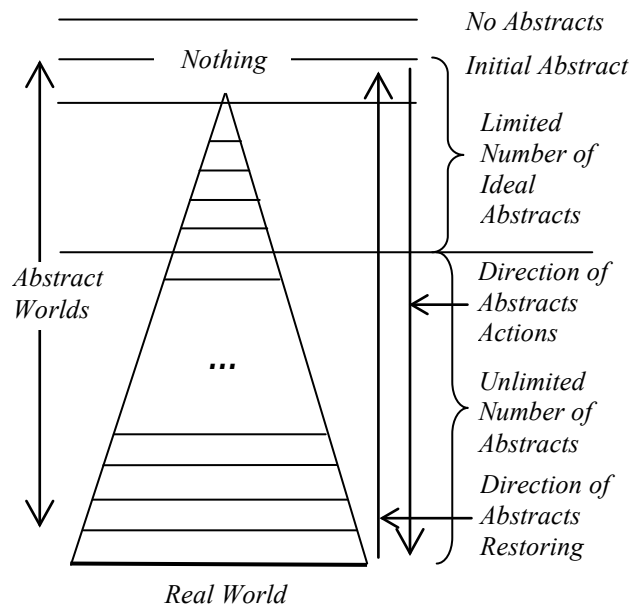


Figure 5. The Scheme of WAP

Cognoscibility of the World

Absolute cognoscibility means the possibility of complete copying of the infinite World, beginning with any of its real entity and zero state of knowledge (Fig. 6). According to the above mentioned definition it follows from the complete accessibility of all parts of the World and gives such basic possibility to all the subjects taking into account complete external connectivity and internal infinity of all the entities.

The real part of the World is directly observed, the abstract part is restored by the methodology specified below. Generally, the World cognition is restoration of WAP areas by means of the observed real bitmap.

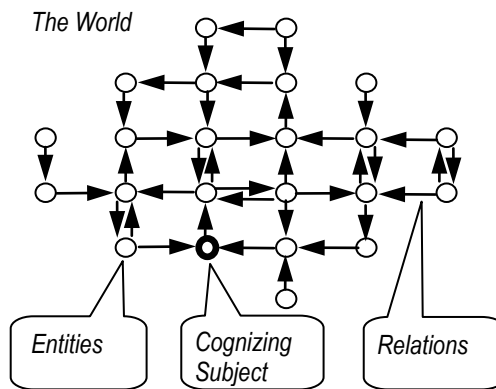


Figure 6. The Scheme of the Direct and Indirect Cognition of all the Entities of the World from any Subject

Harmonious Scientific Methodology

As well as any entity, the scientific methodology comes from the Super Law of Harmonization that aspires to establish every possible harmonious relation in the World. It produces consistently basic concepts of cognition (copying, communication, existence, cognition and further), which are in general presented in [Sosnitsky, 2008] and [Sosnitsky, 2009].

The second methodological level is formed of this Law by the three derivative basic methodologies of restoration of WAP phenomena (Fig. 7).

The initial abstract methodology is the process of restoration of abstracts through their repetition in related phenomena by means of separation of the general part, then through the separation of the general parts in the separated parts etc. upwards. We call it "dog methodology" by analogy with the experiments of a Russian academician Ivan Pavlov, the Nobel Prize winner who investigated conditioned reflexes on dogs [Pavlov, 1927]. It is natural that the accuracy of such a restoration is insignificant and applicable only to the phenomena with low-level purposes (dog entities).

However, multiple repetitions gradually increase a stable high-level system of abstracts, from which it is possible to deduce derivative abstracts. It can be used for separate considerable horizontal and vertical areas (God/dog methodology, God/dog entities).

While achieving the highest abstracts and cognizing the mechanisms of an exact deduction of derivative abstracts there arises the ultimate God methodology (the sense and form are opposite to the word "dog") for the phenomena with high-level purposes (God entities).

Then the derivative methodological levels follow concretised by the procedures described in [Sosnitsky, 2008], [Sosnitsky, 2009].

At the lower levels the processes become specific and have to synthesize themselves automatically by active harmonizers.

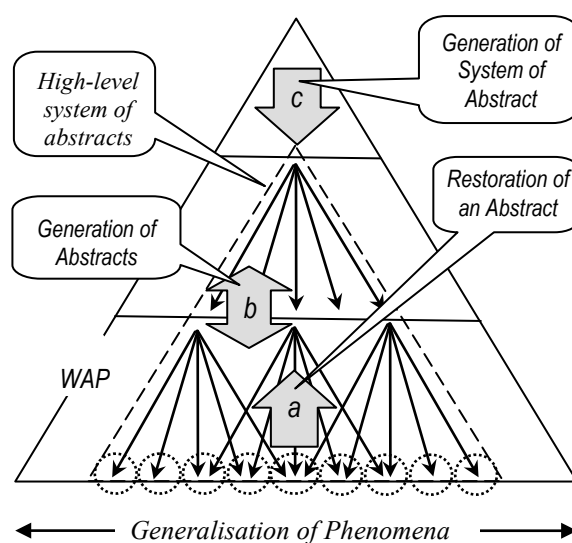


Figure 7. The Schemes of dog- (a), God/dog - (b) and God- (c) methodologies

Control of the Science Completeness

The harmonious theory gives the unique possibility of the control of integrity and completeness of scientific research by means of a full deduction of all the system of abstracts from the only initial abstract into extending in infinity WAP.

Two important possibilities follow from this:

1. The control of complexity of the infinite World and its phenomena by means of a choice of admissible for processing the final top parts of WAP without losing the most important relevant parts of the model (Fig. 8). Hence, the existence of the best model for every arising purpose follows from that. The World becomes small,

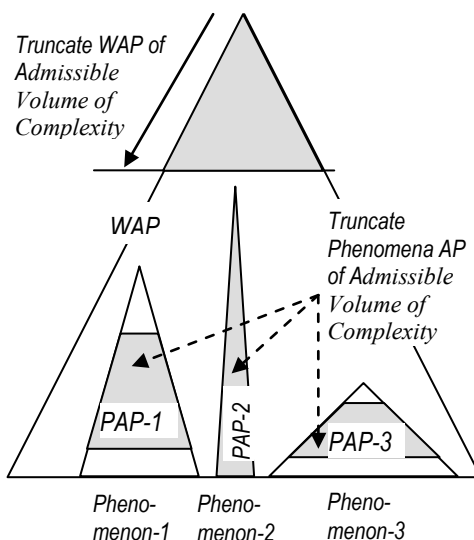


Figure 8. The Scheme of the Control of Complexity Volume of Phenomena (PAP) and the World AP (WAP) beginning with one point from what big technological conclusions follow

2. The control of the completeness of cognition of the World by means of a comparison of hypothetically deducible and available Knowledge that allows to discover some new both existing, and virtual future concepts and laws. The World becomes infinite in its virtual variations, but fuller and more stable in human perception. The possibility of stabilization of Science and succession of the World models and separate phenomena arises from here (Fig. 9).

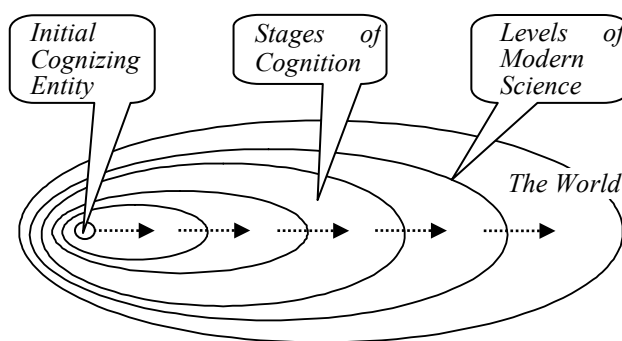


Figure 9. The Scheme of the Control of Integrity and Completeness of Scientific Research

Conclusion

As well as any final model, the given theory is not complete and remains hypothetical, as well as all modern sciences differing only in the degree of substantiation. However, the harmonious theory is for the first time integral and capable of defining all the arising actual concepts objectively. It discovers the new ways of solving actual problems, and now it already has numerous theoretical and practical applications and prospects in many areas. In fact, it prepares radical Reformation of all the system of modern Science [Kuhn, 1962].

In particular, for the first time it allowed to deduce an objective definition of Intelligence and to give a holistic specification of its basic properties and procedures. Moreover, the basic system of initial definitions of knowledge, including the concepts of existence, relation, information, knowledge, understanding, research, harmonization, etc. is deduced for this purpose.

In the given paper the substantiation of the theme is continued and (many unexpected) scientific fields connected with it are specified, the problems of which are subject to the preliminary solving to achieve full-fledged Intelligence: uniform formal World theories, universal formal modeling of the World phenomena, World copying, World abstracting, information cosmology, the theory of formalization, the objective system of definitions, the uniform scientific thesaurus, the integration of specialized sciences, the expansion of information and conceptual space, the objective uniform classifications, the uniform World outlook, the control of completeness of cognition, the management of the World cognition, the stabilization of Science and the evolution of World models.

It should also be noted that the given field of Science is undeservedly forgotten, probably because of its extreme complexity, so between the Ancient Greek thinkers [Aristotle, 1928] and the given research are not seen other similar papers in the field of the exact sciences.

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Major Fields of Scientific Research: Absolute Theories of the Universe, Reform of Science and new Scientific Methodologies, Artificial Intelligence