

Problems of Many-Valued Logic from the Point of View of the Theory of Socio-Cultural Code

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Abstract

It is shown that there are prerequisites for returning to the original interpretation of logic as the science of the laws of thought. Using the methods of the neural network theory of the noosphere, it is proved that the nature of thinking is significantly influenced by the socio-cultural code of the ethnic/social system. A connection is revealed between philosophical categories as basic undefined concepts and archetypes, understood according to Jung. It is proved that the formalization of the laws of thinking, built on multi-valued logic, should operate not only and not so much with the concepts of natural language, but with "reflection quanta" lying on the archetypal level of consciousness. It is shown that the category of truth underlying classical logic can also be interpreted as a "reflection quantum", but which has undergone a formalization procedure. It is demonstrated how exactly the apparatus of multi-valued logic can be applied to identifying links between the "quanta of reflection", which can be considered as a generalization of the rules of reasoning established in classical logic, dating back to Aristotle. The category "Qi", which underlies ancient Chinese philosophy and is inseparable from the Chinese sociocultural code, was used as an example. Meaning of this category in the version that is assimilated by European and Eurasian sociocultural codes is revealed.

Keywords: Multi-valued logic; laws of thinking; sociocultural code; levels of consciousness noosphere; noosphere; category "qi".

Introduction

Science, called logic, was originally created as a means of establishing the objective laws of thinking. Its subject has a long history dating back to Aristotle, who viewed logic as the science of how to reason correctly.

J. Boole, who made a more than significant contribution to the development of the apparatus of formal (mathematical) logic, also considered it through the prism of establishing the laws of thought. In a well-known monograph on the history of mathematics (Morris, 1980), the following excerpt from one of the main works of J. Boole, which is called "The Study of the Laws of Thought" is given for illustration just such an approach, which then dominated the field of creating logic.

"In the treatise brought to the attention of the reader, we intend to investigate the fundamental laws of those operations of the mind through which thinking is carried out in order to express them in the symbolic language of calculus and on this basis to build the science of logic and its method."

In the same place (Morris, 1980), it is noted that J. Boole relied on the studies of his predecessors (the Cambridge group, of which de Morgan was a member), who also shared precisely this point of view on the purpose of logic.

However, we have to state that in the 20th century, research in the field of symbolic logic was carried out in a different way (Morris, 1980). The problems generated by the own logic of the development of the relevant scientific areas have come to the fore. In particular, here we are talking about the closest connection between research in the field of symbolic logic and numerous attempts to create a logically consistent and flawless foundation of mathematics, which would not in the slightest degree appeal to empirical knowledge (Morris, 1980).

Another very important direction in the twentieth century was the creation and subsequent development of many-valued logics.

In the logic of Aristotle, the law of the excluded middle is formulated: any statement can be either true or false. The limitations of this position - at least from the point of view of the nature of everyday human thinking - became one of the motives for creating polysemantic logics at the beginning of the 20th century.

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An equally significant motive was the creation of non-Euclidean geometries, which forced the question of creating a "non-Aristotelian" logic to be raised.

Pioneer works in this direction are written by the outstanding Polish thinker Jan Lukasiewicz, who created three-valued logic in the first quarter of the 20th century (Lukasiewicz, 1970). He introduced the fractional value of the boolean variable $\frac{1}{2}$ (1 is true, 0 is false, $\frac{1}{2}$ is undefined).

Research devoted to the philosophical aspects of many-valued logic has been very actively carried out throughout the 20th century, and is no less actively continuing at the present time (Rapoport, 2011; Fitting & Orłowska, 2013; Dubois & Prade, 2001; Seddikin et al., 2023). However, as will be clearly demonstrated below, the approach developed by J. Lukasiewicz and his numerous followers de facto implied a rejection of the centuries-old tradition, according to which logic was considered as a tool to reveal the laws of thought.

There is no doubt that objective circumstances also played a significant role in such a development of events. The professionalization of science and the formation of its branched disciplinary structure in the first half of the 20th century led to the fact that the laws of thought became de facto part of the subject field of psychology (and a number of other humanitarian disciplines), while mathematical (symbolic) logic focused on the development of various kinds of structures, which often do not have an adequate interpretation at all (in particular, from the point of view of real use in applied sciences).

In modern conditions, when the issue of creating a new paradigm for the development of science, complementary to the post-industrial (with all the conventionality of this term) society, is acute, it is no longer possible to put up with this state of affairs. We emphasize that in the anniversary report of the Club of Rome (Weizsäcker & Wijkman, 2018), which is de facto the official elite of the world community, the thesis was put forward about the need for the formation of the New Enlightenment.

With regard to the problems caused by the negative impact of the overly branched disciplinary structure of science on the dynamics of scientific and technological progress, this thesis means that we are no longer talking about simply overcoming interdisciplinary barriers. On the agenda is the question of a new synthesis of sciences, the question of creating tools capable of creating a complete picture of the universe.

The challenges that humanity faces require the creation of an adequate image of the future. This requires tools for adequate forecasting at the systemic (civilizational) level. None of the concrete scientific disciplines, the format of which was formed by the end of the 20th century, will certainly be able to cope with such a task. The time has come to recognize that the division of sciences into natural and humanities is nothing more than a kind of artificial classification instrument introduced only for the sake of convenience (including the convenience of managing science as a social institution). At a certain historical stage, he played a positive role, in modern conditions - on the contrary.

It is no coincidence that an increasing number of supporters are acquiring the thesis of the convergence of natural science and the humanities, as well as the thesis of the renaissance of philosophy as a metascientific discipline that ensures the formation of a unified picture of the universe.

The implementation of this program, obviously, involves the creation of an appropriate methodological foundation.

Returning to Aristotle, it seems appropriate to start building such a foundation from the foundation of the foundations - from logic in the original meaning of the word, i.e. as the science of the laws of thought.

There is, however, a more than important nuance. A person's thinking is largely determined by the sociocultural code of the ethnic and/or social system/subsystem to which this person belongs. It is noteworthy that thinking (in the broad sense of the term), strictly speaking, is not necessarily connected with logic, understood in the spirit of the Western European paradigm of science. Moreover, the apparatus of formal logic, which goes back to Aristotle, is a later invention. The fact, in particular, is shown by the studies of Lévy-Bruhl, L. (Lévy-Bruhl, 1963); it was shown that primitive cultures lacked logical thinking as such.

The style of thinking generated by different socio-cultural codes can be (and is) different. The fact cannot be ignored when developing the methodological foundations of that logic, which is called upon to solve problems inherent in it historically, but already at a different stage of historical development.

The purpose of this work is to substantiate the need to take into account the factors associated with the peculiarities of the formation of a sociocultural code in the development of logic, which is considered as a discipline designed to abstract the laws of thinking from an array of results accumulated by scientific and protoscientific knowledge.

We emphasize that thinking is obviously not connected only with scientific knowledge. At a minimum, there is intuition, including the intuition of a scientific worker. In addition, any of the existing sciences in its development passed the stage of protoscience. Therefore, when speaking about thinking as such, such factors cannot be ignored.

Some Features of the Development of Symbolic Logic in the 20th Century

The development of many-valued logic in the twentieth century proceeded in several directions. In addition to works aimed at studying the philosophical aspects of such logics (Malinowski, 2007), we can mention numerous works aimed at reconciling them in technology, for example (Jo et al., 2021), in cryptography (Bykovsky & Kompanets, 2018), in telecommunication technologies (Kalimulina, 2021), in digital signal processing (Suleimenov, Matrassulova & Vitulyova, 2022), etc.

The main direction in this area, however, remained the creation of more and more varieties of many-valued logics, which, for example, include paracomplete and paraconsistent logics (Usó-Doménech et al., 2015; Caret, 2017; Abe et al., 2019). The fundamental problem, as noted in (Strollo, 2022), is the interpretation of the values of many-valued logic. Indeed, it is far from obvious what can be understood by "truth" if there are more than two logical variables. As noted above, this state of affairs is largely due to the fact that logic, as an independent scientific discipline, has its own subject field, which very little overlaps with disciplines that study the nature of the functioning of the human mind and the nature of thinking as such.

This state of affairs has led to the fact that the achievements of many-valued logic are not as widely used in practice as the scientific directions using binary logic. Behind binary logic, in essence, is not only convenience and visibility of use, but also an ancient philosophical tradition, long and firmly embedded in the mass consciousness of the scientific and technical community.

It is far from accidental that (Kulik, 2000) states: "By the end of the 20th century, the problem of the connection between logic and thinking was in the margins of science, and this circumstance became one of the main reasons for the loss of public interest in logic. Logic gradually turned into a loose collection of closed and self-sufficient languages for correspondence between specialists". This point of view is, of course, quite radical, but, as noted in (Zaitsev, 2011), in modern logic the problem of generalization and classification of the currently existing variety of "logics" is really quite acute, as well as the problem of "establishing links and relationships between different logical theories, sometimes even formulated in different languages".

The development of artificial intelligence systems, however, forces us to return to the point of view that was held by J. Boole and other researchers who laid the foundation for modern symbolic logic.

As noted in (Karpenko, 2003), the author of which is one of the most prominent specialists in the field of philosophical and mathematical logic, "Gabbay predicts that the day is not far off when a computer scientist wakes up with the realization that his professional occupation belongs to formal philosophy."

In particular, it turns out that even to answer the question of which specific systems should be considered as AI and which should not (discussions on this topic have been going on for a very long time), philosophy cannot be dispensed with. The discussions mentioned above will remain pointless until the essence of intelligence as such is revealed (Suleimenov et al., 2020).

It is obvious that it is not possible to establish the essence of intellect, bypassing the question of the laws of thought. At the same time, it is important to take into account that the thinking of the biological prototype of artificial intelligence cannot be reduced to binary logic (Gabrielyan, Vitulyova & Suleimenov,

2022), and moreover, the laws of thinking, as noted above, cannot be fully disclosed without taking into account the factors associated with the formation of a sociocultural code.

Research Methods

The basic research method is based on the theory of sociocultural codes. This term is now replacing the much less specific concept of "mentality". Such a transformation of the conceptual apparatus is due to the fact that the term sociocultural code directly reflects the existence of transpersonal information structures (Bakirov et al., 2021), which are really capable of "programming" human behavior.

In a simplified interpretation, the sociocultural code is an "executable program" that dictates a certain style of thinking and behavior to a person, sometimes in a direct form (for example, through the mechanisms of the dictates of the environment, which often force the individual to act contrary to his interests and views).

The essence of the sociocultural code is revealed by the neural network theory of the noosphere (Suleimenov et al., 2022). Briefly, its main idea can be revealed as follows.

Consider two people entering into a dialogue. It is customary to say that in this case two individuals exchange information, but this is nothing more than an approximation, and a rather rough one at that. In reality, there is an exchange of signals between the neurons that enter the brain of the interlocutors, i.e. interpersonal communication leads to the emergence of a common neural network. Continuing this reasoning, we come to the conclusion about the existence of a global neural network, which can be identified with the noosphere, understood according to V.I. Vernadsky.

Further, the exchange of signals localized within the brain of an individual gives rise to such entities as the mind, consciousness and intellect of a person. Similarly, the exchange of signals between neurons of the global neural network generates non-trivial information entities of a transpersonal nature, or rather, a transpersonal level of information processing. The emergence of such entities is due to the fact that the "information capabilities" of neural networks depend non-linearly on the number of neurons - otherwise it would not make sense to create neural networks from an increasing number of elements, as is the case in practice.

Information objects that are formed at the transpersonal level of information processing may have a different nature. One example is any of the natural languages. This is an information object that is by no means localized in the memory of individual people; it exists and develops only through interpersonal communication. Umberto Eco (Eco, 2019) expressed this metaphorically: "it is not we who speak the language, it is the language that speaks us."

The existence of a transpersonal level of information processing, among other things, leads to the conclusion about the dual nature of the intellect, consciousness and mind of a person (these concepts are by no means identical). In the human mind, both individual and collective components are present at the same time. This conclusion clearly correlates, among other things, with the well-known philosophical conclusion: "social consciousness is not reduced to the consciousness of individuals." Moreover, within the framework of the neural network theory of the noosphere, this and similar theses receive consistent justification from a natural science point of view.

However, for the purposes of this work, it is most important that the neural network theory of the noosphere allows us to reveal the essence of the archetypes understood according to Jung, and further connect them with the categories used by logic. It is this tool that is used to analyze the problems of multivalued logic from the point of view of the theory of sociocultural codes.

Results and Discussion

Category of Truth from the Point of View of the Theory of Sociocultural Codes

As shown above, multi-valued logic faces a significant problem in the interpretation of its variables. In part, this problem is removed in ternary logic, where a variable can be introduced that corresponds to the state "Uncertain" or "Maybe". However, with a larger number of logical variables, a non-trivial question arises about how their values can correlate with the philosophical category of Truth.

From our point of view, it is necessary to go beyond the plane of the opposition "Truth - Falsehood", having considered the question of what "Truth" is from the point of view of the theory of sociocultural codes.

One of the undoubted advantages of the theory of sociocultural codes is the ability to give a consistent natural scientific interpretation of the essence of archetypes. These are some basic elements that structure the nature of the interaction of transpersonal information structures with individuals. The easiest way to prove this is by referring to ancient Greek mythology.

The images of ancient deities are associated with archetypes. The most indicative in this regard is the cults of Rhea, Cybele or Astarte, i.e. deity, rigidly associated with the archetype of the Mother (Casadio, 2003).

From the point of view of the neural network theory of the noosphere, ancient deities are, in a certain sense, real. These are reflections of transpersonal information structures by means available to people of that historical era. Otherwise, it can be said that ancient deities are a kind of metaphor of transpersonal information structures, formed in natural language, which could not fully reveal the true essence of these objects, which, moreover, were and remain inaccessible to direct sensory perception.

It should also be taken into account that during the formation of the mind, its collective component could not but be dominant. Traces of this are still clearly visible in all cultures where traditions inherited from the tribal organization of society are strong.

With the dominance of the collective component, interaction with transpersonal information structures was much closer than in later historical periods. Ancient Greek myths speak of the direct intervention of ancient deities in the affairs of people, and there is every reason to believe that this is an indirect, significantly distorted reflection of the processes that took place in that historical period when the individual component of the mind gradually became dominant.

At the same time, the perception of transpersonal information structures gradually ceased to focus on myths as a source that codifies the norms of behavior, ideas about the universe, etc., but the public consciousness (or rather, the collective component of consciousness) fixed the basic images, which are the archetypes.

Consequently, archetypes, among other things, can be interpreted (in modern terms) as some kind of "genomes of culture", serving as a link between the personal and transpersonal levels of information processing.

From this point of view, the initial sense of category "Truth" is, in essence, also an archetype. This judgment is correct, at least in the sense that any sociocultural code, along with the archetypes discovered by Jung and his followers, includes deep ideas about truth, justice, etc. More precisely, everything that reflects the word "Truth" so far occupies a unique place. This is both a reflection of a certain archetype, and a philosophical category, and a variable of binary logic. From the point of view of the theory of sociocultural codes, the uniqueness of its position is determined by the fact that the category of Truth simultaneously belongs to both the "world of archetypes" and the "world of formalized concepts".

There is another argument in favor of this judgment. From the point of view of the theory of sociocultural codes, the "quanta" of thinking, or the "quanta" of reflection, are precisely the archetypes (as noted above, they can be interpreted by analogy with the "genomes of culture", which are widely represented in the modern information space).

At a minimum, they form the basis of any pre-scientific/extra-scientific classification used by both individual and collective consciousness in everyday life. Willingly or involuntarily, but any person correlates his own and other people's judgments, as well as the phenomena of the surrounding reality, with what lies at the basis of his consciousness as such. So, a lot of what happens in the world around (the existence of state / power structures, the existence of industrial discipline, etc.) the individual correlates with the image of the Father (in the sense of Jung's theory).

Aristotle's logic successfully singled out and formalized one such "quantum" - what is called the category of Truth.

Therefore, the generalization of Aristotle's judgments is as follows.

Human thinking operates with a complex system of concepts. These concepts are interrelated and interdependent. But, behind this system is what forms their "framework" - archetypes. Some of them allow description in one or another natural language (and even allow for formalization), some do not.

But, any judgments of any person, i.e. the process of his thinking is inevitably formed by the projection of these judgments (as a means of reflecting the phenomena and events of the surrounding world) onto one or another archetype or their totality.

Aristotle's logic formalizes the projection of judgments onto one of these archetypes.

Therefore, its generalization should provide for the formalization of such a projection onto other archetypes.

In this respect many-valued logic is of more than significant interest for the purposes of this paper. Let's show it.

The formalization of the archetype corresponding to the category of Truth is ensured by the existence of a natural opposition "Truth - Falsehood". In this regard, it is appropriate to recall that objective dialectics defines all basic philosophical categories through the opposition: "Quantity - Quality", "Content - Form", etc.

This circumstance is closely connected with the existence of undefined concepts. Any explanatory dictionary reveals the meaning of words of natural language through other ones. Undefined concepts are needed in order to avoid a vicious logical circle.

Here, however, there is a nuance. Any natural language forms a well-defined system in which the meaning of concepts is given solely through their connection with others. Outside of this connection, any word will be nothing more than a certain set of symbols or sounds.

Consequently, there is every reason to assert that undefined concepts can be revealed only through connections between them, and direct opposition corresponds to only one of the varieties of such connections.

More precisely, opposition is the simplest form of connection between concepts, the one that corresponds to the simplest (binary) logic. Relationships between concepts can also be of a more complex nature, which makes us pay close attention to the tools of multi-valued logic.

The following non-trivial question arises. Any developed natural language has more than 10,000 words, especially if you count the technical terms. Obviously, establishing a connection between all these words (if we interpret them as concepts) is a task of such a level that even if it is solved with the help of a computer, the result will still be impossible to interpret due to the significant amount of data received.

This returns to the question of archetypes as some kind of "reflection quanta" of being.

The number of archetypes (even in the broad sense of the term) that form the "framework" not only of any natural language, but also of thinking, is orders of magnitude smaller.

Therefore, again starting from the proposed understanding of the category of Truth, the problem that modern ontology tries to solve (in the technical sense of this term (Daya, 2010)) should be solved not in relation to the terms of natural language, but to what stands behind them, i.e. to archetypes. (It is appropriate to emphasize that there are already significant attempts to use many-valued logic in linguistics (Charalambidis et al., 2021).

We emphasize once again: from the theory of the socio-cultural code, it unequivocally follows that the laws of thinking cannot be established only on the basis of an analysis of the behavior of individuals. Thinking as such is determined, among other things, by transpersonal information structures, the "logic" of which remains unknown (the correct formulation is that the algorithms for processing information by transpersonal information structures remain unknown).

Let us demonstrate the constructiveness of the proposed approach on the example of the interpretation of the category "Qi". This category obviously has nothing to do with the European socio-cultural code and, strictly speaking, remains difficult to interpret using the means of any of the Indo-European languages.

However, the massive interest in the Chinese teaching of Feng Shui, which arose in the Eurasian states at the end of the 20th century, led to the category “Qi” being assimilated to a certain extent by the culture of the Eurasian peoples. Therefore, it should not be ruled out that the proposed interpretation of the category “Qi” should be associated not with the Chinese, but with the Eurasian sociocultural code.

Category “Qi” from the Point of View of the Theory of Socio-Cultural Codes

The category “Qi” is one of the most important for Chinese philosophy and Chinese tradition in general.

The official website of the Chinese Consulate General in Khabarovsk, affiliated with the official website of the Chinese Foreign Ministry, provides the following popular interpretation of this category (Xi Jinping, 2022).

According to Chinese ideas, the world and even the entire cosmos are permeated with the finest material substance - the life energy “Qi”. In us, people, “Qi” also flows. We all constantly perceive it when, for example, we breathe or eat. But still “Qi” means something more than just that. This concept covers the mental and spiritual energy of every living being. “Qi” is the force that governs all processes inside the body and beyond, both living and inanimate matter. Other basic substances are also composed of Qi

The highest level of inclusion of the “Qi” category (as well as the closely related Feng Shui teachings) in the Chinese information space (Wen et al., 2021; Chen et al., 2018) allows us to assert that this concept for Chinese culture lies on the same level as Jung’s archetypes for European.

This conclusion is also confirmed by the difficulties of interpreting the category under consideration by means of the Indo-European languages. Recall that Jung interpreted the concept of archetype as follows. “The archetype itself is a hypothetical image, inaccessible to contemplation, like what is called “pattern of behavior” in biology (Jung, 1954). For clarity, he compared the archetype with the system of crystal axes, which, being itself immaterial, “forms” a crystal in solution, “orienting” the particles of matter in it in an appropriate way. The concept of an archetype “eludes” a straightforward interpretation, like the archetypes themselves, which gives rise to a plurality of interpretations and the need to resort to allegories and metaphors.

Similarly, the category “Qi” does not allow a straightforward interpretation and in various sources it is interpreted as “energy”, and as “ether”, and as “life force”. All these descriptions are nothing more than illustrative, but namely such descriptions form the basis for the reflection of this category by the mass consciousness of the Eurasian peoples.

Let us show that the category “Qi” (at least in its Eurasian interpretation) can be consistently interpreted from the standpoint of classical dialectics.

From our point of view, defended in works (Vitulyova et al., 2020), information should be considered as a dialectical category, paired with the category of matter. This, among other things, makes it possible to avoid a logical vicious circle in the interpretation of this concept. Further, as emphasized in the cited works, the category “information” corresponds to an equally large variety of objects that the category “matter”. The world as an objective reality “consists” of two components - material (in the physical sense of this term) and informational (which is also material, but in the sense that it is a manifestation of objective reality). These “components” fully comply with the law of unity and struggle of opposites. Matter cannot be “deprived” of information (any object carries information at least only about itself). Information cannot exist without a material carrier.

Such a duality of the universe is expressed, in particular, in the fact that information objects also form a hierarchy of levels of organization, similar to the levels of organization of matter (from mechanical to biological and further social).

At one of the highest levels of this hierarchy is the human intellect, but there are numerous intermediate levels.

Let's consider an illustrative example. Geometry textbooks prove the Pythagorean theorem. The statement of this theorem, on the one hand, is a plain text, so the amount of information contained in it can be calculated using the Shannon’s formula. On the other hand, many others conclusions are proved on the basis of this theorem. From this point of view, the information contained in the Pythagorean theorem is

much more than is given by the direct use of Shannon's formula. Such a calculation does not take into account the fact that an information object is considered that belongs to a higher level of the hierarchy than "just text".

At even higher levels of the hierarchy under consideration there are information objects capable of exhibiting their own non-trivial behavior. An example of such an object is the socio-cultural code of any ethnic group, the nature of which was discussed above. We emphasize that the sociocultural code is generated not by its carriers, but by the connections that exist between them - and in this sense, the behavior of each individual carrier for its existence is secondary. Some carriers may die off, but their place is taken by others, who, due to branched ties within an ethnic group, also acquire qualities dictated by the sociocultural code.

These and similar examples show that there really are information objects that have their own non-trivial behavior.

Let us compare this conclusion with the interpretation of the concept of "energy" generally accepted for modern physics.

The most correct (and general) definition sounds like this: energy is a quantitative measure that characterizes motion as a form of existence of matter.

Recall that behind the term "energy" in its modern interpretation as a physical quantity measured in Joules or ergs, historically there was nothing but mathematical formulas (Lopes, 2009; Berzina et al., 2019). Initially, this concept arose as an integral of motion of differential equations of mechanics. Only by the end of the 19th century, with the establishment of the mechanical equivalent of heat and the development of thermodynamics, this concept began to be given a universal meaning, reflected by the law of conservation of energy (Lopes, 2009; Berzina et al., 2019).

The mass use of the term "energy" in everyday language (including in relation to mental phenomena) refers to even later stages. There is, however, a nuance: there are grounds for classifying the concept of energy as an archetypal one.

The term "ἐνέργεια" was used by Aristotle in the sense of "real implementation of an action, as opposed to only its possibility of its implementation" (Murphy, 2015). In a similar sense, this term was used in medieval theology. Thus, Gregory of Nyssa argued that the terms applicable to God (the very name "God", as well as such descriptive terms as "good", "fair") indicate not the divine nature, but the divine "energies" (Geerts et al., 2014). He distinguished between divine "energies", which are knowable and can be named, and the divine essence, which has no name and is known only through the "energies", the source of which is (Geerts et al., 2014). This tradition has been preserved for a very long time (and is preserved in Christian philosophy today). So, according to A.F. Losev "the name of God is the energy of God, inseparable from the very essence of God, and therefore there is God himself" (Plakhtiy, 2021).

From the point of view of the neural network theory of the noosphere, it can be argued that the concept of "energy", with all the ambiguities of its interpretation, is "fixed" by the socio-cultural code of European civilization. This explains both the fact that this concept so easily entered the mass consciousness already by the beginning of the 20th century, and the fact that in the humanities literature, attempts to interpret many phenomena of the psyche from the point of view of ideas about "energy" do not stop (Lieberman, 2007; Millett, 2001).

This, apparently, should explain the fact that the interpretation of the category "Qi" through the term "energy" is most often used when translating Chinese texts into Indo-European languages, and the fact that this category so easily entered the Eurasian and European cultural environment.

Returning to the interpretation of information as a dialectical category, a paired category of matter, we note that information can also manifest properties that are interpreted by analogy with movement.

For example, the information objects discussed above (such as a sociocultural code) can have a pronounced effect on carriers. Simplifying, different information objects may have different "life force" (note that Leibniz originally used this term when speaking of energy in the physical sense of the term).

Therefore, proceeding from the principle of dialectical symmetry, there should be a category paired with the category of energy. The relation between this category and category of information should be the same as between category of energy and category of matter (Table 1).

In accordance with the above, the missing place in this table should be replaced by the category “Qi”, at least in the sense in which it was assimilated by the Eurasian cultural environment (Suleimenov, Gabrielyan & Bakirov, 2023).

Table 1.

Matter	Information
Energy	? = "Qi"? or "World Spirit", "Soul"

We emphasize that we used the Chinese term not only to demonstrate the possible penetration of archetypes from one cultural environment into another, but also for lack of a more suitable term in the other languages. With more than a serious stretch, one could use the term "World Spirit", but it is already taken and in the traditional interpretation has a completely different meaning. The same applies to any terms built on the basis of the word "soul".

Further, the construction that led to the interpretation of the category "Qi" in accordance with Table. 1, in essence, is a step towards the construction of rules that provide the formalization of archetypes and / or concepts close to them.

This table defines a set of concepts close to archetypes through the connections between them, and these connections are more complex than simple opposition. Formally, this table corresponds to the application of four-valued logic, but this correspondence is more an illustration of the main idea of this article than a real tool for using multi-valued logic for the operationalization of archetypes.

The use of multi-valued logic becomes significant if we move from the extremely simplified Table. 1 to its expansion.

The proposed method of expanding such correspondences as reflected in Table. 1 is as follows.

Based on the dialectical opposition of concepts, it is possible to identify the connection of the pair under consideration with other concepts.

To identify such a connection, one can use, for example, the ancient Indian system catuskotika (that is, “having four peaks”), developed in the 6th–4th centuries BC. This system operates with four variants of judgment about an object: it is, it is not-is, it is and is not-is, it neither is nor is not-is (Ruegg, 1971).

If we consider this scheme from the point of view of the category of Truth, then it is indeed very difficult to understand.

However, it has a transparent meaning if it is applied to identifying relationships between concepts.

For example, consider the opposition "hot-cold". Any of these concepts can be considered as corresponding to the pair “he is” and “he is not-is” according to catuskotika. The very concept of “temperature” corresponds to the top “it is and is not-is”.

Note that this connection also corresponds to the simplest version of Hegel's triad: the concept of "temperature" combines the concepts of "hot" and "cold" in their unity and opposition.

The top "it neither is nor is not" in this interpretation, obviously, corresponds to any phenomena or objects to which the concept of "temperature" is not applicable at all. Recall that temperature as a physical quantity is introduced only within the framework of statistical physics; it is not applicable to single molecules at all - they are characterized only by kinetic energy.

A less obvious, but more interesting example is the consideration of the dialectical pair "matter - information". This pair can also be interpreted from the point of view of the law of unity and struggle of opposites. Indeed, it is impossible in principle to imagine an object that has no informational content - it

carries information at least about itself. Similarly, information cannot exist without a material carrier. But matter is not reducible to any form of information and vice versa.

Let's put the question in the following way. It follows from the law of unity and struggle of opposites that there must be concepts that reflect both “unity” and “opposite” of concepts related to a specific dialectical pair, in particular, the “matter-information” pair.

"Opposite" is realized when the "unity" is destroyed.

More precisely, starting from the scheme of catuskotika and the provisions of classical dialectics, it is permissible to assert that the very concept of “negation” should also be dialectical.

Classical for dialectics is negation in the Hegelian sense (the law of negation of negation). Opposite to it is the concept of negation, expressing "opposite" as the destruction of "unity".

In relation to the pair "matter - information", on the basis of this reasoning, it is permissible to introduce the category of alienated information.

Namely, a prerequisite for the generation of any information (in the "everyday" sense of the term) is the observation of any object. For example, information about the properties of a particular chemical compound is obtained in the laboratory during experiments.

This information was initially carried by the studied chemical compounds themselves. Such information was one with the material carrier in the full sense of the word. The activity of the experimenter led to the emergence of a new object - alienated information, and when it was received, the original unity was destroyed.

From the point of view of dialectics, the category of alienated information must have a pair. Such a pair, from our point of view, is the signal category.

The reasons for this are as follows. Signal transmission as such is a physical process. However, a signal is a signal only when it carries information, and precisely alienated information.

It can be seen that the use of two different negatives makes it possible to construct a scheme in which the connection will be revealed not between four, but between six concepts.

Constructions of this kind can be carried out further (especially since the current state of research in the field of many-valued logics allows us to consider various types of contradictions, which is already being used in the humanities (Lurie & Mitrenina, 2020)), but this is already beyond the scope of this work.

Summing up, it can be argued that it is possible to offer a specific method for identifying the relationship between concepts, including the archetypal level, i.e. those that not only create the "framework" of any of the natural languages, but also serve as "reflection quanta", i.e. those elements with which thinking ultimately operates. Finding such connections, in contrast to finding connections between all the concepts of a natural language, is a much simpler task, and multivalued logic is indeed the natural way to solve it.

This approach supposes that each "quantum of reflection" is associated with a certain value of a variable of many-valued logic.

Due to this, the links between the “reflection quanta” can be formalized. The simplest case takes place when the number of logical variables is equal to the power of some integer. In this case, each value of the variable can be associated with an element of a well-defined Galois field. Any operations on such elements (functions whose arguments are elements of the field) are reduced to addition and multiplication operations, just as is the case for binary logic.

We emphasize that this approach, among other things, allows us to remove automatically the problem of interpreting the values of variables of many-valued logic (the problem of their truth). The sense of the “reflection quanta”, which in themselves are nothing more than a set of symbols or sounds, is given by the connections between them; namely such connections form the "framework" of the language with which thinking operates.

Conclusion

At present, in research in the field of logic, there is an urgent need to return to the origins - to the interpretation of logic as a discipline designed to establish objective laws of thought. It turns out that this issue is closely related, among other things, to the problems of artificial intelligence. The prerequisite for “endowing” it with thinking is precisely the establishment of the laws of thinking as such.

At the same time, as it follows from the neural network theory of the noosphere, the human consciousness has a dual nature - it simultaneously contains both an individual and a collective “component”. The latter is responsible for the formation of the sociocultural code (mentality), the collective unconscious, etc.

Consequently, thinking as such cannot be reduced to concepts operated by individuals using the means of natural language. "Reflection quanta" is something else, lying on the archetypal level of perception of the existent.

The meaning of such "reflection quanta" or the meaning of "genomes of the socio-cultural code" can be revealed through the connections between them. A similar technique, in essence, is used by objective dialectics, defining basic concepts (categories) through opposition. Such opposition, however, is only the simplest version of the connection between concepts, which corresponds to binary logic.

Multi-valued logic allows one to establish and analyze more complex connections that form the "framework" of a natural language, as a form of realization of thinking, through "reflection quanta" or through "genomes of the sociocultural code".

Such an approach, among other things, automatically removes the problem of interpreting the values of variables of many-valued logic: as in classical objective dialectics, connections between them (and only they) give meaning to undefined concepts.

The proposed approach includes classical ideas about logic as a special case. For example, the category of Truth can be interpreted in two ways. On the one hand, this is the most complex philosophical category, on the other hand, it can be considered as a reflection of one of the archetypes understood in the sense of Jung.

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References

- Abe, J. M., Nakamatsu, K., & Silva Filho, J. I. D. (2019). Three decades of paraconsistent annotated logics: A review paper on some applications. *Procedia Computer Science*, 159, 1175–1181. <https://doi.org/10.1016/j.procs.2019.09.286>
- Bakirov, A. S., Vitulyova, Y. S., Zotkin, A. A., & Suleimenov, I. E. (2021). Internet user's behavior from the standpoint of the neural network theory of society: prerequisites for the meta-education concept formation. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLVI-4/W5-2021, 83–90. <https://doi.org/10.5194/isprs-archives-XLVI-4-W5-2021-83-2021>
- Berzina, K., Kunicina, N., Ziravecka, A., & Caiko, J. (2019). Promoting of Lifelong Learning in Engineering. 2019 IEEE 60th International Scientific Conference on Power and Electrical Engineering of Riga Technical University (RTUCON), 1–4. <https://doi.org/10.1109/RTUCON48111.2019.8982289>
- Bykovsky, A. Y., & Kompanets, I. N. (2018). Quantum cryptography and combined schemes of quantum cryptography communication networks. *Quantum Electronics*, 48(9), 777–801. <https://doi.org/10.1070/QEL16732>
- Caret, C. (2017). Hybridized Paracomplete and Paraconsistent Logics. *The Australasian Journal of Logic*, 14(1). <https://doi.org/10.26686/ajl.v14i1.4035>
- Casadio, G. (2003). The Failing Male God: Emasculation, Death and Other Accidents in the Ancient Mediterranean World. *Numen*, 50(3), 231–268. <https://doi.org/10.1163/156852703322192400>
- Charalambidis, A., Papadimitriou, G., Rondogiannis P., & Troumpoukis, A. (2021). A Many-valued Logic for Lexicographic Preference Representation. In *Proceedings of the International Conference on Principles of Knowledge Representation and Reasoning*, 18(1), 646–650.
- Chen, B., Coggins, C., Minor, J., & Zhang, Y. (2018). Fengshui forests and village landscapes in China: Geographic extent, socioecological significance, and conservation prospects. *Urban Forestry & Urban Greening*, 31, 79–92. <https://doi.org/10.1016/j.ufug.2017.12.011>
- Daya, C. (2010). Wimalasuriya, Dejing Dou. Ontology-based information extraction: An introduction and a survey of current approaches, *Journal of Information Science*, 36(3), 306–323. <https://doi.org/10.1177/0165551509360123>

- Dubois, D., & Prade, H. (2001). Possibility theory, probability theory and multiple-valued logics: A clarification. *Annals of Mathematics and Artificial Intelligence*, 32(1/4), 35–66. <https://doi.org/10.1023/A:1016740830286>
- Eco, U. (2019). *La struttura assente. Introduzione alla ricerca semiologica*. Bompiani; quinta edizione o successive (1 gennaio 1968)
- Fitting, M., & Orłowska, E. (Eds.). (2003). *Beyond Two: Theory and Applications of Multiple-Valued Logic*. Physica-Verlag HD, 114. <https://doi.org/10.1007/978-3-7908-1769-0>
- Gabrielyan, O.A., Vitulyova, Ye. S. & Suleimenov I. E. (2022). Multi-valued logics as an advanced basis for artificial intelligence, *Wisdom*, 1(21), 170–181.
- Geerts, R.-J., Gremmen, B., Jacobs, J., & Ruivenkamp, G. (2014). Towards a philosophy of energy. *Scientiae Studia*, 12(spe), 105–127. <https://doi.org/10.1590/S1678-31662014000400006>
- Jo, S.-W., Choi, J., Hayakawa, R., Wakayama, Y., Jung, S., & Kim, C.-H. (2021). Organic-semiconductor nanoarchitectonics for multi-valued logic circuits with ideal transfer characteristics. *Journal of Materials Chemistry*, 9(43), 15415–15421. <https://doi.org/10.1039/D1TC04366H>
- Jung, C. G. (1954). *Von den Wurzeln des Bewusstseins: Studien über den Archetypus*. Rascher, 681.
- Kalimulina, E. Yu. (2021). Application of Multi-Valued Logic Models in Traffic Aggregation Problems in Mobile Networks. 2021 IEEE 15th International Conference on Application of Information and Communication Technologies (AICT), 1–6. <https://doi.org/10.1109/AICT52784.2021.9620244>
- Karpenko, A. S. (2014). Philosophical Problems of Foundations of Logic. *Studia Humana*, 3(1), 13–26. <https://doi.org/10.2478/sh-2014-0002>
- Kulik, B. A. (2000). What is modern logic going with in the 21-st century? *Vestnik RFBR*. 3 (21).
- Lévy-Bruhl, L. (1963). *Le surnaturel et la nature dans la mentalité primitive*. Presses universitaires de France, 568.
- Lieberman, H. R. (2007). Cognitive methods for assessing mental energy. *Nutritional Neuroscience*, 10(5–6), 229–242. <https://doi.org/10.1080/10284150701722273>
- Lopes Coelho, R. (2009). On the Concept of Energy: How Understanding its History can Improve Physics Teaching. *Science & Education*, 18(8), 961–983. <https://doi.org/10.1007/s11191-007-9128-0>
- Lukasiewicz, J. (1970). On Three-Valued Logic Jan Lukasiewicz. *Selected Works* Ed. by L. Borkowski, 87–88. Amsterdam, North-Holland.
- Lurie, V. Mitrenina, O., (2020). Indirect meanings in natural language and inconsistent logics, *Logical and Philosophical Studies*. 18(2), 71–111. <https://doi.org/10.52119/LPHS.2020.66.28.005>
- Malinowski, G. (2007). Many-Valued Logic and its Philosophy. In *Handbook of the History of Logic*, 8, 13–94. [https://doi.org/10.1016/S1874-5857\(07\)80004-5](https://doi.org/10.1016/S1874-5857(07)80004-5)
- Millett, D. (2001). Hans Berger: From Psychic Energy to the EEG. *Perspectives in Biology and Medicine*, 44(4), 522–542. <https://doi.org/10.1353/pbm.2001.0070>
- Morris, K. (1980). *Mathematics. The Loss of Certainty*. NY, Oxford University Press, 366, ISBN 0-19-502754-X
- Murphy, J. (2015). Aristotle’s KINHΣΙΣ-ENEPIEIA Distinction and the Ends of Human Action. *Aristos: A Biannual Journal Featuring Excellent Student Works*, 1(2), 1–22. <https://doi.org/10.32613/aristos/2015.1.2.5>
- Plakhtiy, S. V., (2021). Disclosure of the term “energy” in the “Philosophy of the Name” by A.F. Losev. *Philosophical Thought*, 1, 24–39. [in Russian].
- Rapoport, D. L. (2011). Surmounting the Cartesian Cut Through Philosophy, Physics, Logic, Cybernetics, and Geometry: Self-reference, Torsion, the Klein Bottle, the Time Operator, Multivalued Logics and Quantum Mechanics. *Foundations of Physics*, 41(1), 33–76. <https://doi.org/10.1007/s10701-009-9334-5>
- Ruegg, D. S. (1971). On the Knowability and Expressibility of Absolute Reality in Buddhism. *Journal of Indian and Buddhist Studies (Indogaku Bukkyogaku Kenkyu)*, 20(1), 495–489. <https://doi.org/10.4259/ibk.20.495>
- Strollo, A. (2021). Truth Pluralism and Many-Valued Logic: Lesson from Suszko’s Thesis. *The Philosophical Quarterly*, 72(1), 155–176. <https://doi.org/10.1093/pq/pqab018>
- Suleimenov, I.E., Gabrielyan, O.A. & Bakirov, A.S. (2023). Neural Network Approach to the Interpretation of Ancient Chinese Geomancy Feng Shui Practices. *European Journal of Science and Theology*. 19(2), 39–51.
- Suleimenov, I. E., Gabrielyan, O. A., Bakirov, A. S., & Vitulyova, Y. S. (2019). Dialectical Understanding of Information in the Context of the Artificial Intelligence Problems. *IOP Conference Series: Materials Science and Engineering*, 630(1), 012007. <https://doi.org/10.1088/1757-899X/630/1/012007>
- Suleimenov, I. E., Matrassulova, D. K., Moldakhan, I., Vitulyova, Y. S., Kabdushev, S. B., & Bakirov, A. S. (2022). Distributed memory of neural networks and the problem of the intelligence’s essence. *Bulletin of Electrical Engineering and Informatics*, 11(1), 510–520. <https://doi.org/10.11591/eei.v11i1.3463>
- Suleimenov, I. E., Matrassulova, D. K., Vitulyova, Ye. S., (2022). Construction of generalized Rademacher functions in terms of ternary logic: solving the problem of visibility of using Galois fields for digital signal processing. *International Journal of Electronics and Telecommunications*, 68(2), 237–244.
- Suleimenov, I. E., Vitulyova, Y. S., Bakirov, A. S., & Gabrielyan, O. A. (2020). Artificial Intelligence: What is it? *Proceedings of the 2020 6th International Conference on Computer and Technology Applications*, 22–25. <https://doi.org/10.1145/3397125.3397141>
- Seddikin, N. S. M., Burhanuddin, M. N., & Osman, Z. . (2023). Antecedents of employees’ engagement in Malaysian private higher education. *International Journal of Economics, Business and Management Studies*, 10(2), 51–62. <https://doi.org/10.55284/ijebms.v10i2.979>
- Usó-Doménech, J. L., Nescolarde-Selva, J., Pérez-Gonzaga, S., & Sabán, M. J. (2015). Paraconsistent multivalued logic and coincidentia oppositorum: evaluation with complex numbers. *American Journal of Systems and Software*, 3(1), 1–12. <http://dx.doi.org/10.12691/ajss-3-1-1>
- Vitulyova, Y. S., Bakirov, A. S., Baipakbayeva, S. T., & Suleimenov, I. E. (2020). Interpretation of the category of “complex” in terms of dialectical positivism. *IOP Conference Series: Materials Science and Engineering*, 946(1), 012004. <https://doi.org/10.1088/1757-899X/946/1/012004>

- Weizsäcker, E. U., & Wijkman, A. (2018). *Come On!: Capitalism, Short-termism, Population and the Destruction of the Planet*. Springer New York. <https://doi.org/10.1007/978-1-4939-7419-1>
- Wen, L., Li, Z., & Guo, X. (2021). Exploring Chinese Feng Shui Culture for Achieving Sustainability. *International Journal of Information Systems and Social Change (IJISSC)*, 12(3), 15–26.
- Xi, J. (10.12.2022). President Xi Jinping Attends the First China-Arab States Sum... <https://www.fmprc.gov.cn>.
- Zaitsev, D V. (2011). Truth, Consequence and Modern Logic, Logical Semantics: Perspectives for the Philosophy of Language and Epistemology. *Collection of scientific articles dedicated to the anniversary of E. D. Smirnova Moscow: Creative Economy*, 109–125.