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Language, information and the culture of science (part 1)[1]

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Abstract

The article describes the possibilities and restrictions faced in the process of the creation of an actual culturological area of the sciences about the nature and man. The elimination of the polysemantic limitation and hypothetical humanitarian discourse (from the point of view of chromatism, computer science and semantic logic) has been reached thanks to the construction of information models for those systemic functional communications of ontologically ideal predicates that are connected with their material denotations in the system. Information models of radiation and light absorption enable, firstly, to identify the semantics of the concepts "quantum" and "photon", secondly, to show the metaphysical character of representations about the wave function and, thirdly, to demonstrate the universal character of reflexion by tangential functions of characteristic properties of the absorbed (perceived) information. This leads to the construction of a meta-language that quite unequivocally establishes functional communications between diverse plans of difficult analysis systems, which are characteristic of the studied phenomenon, under boundary conditions. Intensional semantics of this meta-language (due to the universals of the created information models) enables to add known techniques and/or theories with the intrinsic additions based on experience. As a result, the author presents a possible area of a uniform science about the subject-objective relations of psychophysical culturanthropology.

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The relationship between the processes of reasoning and processes, formalized in logical models, is considered as a problem that requires study, and not as a postulate included in the definition[2].

M. Henle

Introduction

Humanitarians often imagine the natural science field of knowledge as something perfect, undeniable and rely on its adequacy to the modern development of science, which, in their opinion, is becoming more and more far from understanding. In fact, today virtually no section of physics, chemistry, and even biology and/or psychology is complete without references to such "incomprehensible" subject as quantum mechanics[3], which today is attributed to all conceivable and inconceivable successes in the development of modern technologies. But is it based on belief in words or on knowledge of words?

Generally speaking, each religious direction began with the Word (Scripture). What do "words" mean in modern knowledge? Can they precede the world of nature and/or culture? Are they information or is it just data for their information interpretation? After all, even Ludwig Wittgenstein revealed in "words" actually "a play on words". A play ... On words or meanings? And will this "play" have certain rules? Or there will be some "principles of uncertainty", " axioms of a probabilistic knowledge", which are historically and semantically go back to the construction of "belief" (religiosity), dividing humanity into different words (terminology) even in the exact sciences?

Today, almost all humanities are coming closer and closer to the need to start formalizing their databases. Therefore, the purpose of this article is to present the possibilities and restrictions of the ways of this formalization on the example of quantum mechanics and semantic logic in relation to the Goethe's principles of chromatism. To understand the meaning of further presentation, the reader may simply not pay attention to occasionally occurring formulas, which are given only as a semantic justification of logical reasoning.

Historically, quantum mechanics has its origins in the Faraday's experiments with metal filings, which was located along the lines of electromagnetic field in a certain way. Maxwell gave a mathematical description of these lines and spread it to the field itself. In turn, Erwin Schroedinger used this spreading for the description of the microcosm itself and, in particular, "planetary" representations of Rutherford, Bohr and Planck on the structure of the atom and light.

However, it is unlikely that the *macro*cosm of metal filings was adequate to *micro*components of the electromagnetic field and especially atom. And since there was already a *possi*bility,

2 Quoted in: Cole M., Scribner S. (1977) Culture and thought. Moscow: Progress Publ. P. 179.

3 Conclusions of the founders of quantum mechanics: "If you think you understand it, that only shows that you don't know the first thing about it " (N. Bohr); "It is not only practical unavailable, but simply unthinkable. Or to be more precise, we can certainly think about this, it is more clear than the triangular circle, and less clear than the winged lion" (E. Schroedinger:); "No one understands quantum mechanics" (R. Feynman, one of the greatest physicists of our time) [Quoted in: Gankin, Gankin, 2011, 31].

then physicists could only *believe* that it was so. As a result, the Schroedinger wave equation was named "material" as it was intended to describe the material attributes of the microcosm.

On the other hand, even antiquity considered the possibility of representing the ideal aspects of the interaction of light and material objects. So, Plato in Cratylus (423e) suggested that "each thing has also a nature – like color", and asked himself a quite modern question: "Doesn't a color itself… have any entity?" Aristotle, and after him Newton saw in light and color only the material properties of nature. Goethe (unlike Newton) explored the ideal sides of light and/or color and concluded that without human perception they cannot be studied. Goethe's "Chromatics" was then developed by Hegel and Schopenhauer, who showed that light/color contains internal opposites, including the ideal side of life. On the basis of these studies cultural and anthropologic sides of the ideal in the form of image-concepts, reproduced for thousands of years in the history of mankind, were specified [Serov, 2013].

The "ideal" equation $Em = Ki\Sigma En$ for the description of the microcosm was obtained empirically for the first time in 1982 [Serov, 1982] and specified in the "Optics and spectroscopy" [Serov, 1984, 390] on the example of the hydrogen molecule with a higher accuracy than the results of quantum chemical calculations. It took more than 30 years of work on this subject to obtain a basic equality for the ideal aspects of the interaction of light and matter [Serov, 2016][4].

It is curious that these 30 years since the publication of equality (2) have been accompanied by complete ignoring of it. What was the reason for that? Hundreds of universities, each with thousands of researchers, worked on the implementation and/or improvement of the equality (1). Why would they learn (2), if neither their heads of departments, nor grantors could give them any time or money to use (2) in practice, and even more so for the development of the theory.

And the main thing, in my opinion, was that the finding of the equality (2) was clear, then as (1) was a kind of religion. Of course, even if a believer wanted to understand God, the very principle of uncertainty and/or the probabilistic nature of teaching would not have allowed him to do it. And it is unlikely that a true believer can act against his own religion. God is unknowable just as the ratio (1).

In this regard, the opinion of Schopenhauer comes to the mind, according to which *the concept of impulse and regulation need to be dropped in when they only have "fuzzy" values*, that was quite justified for Einstein: *"The soothing philosophy – or religion? – of Heisenberg-Bohr is so cleverly concocted that for the present it offers the believers a soft resting pillow from which they are not easily chased away. Let us therefore let them rest"* [Quoted in: Rodin, 2015, 60]. We can only agree with Einstein, i.e., to let scientists studying quantum phenomena rest in peace. Humanitarians, however, may continue to be unaware that quantum mechanics/chemistry is fundamentally unknowable, as confirmed by remarkable examples with outstanding

4 For brevity, we call the "material" Schroedinger equation ($H\psi=E\psi$) as mat-plan (1), and "ideal" Serov's equality ($QE=\varphi Z$) as id-plan (2) of the microcosm. It is clear that each of them describes one of the parties of interactions of macro- and microcosm. The meaning of (1) and (2) will be disclosed below.

students, who only "bone" at a subject before exam, desperate to somehow understand its essence[5].

In this regard, a team of scientists of the USA in 80-ies of the XX century organized the Committee on revision of textbooks on general chemistry in the hope that their development will provide basic knowledge without the involvement of the foundations of quantum chemistry, which are "impossible to understand". Most likely, these textbooks will not change anything, because the mentioned thousands of departments are headed by professors studying quantum phenomena who for 20-30 years had to deal with the introduction of the equality (1) into students' minds. And, of course, they will strongly suppress any publications which are different from their courses of lectures.

So, the question is whether the languages of modern (divided) science, not the language of nature could be given top priority? After all, for more than a century there is a trend of separation of different branches of science, in particular philology, psychology and physics. From the standpoint of metaphysical ontology, we can compare such seemingly disparate words like "man", "light", "color", "spectrum", "photon" and "humanity". Indeed, without light, we notice nothing but our own imagination. However, if only the light appears, as we cease to notice the light itself. But we begin to notice the world around us in all his unlimited contradictions.

Natural light of the Sun even Plato likened to an eye (Republic, 507e-508d), which today is formulated as a "sunny eye" (S.I. Vavilov), meaning the historical conditionality of the dependence of the eye on the Sun. If the light is created by an eye (brain), the over time this eye (people, culture, civilization) creates the light. The latter changes with every era (fire – wood – lasers, etc.) and creates a new culture and civilization thank to interdependencies "light – brain". It creates information.

To harmonize the information of native (natural) light with the information of new culture/civilization there is a theory and methodology of chromatism, the basic axiom of which is the following provision. Adequate representation of complex systems requires building information models (IM) in which information has a universal dimension for all objects of nature and/or culture without exception.

Today, almost no branch of physics is complete without references to quantum mechanics, which allowed to reach the modern breakthroughs in the technologies. On the other hand, it is assumed that the quantized energy of optical radiation in the form of a "photon" has no serious justification in theoretical physics [Klyshko, 1994, 1189, 1213].

Along with this, there is a system of harmonic octaves correlating with the optics of the radiation sources [Meshkov, 1979, p. 1, 15] on the characteristic properties of their trigonometric functions (TF). In this case, it is usually believed that *the final clarification of the "true" properties of a photon*

5 R.J. Gillespie believed that "even if they [students] set out trying to understand [quantum chemistry], then usually soon conclude that it is too difficult, at least in the time they have available ", and then they turn to memorizing the material [Quoted in: Gankin, Gankin, 2011, 39].

is only a matter of time and effort. Great hopes are pinned on the introduction of new, often vaguely defined terms and concepts leaving wide scope for further interpretations and clarifications. This optimistic point of view (which, apparently, a significant part of physicists until now adheres to) has been preserved since the introduction of the concept of light quantum by Einstein at the beginning of the century, despite the apparent lack of any progress along the way [Klyshko, 1994, 1192].

As is well known, the twentieth century was marked by relativistic and quantum revolutions in physics, however, *daily use of these theories cannot numb the sense of wonder from their immense empirical success. On what is based their instrumental efficiency: on the rock of reliable concepts or on the sand of uncertain bases? Does the measurement of a quantum system explore or even creates reality or simply change faith?*, scientists ask very reasonable questions [Briggs, Butterfield, Zeilinger, 2013, www].

Is not there any contradiction: the apparent progress of the century of STD vs a lack of progress. Lasers, smartphones vs the lack of progress. GPS navigation, flights to Mars vs a lack of progress. What's the matter? Perhaps in an iconic turn from image to word ('name')) in the situation of the twentieth century, in the age of escape from the realities of life to the virtual namespace belonging an empty class? This will be discussed in detail below.

Until recently, there was no methodology for the simultaneous comparison of these contradictions in both the living human world and the inanimate physical world. Therefore, the primary objective of our work is the creation of such a methodology. However, to achieve this objective, we will have to touch on the possible causes of the "aging" of the old axioms, i.e. to consider the historical refraction of several facts from psychology and physics. And no matter how strange it sounds (physics and psychology), then we will see their quite harmonious combination in relation to the similarity of the ideal and material planes of existence, or (if it is clearer to philologists) the meaning of the names and meanings of denotates of the real world, the essence of which will be discussed below.

Languages of modern science

Let us ask ourselves how does the humanitarian language differ from the natural-science one? Does not the fact that it has no meta-language (exception – linguistics (semantic logic) and philosophy (epistemological *dichotomy on the ideal and material*))? According to the trends of development of computer science, it is time for humanitarians to get used to the transformation of their computer science in at least a first-order metalanguage, as it is customary, for example, in logic semantics. For without this there can be no real codes of knowledge. Below we will see that the reasons for this absence may be not as much in the imperfection of knowledge of the external world and/or intelligence, as in the formal logical method of our science.

The problem of natural intelligence is caused by humanitarian nature of not as much the subject of the analysis, as its interpretations. For example, as psychologists say, *the fundamental differences of explanation in psychology and in natural sciences are exacerbated by the fact that* *often the basis of psychological explanations is not empirical laws, but the concepts such as libido, morbido, etc., which need themselves not only an explanations, but also evidence that there is any reality behind them*. A.V. Yurevich suggests that it is possible to break this vicious circle only one way – by opening the space of psychological explanation by changing attitude to reductionism [Yurevich, 2006]. However, the fear of psychologists to solve the psychophysical problems created by them does not allow them to change this attitude.

A similar conclusion can be made about such field of physics as quantum "mechanics". For we see here the transformation of the consciousness of the scientist in the quantum-changing world: traditional codes of the classical picture of the world (which had denotates in relevant classes of things) were replaced by such pragmatic virtual methods of interaction of theory and practice, *rules of the play* with which we may not explain themselves or others – any "play on words" [Wittgenstein, 1977, 29].

Hence the problems of modern education: codes of classical science and culture were replaced by more and more increasing instructions and requirements of the ministries to lead students not to knowledge, but to success and/or pragmatics, not to meanings, but to form, to formal competencies, which led to the reduction of the problem of language competence to guessing test answers, i.e. to a form, not to a content.

In purposes of "unity" of modern science let me give you remarks of physics D.N. Klyshko: "Metaphysical language is based on the belief that the concept of "photon" meet not only mathematical symbols, but also some "real" physical entity with some a priori properties (elements of physical reality – according to Einstein's well-known formulation) and that any electromagnetic radiation field consists of a set of such independent entities, just as an ideal gas consists of non-interacting atoms). In general, in quantum physics there is a sharp contrast between the very high accuracy of some calculations, sometimes giving a coincidence with the measured values in the seventh sign (and better), and the vagueness of the verbal description of the phenomena, driving students to despair. Additional difficulties are created by the absence in textbooks of a clear boundary between mathematics and physics, between classical and quantum physics, as well as unsuccessful terminology" [Klyshko, 1994, 1191].

However, the spectroscopic analysis of the energy levels of atoms and/or molecules raised many questions. If electrons made up a single system in an atom and/or a molecule physically, then was it possible to allocate separate electrons, the concept of which in an atom/molecule was based only on the rough (one-electron) approximation of quantum mechanics [Elyashevich, 2001, 197, 729]? Is it possible to compare in one row the atomic/molecular spectra of elements, some of which contained dozens, while the other one or two related terms? And what kind of comparison of terms could be discussed if in the mentioned approximation there were discrepancies in the attribution of even the basic state of lanthanides and actinides (comp. contradictory data of Ce(58) or Tb(65))[6], because quantum mechanics allowed to calculate only low electronic terms even in

6 Comp. [El'yashevich, 2001, 201] and [Sansonetti, Martin, 2005, 1640, 2046].

the notorious H_2 molecule. In addition, the available experimental material on the spectrochemical parameters of atoms and/or molecules contained extensive lacunae of a controversial nature [Constants of diatomic molecules..., www; Meggers, 1975, www], which made it difficult to adequately select their values for the relevant verification of the results obtained.

So, both physicists and psychologists say almost about the same thing: words exist, and things disappeared. What's the matter? How to understand the causes of this paradox? How to approach the solution this problem? Is it possible to combine all these quite different concepts in a single information picture of the world? How to avoid the polysemantic restrictions and hypothetical character of humanitarian discourse of philosophers, psychologists and/or sociologists? Is it possible to adequately formalize correlation between ontologically ideal predicates and their material denotates for subsequent classification and rigorous scientific analysis?

The methodology of chromatism

In search for answers to these questions, the study of the optical-trigonometric laws to find the physical meaning of the above provisions on the correlations between the empirical data of both approaches turned out to be relevant. The final task is to build an information model of radiation (*IMR*), absorption of the latter by the atom (information model of atomic absorption – *IMAA*) and, finally, the model of additivity of terms (*IMAT*) for generalization of the presented provisions.

To achieve this objective, it is necessary to solve such issues as the separation of data and information in information models, as well as to try to find reliable justifications for the division of "quantum" and "photon" from the position of IMR. All this, in turn, can be based on the optical properties of these octaves in the form of relevant correlations, which can be obtained by spectroscopic interpretation of TF, describing the natural round symmetric (in the limit – point) radiation source [Meshkov, 1979, p. 1, 21-23]. In addition to the type of emitter, the solution of the problem is associated with the need to introduce obvious postulates that are directly combined with the known axioms of optics:

First, the optical-mechanical analogy, i.e. the similarity of the particle trajectory in a potential force field with a light beam trajectory in an isotropic optically inhomogeneous environment, was based on the universality of mathematical models of physical phenomena [Khodanovich, Sorokina, Sokolov, 2015, www]. Hence it was possible to conduct correlation between TF of round symmetric radiation source according to its projections with spectroscopic interpretation of obtained octaves.

Secondly, it is necessary to find native (natural) correlates of light and matter. Since the interaction of radiation with matter is determined by refraction of light, then we need a parameter related to the change in the refractive index of n medium through which the rays pass. It is seemingly necessary to use sinusoids, corresponding to the laws of geometric optics here. But we need to search for "internal" essence of light.

If the light is absorbed by the object and/or subject, then it is relevant to use the laws of refraction to characterize the absorption, which correspond to the tangential, but not sinusoidal properties of a system with abnormal dispersion. The sinusoidal characteristics are typical of radiation missed by a system with normal dispersion. It followed that the value of the tangent was typical of absorption.

However, the question arose: is there an alternative to the one-electron description of multi-electron atoms and/or molecules? Maybe it made sense to pay attention on the tangential functions to study the characteristics of matter in the absorption of radiation? Indeed, if an anomalous dispersion was observed in the absorption region, description of which is associated with the notion of tangential patterns, it was necessary to "avoid" such familiar concepts of sinusoidal components, due to normal dispersion, i.e. lack of absorption. Thus, this issue was resolved.

Since the relevant value for the study of optical correlations was tangent, the semantics of which is very indicative for the construction of IMR, the already known analogy of the behavior of the tangent and the refractive index of the medium $n = c/\lambda v$ in the absorption region interaction with the atom allowed to consider it as an important parameter for the construction of adequate IMR. On the other hand, the semantics of the concept of "tangent " historically included essential values (translated from Arabic "tangent" – inseparable from the subject shadow, satellite, touching; from Latin tangibilis – perceived by touch from tangere – to touch, to border on, to seize). Therefore, the best option was tangensiod, which literally echoed with the experimental data for refraction of light.

Generally speaking, we tried to find the language of nature that would not divide the light into some of its "incomprehensible" wave function. After all, thanks to the properties of tangent it was possible to reveal the natural language of the nature of light, for any natural language is not only a means of communication, but also a necessary *tool* for learning world. And here, of course, tangent was the most natural and universal language from existing ones, for it carried such characteristic properties as the dependence on the numbers π, which had an all-encompassing character for all branches of the science of light and man.

Third, extrema, i.e., the nodal point of octaves, were to relate trigonometry of radiation source, since the projection (cross section) of the natural source could be correlated with the measured radiation angles multiple of $x\pi$ at $x < 1$. If energy of electromagnetic/light field was moving with the phase velocity, the energy of the photon was correlated with the frequency in vacuum and/or with the relevant wavelength as self-consistent data codes and methods of their processing. Therefore, the required value, which carried information flows from the radiation source to the receiver, was not energy and not the wavelength of the separation, but the joint dependence of their changes, i.e. $\Delta E(\Delta\lambda)$ as some hypothetical "hardware function" of the ΔE source energy change by changing $\Delta\lambda$ "slit width". Then this value could be further considered as a relevant argument for establishing the information characteristics of radiation in IMR and/or IMAA. First, it is necessary to specify the essential properties of information models.

Any system perceives only the information that it is able to absorb. Since this part of the information will have resonant characteristics, united with the components of the absorbing system, then – as perceived (absorbed) information – may be one of the most inside information of ontologically ideal plan, which we associate with the characteristic components of simulated object.

Then the *related* information can be attributed to such a type of information that correlates with functions, but not with the structure, not with the composition of the components and intercomponent interactions of the system relating to the ontologically material plan. The latter in this approximation can be attributed to the free. Hence, it is easy to give a semantic definition: information is a consistent distribution of relevant source codes on the bound and/or free states of the receiver. What does this definition give? Let us compare it, for example, with the definition of S.V. Simonovich: "*Information is a product of the interaction of data and methods adequate to them*" [Simonovich et al., 2000, 13]. This formulation fully confirms our definition based on the substantive semantics of the concept of "information".

Signal as a process carrying information is divided into mechanical, electromagnetic, heat, light color, etc. In other words, each of these types of signal contains a data stream, which, with an adequate method of interpretation, becomes information. Since it is not the mass in mechanics, it is not the charge (frequency, amplitude or phase) in electromagnetism, heat capacity in thermodynamics or photon in optics, but the actual information, which these values carry in the signal that matters to us, try to identify, if we may say so, their *quality-functional* and at the same time metalanguage unity.

For computer science, this unity is derived from the generality of Newton's laws for interacting mass, Coulomb for charges and/or Kepler for radiation source and receiver. Below we will touch on this commonality, as the *qualitative* side of the information transmitted by these masses, charges and/or photons remain functionally unchanged for both mechanical and electromagnetic type of signals. How we can solve this problem? Is it possible to combine all these seemingly very heterogeneous views in a single information model? Is it possible to formalize adequately connections of ontologically ideal predicates with their heterogeneous material denotates for subsequent classification and rigorous scientific analysis?

Since IM as a set of information characterizes the essential properties and typical features of the object, the construction of IM is not reduced to any trivial simplifications in accordance with its own criterion for the preservation of exclusively characteristic information about a complex system. The optimal example of IM is the dimension of physical quantity in which all non-essential parameters are eliminated, thanks to what the researcher can easily check the formalization of his arguments.

As you know, any measurement in any area is exclusively information process, i.e. obtaining information (about the measured object at the level of the extensional context), which further include these extensionals into generalizing theory (intensionals). For the possibility of adequate modeling of problem areas the known theory of dimensions of physical quantities has been modified in chromatism. The analysis of dimensions, generally speaking, is a meta-language that allows establish functional relationships between the essential for the study phenomena heterogeneous plans of a given system of analysis.

At the same time the dimensional analysis in chromatism is based on such representation of dimensions of these plans, in which the expression defining the functional relationship between the plans remain valid for any change to the specific components of the given systems. Strictly speaking, the invariance of plans in the system of chromatic dimensions as invariance of their relative (i.e. relative to each other) properties in relation to transformations in different analysis systems is postulated here. Therefore, we need to introduce a triad criterion for the dimension of values that is essentially independent of knowledge area by virtue of its intensional, i.e. generalized semantic nature.

It is considered that the dimension of the basic value does not depend on other values and in relation to itself is equal to 1, i.e. the formula of dimension of the basic value coincides with its symbol [Khantli, 1970, 17-19.] In chromatism, the interaction of all of the parties of the objective and subjective world without exception is the subject of analysis. In this regard, we have adopted axiom: in addition to time *[T]* and space *[L]*, there is a single independent generalized (common to measurement of any kind) value – information *[I]*. Really, information is the basic value, i.e. at the same time independent of the above-mentioned ones, and the most common (intensional) for any areas of research, including humanitarian.

If the unit of the derived value does not change when any of the basic units change, such a value has zero dimension with respect to the corresponding main value. It directly follows that any other values must be related to information, but not to mass, charge, etc. (e.g. in units of energy). In other words, if information as a basic unit can exist outside energy, the energy without information cannot, because the energy is determined by the product of relevant information on the potential of the relevant field.

Thus, the dimensional analysis of the parameters used included units and the results of measurements, which are usually recorded in a formalized form, corresponding to conceptual representations. So, if the dimensions *[L]* and *[T]* traditionally described a generalized idea of space and time, *[I]* carried already an intensional presentation of information that depends on the analysis system was determined by relevant extensionals: mass *(m)* in mechanics, specific heat (c_v) in thermodynamics, charge *(e)* in electromagnetism, etc., remaining invariant for all fields of knowledge, including humanities.

So, from these positions it is possible to start solving the objectives. In the philosophical and methodological literature, the model is most often understood as a functional homomorphic transfer (mapping) of the components of the external world to a system of concepts (images, symbols, signs, etc.). While not isomorphic, this mapping still retains certain relationships that exist between the components of the outside world. The latter property allows the model not only to describe the connections and relations between the components of the external world. Since algorithms, ways and/or methods of constructing such models are not usually given, we raised the question of creating a method of building information models.

First, let's define the minimum requirements to be met by such a construction. Essential components of the information model *(IM)* are following:

1) concepts, definitions, terms, signs, symbols relevant to the concepts used for an adequate understanding of the model;

2) essential postulates (theories, laws, specific model), based not on axioms (they are temporary), but on experience and reproducibility;

3) analysis and inclusion of functions (ontologically ideal plan), but not structure as relatively material plan of complex systems (objects);

4) intensionals as a base for inclusion of the relevant extensionals;

5) rules of transformation (calculations), allowing to compare the results obtained in the analysis of IM, with experimental data and/or practical results of comparison with the theory.

In physics, "information" is considered also from the standpoint of theorists *(information is any data reflecting the properties of objects)*, and experimenters *(information is the content of the message, considered in the process of its transmission, perception and use)*. In the humanities, "information" has a subjective-objective character, as it arises only in the subjective interpretation of objective data.

From the standpoint of ontology, information is ideal with respect to data, but material with respect to subject-interpreter. In turn, this is how the "word" is characterized – as the ideal relative to its materialized form (in phoneme, lexeme, symbol or certain sign), but material relative to its meaning (semantic content, codes of interpretation, etc.). So, still Niels Bohr in response to maxims about fundamental character of the reality lying at the base of the tongue (almost according of Wittgenstein [Wittgenstein, 1977, 3]), stated: "We are suspended in language in such a way that we cannot say what is up and what is down. The word 'reality' is also a word, a word which we must learn to use correctly." [Quoted in: Petersen, 1985, 302].

A connected issue is the Copenhagen interpretation of quantum theory, almost reduced to information interpreting the formalism introduced. According to the early versions of this interpretation, "the state of the quantum system" is relevant not to the real world, but to our knowledge, i.e. to the information received at measurement of quantum systems. Or, as Bohr said: "There is no quantum world. There is only an abstract quantum-physical description" [Ibidem].

However, according to Schrodinger, *the Heisenberg's uncertainty relation already indicated that the classical concepts of spatial position and impulse needed to be changed to some other new concepts that could be used precisely, rather than approximately*. It is clear that Bohr could not accept this and argued that *only classical physical concepts allowed to coordinate our experience in a way that corresponded to our natural ability to conceptualize* [Quoted in: Timpson, www].

And Einstein could not agree with this: "In my opinion, nothing can be done in advance to talk about how to build concepts and connect these concepts with others concepts and experience. Only a certain set of such rules is needed, since without rules it is impossible to acquire any new knowledge. You can compare these rules with the rules some games that are completely arbitrary, but without which this the game is impossible. However, these rules are not set once and for all, but only apply in a strictly defined framework " [Quoted in: Fine, 1986].

In fact, according to Bohr, in quantum mechanics it was not about the external, objective world, but about the information that can be obtained from the measurement and relevant interpretation of the parameters of quantum systems. In the philosophy of science this position is called *instrumentalism* as opposed to the *realistic* interpretation of quantum mechanical apparatus [Timpson, www].

It is significant that the supporters of the latter, as if eliminating the scientific correlation language and reality and/or instrumentalism and realism, confirm the adequacy of their beliefs in the following way: *all the technological achievements of the XX-XXI centuries could to be created, if the applied scientists and technologists did not use a real quantum systems, such as photons, and would be guided by the idea that quantum mechanics was not about the real situation in the world, but only about our knowledge of the results of measurements of states of quantum systems* [Mamchur, 2014, 64].

Information models of reality

In fact, any field of science deals exclusively with information. IM reflecting only the essential properties of an object is its characteristic description, thanks to which the real reality is known. In other words, IM further means a set of information on the state and functioning of the analyzed system which is organized according to certain rules. For example, chromatic IM are models created in the natural language of semantics of color concepts and their ontological predicates (i.e. in the language of sense and meanings of color canons, which were representatively reproduced in the world culture). Examples of chromatic models are the "atomic" model of intelligence (AMI) and the model of axiological and social semantics (MASS), created on the basis of the theory and methodology of chromatism. They are compared with each other by the criterion of chrome plans (χ) in table 1.

On the other hand, the intensive semantics of this meta-language due to universals of created IM, allows to add essential supplements based on experience to the known techniques and/or theories. First of all, this is due to the fact that by reason of the combination of database and/or representations "incompatible" for a common language in a single semantic space of meta-language knowledge bases IM creates new information that further begins to settle in the exact sciences by the formal and logical means, i.e. methodology we have adopted gave the grounds for tasks solution.

Table 1. Information predicates of the individual and society

χ	Criteria	AMI	MASS
Mt	Social, rational, theoretical, pragmatic	Consciousness (soul, mind) is arbitrarily conscious functions of formal-logical operations with experience and/or concepts*	Legal concepts as the social-perfect relatively MA-, but relatively ID – ideologically objectified in the thesaurus (power as Mt-plan)
Id-	Cultural, aesthetic, unpragmatic	Subconscious mind (spirit) – partially conscious functions of figurative operations of "perception" (in game, art, creativity)**	Culture as an individual concept predicates of society-mental, aesthetic, perfect, distributed (intelligentsia as an Id-plan)
S-	Natural, biological, utilitarian	Unconscious (body) is fundamentally unconscious functions of natural genetic coding of information [Barbieri, 2002]	Socio-bodily destiny of man (f – birth, education, m – work) – biological, syntonic (mass, crowd as C-plan of MASS)***
Ma	External environment	External light and/or social environment (Ma-plan of the system "Environment – AMI")	Civilization as legal, ideological, technical, biological environment, defined in the Ma-plan of MASS

* For example, as Kant notes, "human mind is discursive and can only learn through general concepts" [Kant, 1994, 115].

** Following Kant, "it is good that it is known without the mediation of concepts" [Ibidem, 1091].

*** "Birth should be understood not only as the birth of children in the narrow sense of the word, but also as any sacrifice of one's own energy and matter, the beginning of space unlike personal. The woman is the soul of the world and the soul of the earth, giving birth and harboring in its bosom" [Berdyaev, 1931, 264].

To do this, we conducted a detailed analysis of TF. As shown at the beginning of the article, the ratio of the square of the tangent of the emitted energy tg^2E to the information component of this radiation $ΔE(Δλ)$ was relevant for our purposes. The sequence of action was as follows: $π/4$ was the angle $φ_1$ = 0.78539 radian. It was the first point of the octave for a step of 45°. It turned out that all points of this octave ($φ_2$ = 1,57080, $φ_3$ = 2,35619, etc.) with a precision of 5 digits coincided with the known scale of energy in electronvolts (E_1= 0.78539 eB, E_2= 1.57080, E_3= 2.35619, etc.). Hence according to the formula $λ = ch/E$ the wavelengths λ were obtained, as well as certain numbers q and·Z, which corresponded to ordinal numbers of indices for the quantities $φ$ and E.

Verification of the first octave values obtained in this way was confirmed by the correspondence of the energy E_1 = 0.78539 эВ at the intersection of $sin^2 e/ΔE(Δλ)$ and $cos^2 E/ΔE(Δλ)$ curves, i.e. the characteristic value tg^2E at λ = 1578.63 nm. And this, in turn, confirmed a well-known position on the minimization of quantum effects in the transition from the visible to the IR radiation region under normal experimental conditions (in a weak field).

Generally speaking, if the dependence of all TF from $ΔE = const$ gave harmonics, and from $Δλ = const$ – progression, then TF from $ΔE (Δλ)$ showed the characteristic properties of the spectrum radiation in IMR. This is probably due to the fact that, according to the definition of "information", codes of source and receiver of information were matched due to the natural character of the point source of radiation and the projection of the receiver. If with $λ$ = 1578,63 nm quantization of the continuum began, it seems, it was necessary to talk about the possibility of building an information model of quantization (IMQ), which in the zero approximation could be based on the obtained relations of TF between IMR and IMAA.

The criterion for manifestation of the extrema of radiation on octaves were the values of amplitudes $A\ tg_2\ E/\Delta E(\Delta\lambda)$ for values that are multiples of $\pi/4$ with a period 2π, i.e. determined by the formula $\Delta En = (En - En\text{-}8) = 2\pi$. All this allowed to interpret the obtained data on TF from the perspective of color vision psychophysiology, and in the representations of spectroscopy and/or physical optics. If the beginning of the first octave was within the IR region (1578,6 nm – π/4), its maximum – when 789,3 nm (π/2), which is almost answered to the top known-relative border to visible light 780-790 nm. The lower boundary of the visible area at 395.7 nm – (π) – also coincided with its conventional designation of 390-400 nm. Is it by chance that in the table 2 the point at 526.2 nm (3/4π) was the boundary between the "warm" and "cold" colors of visible light, which was previously considered relevant to the "average standard observer" [Lazarev, 1979, 72-85]?

The next point of the first octave correspond to the border of the UV with a maximum at 263.1 nm (3/2π) and the boundary of the vacuum UV region (197.3 nm – 2π). Could all these "coincidence" be considered as random, if long before identifying of these points of TF they were obtained empirically by scientists in various fields of research on "light, color and human" [Ibid]?

The ratio for all members octaves were obtained this way: the ordinal number of octaves was defined by the expression $n = Z_{2\pi}/q_{2\pi}$; in each octave the values of the sequence number q (from 1 to 8) were obtained by the dependence $q = \phi Z/E$, where q is the correlation coefficient, and Z is an integer number corresponding to the sequence number of characteristic lines/bands of TF throughout optical area, starting at the intersection of functions $sin^2\ E/\Delta E(\Delta\lambda)$ and $cos^2\ E/\Delta E(\Delta\lambda)$. In the next (II and III) octaves values of the sequence number in each period q (from 1 to 8) were defined according to the same formula. How can this be interpreted?

As shown above, the theory of dimensions is also used for conceptualization and specification of a complex system of heterogeneous relations. The possibilities of adequate modeling of problem areas allowed to modify the theory of dimensions of physical quantities. This, in turn, led to the construction of a meta-language, which quite clearly established functional relationships between the characteristic for investigated phenomenon heterogeneous plans of the given analysis system for the studied phenomenon under given boundary conditions.

Thus, the dimensional correspondence of the information about data m_e, e and k was found to be adequate, where m_e and e are the mass and charge of the electron, and k is the Boltzmann constant, which could be figuratively compared with the heat capacity of the electron (if modern science allowed it). This led to the relationship between their derived values, which turned out to be a kind of equivalents (conversion factors of their semantics) in the transition, for example, from heat to micromechanics and/or quantum optics, which is presented in table 2.

Table 2. Information model of equivalents (IME)

Dimension [LIT]	Heat	Micromechanics	Quantum optics
Information [L^0 IT^0	k = R/Na [эВ/0 К]	m_e = 9,1·10-31 [кг]	e = 1,6·10-19 [к]
Potential [L^2 I^0T^{-2}]	T = b/λmax [0 K]	c^2 = 9·1016 [м2 /сек2]	U = Eφ/e [эВ/к]
Energy[L^2IT^{-2}]	E_T = kT ≈ bk/λ [эВ]	E_m = me ·c2 [кг·м2 /сек2]	$E_φ$ = φ1 ·Z = ¼πZ [эВ]
Volume energy [L^3IT^{-2}	bk ≈ 2,5·10-7 [м·эВ]	ch ≈ 1,24·10-6 [м·эВ]	λZ ≈ 1,58·10-6 [м·эВ]
Equivalents [$L^0I^0T^0$]	bk/ch ≈ 0,2 ≈ π/16 ≈ 120	ch/λZ ≈ 0,8 ≈ ¼π = 450	λZ/bk ≈ 6,3 ≈ 2π = 3600

Of course, in each case study, the IME was more specific and expressed through specific (characteristic) parameters as it is carried out, for example, in accounting of chemical potentials. So, according to table 2, information components of the obtained regressions could be identified by the formula $[I] = [E_φ\ λik / λ_φ\ T]$, where $E_φ$ and $λ_φ$ are the energy and wavelength of the photon, $λ_{ik}$ is the wavelength of the resonance transition at T, in °K. From the values $Eφ_{λik}$ information was extracted in accordance with dimensional criterion of their validity $[I] = [L^3IT^{-2}]/[L^3T^{-2}]$. Regression of the atomic terms for all groups of PSE showed good agreement with dimensionless equivalents "radiation-matter" $λ_{ik} / λ\ φ = E_φ / E_{ik}$.

Representations of quantum optics

For a correct comparison of the results with the known one-electron construction of multielectron atoms, we briefly outline the representations known today. The description of a multielectron atom is based on the classification of one electron, since there is no other way for the spectroscopic calculation of excited states. This is due to the fact that to date there is no method of calculation of multielectron systems, which would be comparable in accuracy with spectroscopic methods of their measurement. However, we have seen above that theorists *sometimes get excellent results*, but" sometimes" is not science. Strictly speaking, if neither Schroedinger equations nor Heisenberg matrix approaches, due to the uncertainty principle, give the required accuracy and/or reliability, then perhaps it makes sense to try to look for other postulates and/or methods of calculation?

If we assume that the basic state of the atom corresponds to zero energy E_o, and excited – $E_n = hv$, then for each atom you can find a sequence of numbers, usually called spectral terms of this atom $T_n = E_n – E_o = E_n$. Both an additive properties of energies, and the relations defining an arrangement of spectral lines in different series can be obtained from the combinational principle.

The current state of spectroscopy allows for a rather strict consideration only in the case of single electron atoms, i.e. for the hydrogen atom and hydrogen-like ions He^+ , Li^{2+}, Be^{3+}, etc. The theory of the spectra of multielectron atoms is based on the approximation of the central self-consistent field, in which the state of the atom as the whole is determined by the set of states of all its electrons taking into account their interaction [Schmidt, 2007, 36-39]. Detailed analysis of a single-electron application to a multi-electron the atom is widely represented in modern literature and we are not done discussing this.

According To D.N. Klyshko, *in quantum optics there is a paradoxical situation: there is not clear a certain place for its basic concept – a photon (as an elementary particle of a light field) in formal quantum theory. Judging from the modern publications, the photon is something objectively existing in space and time*. Analyzing this issue in detail, D.N. Klyshko comes to the conclusion that *the photon as an elementary particle of the optical field has no reasonable clear definition and, therefore, it is, by the proposed definition, a metaphysical category* [Klyshko, 1994, 1191-1192].

On the other hand, it is still commonly believed that *"photon" is synonymous of "quantum of light"*: photon as an elementary particle is a quantum of electromagnetic radiation (light). It is often added that the light emitted is usually continuous and quantized only when absorbed by the matter [Meshkov, 1979, p. 1, 12-13], which is consistent with basic provisions of quantum theory, and with a generally accepted definition from the International Lighting Vocabulary: *PHOTON is elementary particle of radiation, energy of which (QUANTUM) is equal to the product of the Planck's constant and the frequency of the electromagnetic radiation* [Lazarev, 1979, 19].

However, Einstein also stated, "All the fifty years of conscious brooding have brought me no closer to the answer to thequestion, 'What are light quanta? Of course today every rascal thinks he knows the answer, but he is deluding himself." [Quoted in: Gankin, Gankin, 2011, 31].

What happens if we take into account the above data of TF in their interpretation of IMR and IMAA? Can we assume that at the same time the photon is the unit of radiation Z, and the quantum is the number of photons Zn? Given these properties of the photon, should we distinguish the concept of photon and quanta of radiation energy with the introduction of the relevant formalization, verifiable according to Popper? Not we are then in a metaphysical view of the photon, strongly condemned by D.N. Klyshko?

Let us suppose the emission of an electromagnetic field consists of photons Z, whose energy therefore can take only a discrete series of values, multiple of an indivisible portion – one quantum Z. On the other hand, if the photon is a unit of light (optical region of electromagnetic field), and quantum is the number of photons, according to the dependence Z(q,φ), then from the positions of the information approach is as follows. "Photon" – as elementary particle of electromagnetic field – has a certain energy in IMR, then "quantum" should be understood as the photon energy converted to IMAA by equality IMC: $E = h\nu = ch/\lambda = Z\varphi/q$, where q and Z are the sequence number in octave (period) and in the entire optical region respectively identified above, λ is the wavelength, φ is the projection angle of IMR on of IMAA, c is the speed of light.

Under the assumption that the photon is a radiation source with energy hν and unit of measurement эV, and quantum is "angle" of its fall on the projection/atom, measured in radians, this equal is fair, which naturally included both number of *Z*, and the quality q of the photons that are relevant to the corresponding parameters of the electron as a self-consistent codes of information processing. As in I octave *1 эV = 1 rad*, and in the subsequent – values $E = Z\varphi/q$, and from the standpoint of the theory of dimensions basic principles of quantization of radiation with the relevant construction of the IMC as function of IMR(TF) and IMAA(TF) have been confirmed.

Strictly speaking, from these positions, the photon and quantum were separated by physical sense not only quantitatively, but also qualitatively. For, if we consider h in the formula E = hν only the coefficient of proportionality between the energy and frequency continuums, then what the physical meaning of their quantization? Is it only in the discretization $\hbar = h/2\pi$? Or could exist any natural ways of identifying discreteness in the continuum of energy and frequency? Since the values of the photon energy can be expressed in terms of the ratio between values q,$\cdot Z$, φ, then their simple substitution gave the ratio $h = Z\, \varphi\, /\, qv$. Verification of octave obtained – charge and/or term of the atom/molecule must be a multiple of the elementary charge and/or therm. And it already pointed to the multiplicity of parameters of TF with a multiplicity of angles of radiation exposure received by us.

It follows that, on the one hand, the value Z is an expression of energy, and on the other – the original quantum number, which is consistently increased by one at the quantization step 0.25 π. In turn, the value q showed qualitative differences of photons in each octave, according to the value of the angle q = 4φ / π.

Thus, the value q was not only the ordinal number of the nodal points of TF in each octave, but also a qualitative indicator of the quantization principle. At the same time Z included this property q with a parallel preservation of the properties of the numbers $q = \phi z/E$, that allowed us to assume in semantics q the coefficient of photon energy transformation φZ into electron energy E=eU as an integer angular coefficient $Z(\varphi)$.

Gratitudes

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Слово, информация и культура науки (часть 1)[7]

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Аннотация

Цель настоящего сообщения – представить возможности и ограничения при создании единого культурологического ареала наук о природе и человеке. На примере квантовой механики и оптики показано, что при формализации гуманитарных проблем с позиций хроматизма, информатики и семантической логики может быть достигнута элиминация полисемантической ограниченности и гипотетичности гуманитарного дискурса культурологов, филологов, психологов и/или социологов путем построения информационных моделей для тех системно-функциональных связей онтологически идеальных предикатов, которые связаны с их материальными денотатами в заданной системе. Поскольку с позиций онтологии информация идеальна относительно данных, но материальна относительно субъекта-интерпретатора, то именно так может характеризоваться и «слово» как «идеальное» относительно своего опредмеченного вида (в фонеме, в лексеме, в символе или в ином знаке), но «материальное» относительно смысла и значения (семантического наполнения, кодов интерпретации и т. п.). Это привело к построению метаязыка, который вполне однозначно устанавливал функциональные связи между характеристическими для изучаемого явления разнородными планами сложных систем анализа при заданных граничных условиях. Интенсиональная семантика этого метаязыка, благодаря универсалиям созданных информационных моделей, позволила

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дополнить известные методики и/или теории сущностными дополнениями, основанными на опыте. В заключении представлен возможный ареал единой науки о субъект-объектных отношениях психофизической культурантропологии.

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Ключевые слова

Языки и метаязыки науки, хроматизм, семантическая логика, информационные модели, формализация языка, спектр, квант, фотон.

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