

**SCIENTIFIC RATIONALITY IN AN EDUCATIONAL CONTEXT:  
HISTORICAL AND PHILOSOPHICAL ANALYSIS**

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**Abstract.** The research paper studies the phenomenon of scientific rationality in historical and ideological contexts in order to determine the relationship between its internal scientific standards and educational projections. On the basis of historical-genetic and comparative-historical methods the paper considers the principles of classical science for the period of its formation in the XVII–XVIII centuries as those that defined the worldview possibilities and topics of cognitive theory until recently. The name of this period in the European history refers to radical changes in the social structure, the reallocation of conventional social institutions and the establishment of new ones. In particular, in the XVII–XVIII centuries the foundations of classical science are laid down in terms of its relationship with technology and the leading role in the civilization development. Reflection of theoretical problems (improvement of cognition methods, fundamental worldview development) and applied tasks (creation of new experimental tools, means of calculation) that accompanied those processes, was reflected in the philosophical thought of that time and subsequent works. Despite the known differences between the current and retrospective views of modern European and contemporary authors, at present time there is a common mechanistic denominator of the mutual impact of natural-scientific and philosophical rationality, which had been developed at that time. As we go to the analysis of modern science we weigh the alternatives of its substantiation, bring to light the changes in the field of philosophy of science caused by the historical and hermeneutic approach, and the reasons for the introduction of value characteristics to modern scientific rationality. The basic historical forms of worldview orientation, relevant educational paradigms, their content-

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related tendency and humanistic possibilities in terms of creative personality development are reconstructed over the course of representing the modern attitude to science and its rationality. We have defined the axiological bases of modern public opinion about science as one that moves only financial progress, and compared the sources and possibilities of humanism.

### 1. Introduction

Scientific rationality research is stimulated by both *external* social and *internal* academic relevance. The first one consists in the ambivalent attitude of modern Western civilization to scientific *knowledge*: if its “fruits” are consumed as quickly as possible, then the “light” emitted by it is often regarded as “cold”. The well-known standards of objectivity, rationality, and methodicalness do not arouse former admiration and respectful imitation in daily activities and spiritual life. Against the background of the New Age – the mass revival and activation of religious and mythological consciousness, increasing interest in archetypal structures, paranormal phenomena and extrascientific knowledge [26, p. 265–286] – the latest social and humanitarian emergencies (human global problems, remoteness of personal origin, consciousness manipulation, human-made disasters, etc.) are every so often considered as implicit consequences of scientific rationality.

Long-term criticism of ordinary empirical justification as a criterion of scientific rationality in the science itself and its philosophical reflection, leads, in the end, to a change in *the idea* of human mind in general – from *instrumental*, reducing it to a formal-logical apparatus, to *culturological and anthropological*, which provide the strong connection between cognitive procedures and social and individual mental context. Since modern generation of scientists as “children of their time” follow these guidelines, and on the other hand must be involved into the common history-making relay of ideas and methods of their field, there is an urgent need to conceptualize historical forms of scientific rationality and possible changes in its content. This topic is quite developed in the well-known works by P. Feyerabend [16], V. Ilyin [5], A. Ogurtsov [9], V. Stepin [14], V. Shvyrev [19] etc. especially in terms of definitions, classifications, criteria, historical contexts, the relationship of its scientific and philosophical aspects. However, the *role* of scientific rationality in the cultural heritage and communication of scientific and educational institutions remains poorly clarified. Despite

major works by I. Chernikova [18], I.G. Fomicheva [17], J.S. Johnston [27], A.G. Holmes [28], J. Miller [33], T. Nichols [35], C.H. Patterson [36], M.I. Romanenko [11], T.A. Rubantsova [12], S.B. Shapiro [38], I.H. Utyuzh [15] devoted to the role of scientific rationality and humanistic traditions in the organization of educational approaches, its spiritual potential is far from practical implementation.

Thus, there is a goal to reconsider the place of science with its professional way of thinking in human civilization and to discover how it is refracted in the minds of its contemporaries. In particular, in order to check the pragmatic status of science as a specific nature of the post-industrial present or as an echo of the industrial past, it is necessary to find out the characteristics of classical scientific rationality in the works of modern philosophers (F. Bacon, G. Galilei, R. Decartes, J. Locke, G.W. Leibniz, I. Newton) and their modern interpreters (P. Gaydenko, L. Kosareva, R. Merton, S. Toulmin, S. Shapin etc.). In order to check whether educational conditions are ambivalent in promoting both instrumental-pragmatic and spiritual-value attitude to science, it is necessary to analyze the educational *paradigms* of the industrial and post-industrial era in the capacity of translators of relevant examples of scientific rationality and exponents of cultural-historical ways of human orientation in the world. At the same time, differences in the subject content, means of its expression and intentions of the authors require the use of *hermeneutics*, which reveals the meaning of original texts by means of translations, comments, life context and cultural resonance of their authors.

## 2. Formation of a classical model of rationality

Reasoning regarding rationality are very complicated by a mixture of terminological traditions: the most general *meaning* of “reasonableness” in some cases refers to the denotation of actual “human”, in other cases it is opposed to the “spiritual”. In science, however, “rationality” is used not only on the worldview, but also on the general scientific level, identifying both with the philosophical reflexivity, and with the features of logical and methodological organization of scientific knowledge. In their turn, the humanity or remoteness of scientific rationality from human beings can be a historically differentiated issue: for example, medieval scholasticism is often called formal and soulless, humanist studies – the inspirers of human victory, etc. However, the educational image of science, firmly rooted by a

modern public opinion, consists of the principles, terms and personalities of *classical science*, which traces its origins to Modern times.

For example, classic of philosophy of science St. Toulmin [40] described this connection in “three *axioms* of the traditions of the XVII century”, which for a long time began to define the course of epistemology despite the skepticism and criticism of individual characters such as B. Pascal, S. Kierkegaard or F. Nietzsche.

Firstly, this refers to the stability of natural ontology, which provides a basis for stable and universal principles of its understanding in the process of scientific research and domination over it in the practice of economy management. This “axiom” was based on the biblical statement defining a clear plan for the Creation of the world and the dominant role of human beings on the earth. F. Bacon, one of the founders of modern European science, understands a human being as a full-fledged master in the workshop of nature, full of its own laws [2, p. 182]. Moreover, although over recent centuries all the components of this “workshop” have turned into historical variables, their perception is also presented as objective representations, the subjective impurities (“idols”) of which can only blur everything.

Secondly, the inertia of *matter*, which provided in it not more than mechanical *activity* (contact, push, exchange of movements) and hence the concentration of all rational activity in the spirit – in the course of the Creation or knowledge of material nature. On the one hand, this “axiom” made it possible for G. Galilei to bring physics to the standards of geometry for the first time [4], and on the other hand, it implies an objectivist *criterion* of empirical justification (“verification”) of scientific propositions, which has not yet been shaken by dynamic models of matter or neurophysiological models of higher mental activity.

Thirdly, the geometric *standard*, which, according to the Platonic model, protects knowledge from skepticism by its own value neutrality. According to Descartes, “of all the sciences so far discovered, arithmetic and geometry alone are as we said above free from any taint of falsity or uncertainty <...> they alone are concerned with an object so pure and simple that they make no assumptions that experience might render uncertain, they consist entirely in deducing conclusions by means of rational arguments” [25, p. 12].

In order to understand the impact of these “axioms”, one must know that they resulted from solving the classical problem of the reproduction of

*metaposition*, which originates in the Christian conception of the Absolute Mind. It can be recognized in R. Descartes's cogito, I. Kant's apriorism and Fichtean transcendental subjectivity. In order to change the idea of the unity of man and the world in the God creatable, philosophical thought has developed the idea of the unity of man and the world in the god acting expediently. Later, the guarantee of this unity was transferred from the God to the absolute mind in the form of the world Absolute or natural integrity, in order to derive the human mind from them with all its cognitive abilities.

The main possible options of this position, developed by modern European philosophy, are similar to the replacement of the theological Absolute Mind by scientific intelligence with its preconditions – axiomatic self-evident and self-sufficient rules of consistent reasoning, though burdened with “idols” of one-sided, in particular outdated or distorted values. That kind of methodical organization of thinking itself in addition to nature and society seemed to be the highest form of *power*, where a human being not only took upon herself/himself the creative abilities of the Absolute to meet and develop their needs, but also found guarantees of their freedom.

Once the formal apparatus of scholasticism created a precedent for mastering spiritual mysticism with its spontaneity and immediacy, mathematics took up the baton of rational reconstructions of transcendental experience from logic. Its novelty consisted of meaningful *theories* that made it possible to deduce formally and unambiguously any complex (complicated) knowledge from their components like from the “atoms”. In this regard, Galileo's interpretation of the theory as a simulation of the infinity of divine *truths* by extremalizing their finite symptoms in the form of self-identical mathematical idealizations gained fame: “the truth, knowledge of which is given to us by mathematical proofs, the truth which is known to divine wisdom; however <...> our way consists in reasoning and transition from a conclusion to a conclusion, while His way is the simple intuition <...>” [31, p. 129].

In this way, being only a kind of *rational*, leading its genealogy from the ancient cultural archetypes, the knowledge, cultivated by the modern European mathematization of science have become the notion (*ratio*, *mens*) that involves the articulating and ordering abilities of the mind. According to its mathematical model, scientists and philosophers not only compare the accuracy and provability of knowledge of the laws of nature, but also establish the comparability of the content of scientific ideas, their

selection and accumulation. “An infinite world, here a world of idealities, is conceived, not as one whose objects become accessible to our knowledge singly, imperfectly, and as it were accidentally, but as one which is attained by a rational, systematically coherent method. In the infinite progression of this method, every object is ultimately attained according to its full being-in-itself <...> nature itself becomes – to express it in a modern way – a mathematical manifold” [30, p. 22, 23].

Mathematics could be represented as a new guarantor of objective cognition, under the condition of rearrangement of the nomenclature of “higher abilities” of the human Self. Thus, the Cartesian model of personality, for the first time, provided a distinction between the objectified *content* of consciousness and its “secondary *qualities*”, which are entirely derived from the perceptual states and their experience. The mind, capable of exploring “things in and of themselves” and acquiring knowledge regardless of will, intentions, faith, intuition and other subjective presentations acquires the status of personal ability of *objective* representation in R. Descartes’ metaphysics, while *objectivity* was identified with subjective transcendental involvement as a means, purpose, instrument, gesture, or statement in the logical imperative of scholasticism.

Despite all the references to human nature, common sense and progressive aspirations, a subject with the said consciousness is not defined in the space and time of not only cultural and historical, but also physical existence. Thus, in order to become a subject of scientific knowledge, a person loses her individual dimension. However, precisely this mind, designed to reflection over the subjective aspect of cognition and corresponding to the further hegemony of natural-scientific problematics, experimental and mathematical methods, proved to be a successful form of interconnection of the concepts of freedom of thought and responsibility for its content. Due to this, scientific rationality has long been established as a link between European values such as freedom and democracy.

Along with a clear explication of methods and demarcation of the research field, the given “axioms” (criteria) of classical scientific rationality provided such a successful progress of science that presented a model of social change (Enlightenment Project) and ensured the formation of independent social institute of science. However, beyond the rational description there are objects that can only be described in qualitative terms,

first of all, the phenomena of spiritual substance, if their properties were not studied by the means of formalization of those times. Accordingly, careful attention of some researcher to such objects positioned him as a representative of *extra* scientific fields or even as an *anti-scientist*.

### 3. Internal and external problems of classical rationality

Ideological reasoning of the *anti-scientific* position took place in *post-Enlightenment irrationalist philosophy*, which started with the opposition of the mind to will, love, instincts, intuition as more fundamental phenomena, and ended up with the limitation of the universalism of scientific rationality: the mind is wider than the science, because unscientific forms of spiritual activity (myth, magic, spiritual traditions, arts) are able to perform not only their own specific but also socio-cultural functions peculiar to science. “It takes billions of dollars, thousands of highly skilled professionals, years of hard work in order to enable a few tongue-tied and rather limited contemporaries to make a steady leap where no person with sound mind would want to go – to the empty, airless world of the burning hot stones. However, the mystics, using only their own consciousness, traveled through the heavenly spheres and contemplated God in all its glory, which gave them the strength to live and enlighten their followers” [16, p. 497–498]. Therefore, we can observe the introduction of a general cultural tendency of complementarity of scientific and unscientific knowledge.

The counter-movement on the part of science was initiated by the *de-absolutization* of G. Saccheri’s, J.H. Lambert’s, C.F. Gauss’s etc. Euclidean system for building knowledge, which found out that attempts of complete explication of the “source knowledge” (principlum ratio) used in the reflexive act turn into paradoxes [29, p. 15–16]. In nonclassical science the said “crisis of *basic principles*” was stimulated by the development of ever more “obstinate” objects: the phenomena of spiritual substance (which in the XIX century received its own scientific residence as the humanities) were followed by quantum mechanical, cosmological and, finally, complex natural systems with feedback links with the environment and alternative development *trajectories* that are not subject to removal from the “initial conditions” of observation. “Nonlinear” objects of that kind (for example, ecological) turned upside down scientific-rationalist objectivism – the position of an external observer, whose cognitive apparatus had to maintain

isomorphism with any modifications of the studied natural processes, and their course, in its turn, – to maintain independence from the cognitive procedures applied. The opposite principle of subjectivity requires taking into consideration the *knower's* activity with its methodological and value preferences and replace cognitive tasks by evaluative ones – in the situations of methodological or financial planning of research, selection of models originated from the fundamental theory, etc.

In the concepts of historical types of V.S. Stepin's and V.V. Illyin's scientific rationality, this transformation of principles acquires a schematic form of rationalization circle revolutionary expansion – from the cognitive object (classic) to its means (non-classic) and goals and values (post-non-classic or neo-non-classical) [14, p. 619–636]. In this way the history of scientific rationality is reconstructed as a revolutionary transition from the epistemological principle (“knowledge is the goal”) to the *anthropic* one (“knowledge is a means”), which introduces the need for universal justification of knowledge into the goals and values of knowledge [5].

Given that they have the revolutionary name, these changes in scientific rationality are fully covered by the original archetype of rationality – the ancient idea of “τεχνη” as an artificial reproduction or transformation of reality, which happened to have its continuation in Christian verbalist creationism. In influential Aristotelian epistemology, τεχνη is defined as a special step of knowledge, which is based on practice (“wisdom of the head and hands”), but differs from handicrafts by clarifying the “general” (ἐπιζήτημα) and “reasons” (ἀρχαί). If the objectivity of the “general”, which is opposed to the opinions, can be unambiguously determined by means of the rules of logic (“Organon”), then the Aristotelian “reasons” constitute a temporary or subjective component of τεχνη. It follows from here that its relative definition and artistic dependence on the chosen goals, means, results and the degree of their complementarity: “rationality can be considered at three main levels of its own operation: as mental activity performance that uses conscious forms in driving towards the goal, methods, logical tools, categories etc.; as cultural existence performance and human spiritual and practical activity, when rationality is attributed not only to the processes of the cognitive plan, but also to the forms of existence of knowledge itself in culture; and finally, rationality is used by the forms of human activity itself, established in the form of various types of technologies, social and vital structures” [6, p. 7].



Thus, the initial relativity of the idea *τεχνη* determines the philosophical scale of the rationality issue and the immanent incompleteness of its solution, which remains invisible in the times of firmly established values.

#### 4. Reason and reason in the structure of modern scientific rationality

As opposed to the ontological concepts of the classics, at present time rationality is called as the property of creative activity (cognitive and practical) to bring reality to its human-dimension modes on a conscious level. Although the relevant fragments of reality are usually provided with this property in the secondary plan – the “first” or “second” nature of ecology, biotechnology, genetic engineering, biomedical devices, artificial intelligence, etc. – the original human-dimension as a theoretical correspondence to a certain context of the Subject contains a distinction between objective (one that determines the *means* of activity) and subjective (one that determines the *goals* of activity) components. In this regard, certain means and goals are as before identified to be organically interconnected by means of a sequence of actions. If some successful sequence of action is degraded, the correspondence of means and goals is established by a complex analytical way: “<...> “intra-theoretical” and, more wider, scientific rationality, represented in a set of strategies and methods of construction of the idealized image of reality, precedes the studied *objects*, and the latter ones are created in the process of rational activity” [1, p. 66].

The last-mentioned thesis points to the inevitability of the reflexive component of rationality, which in the isolated mode constitutes, as a matter of fact, “mind” as opposed to the “reason” of the European philosophical tradition. If the mind performs (re-produces) analysis, abstraction, normalization, the mind reflects over this rationalization, correlating in due from the processes of induction of sensations and deduction of concepts with the normative structure of cognition. The latter represents traditionally human – finite and embodied – reproduction of infinite prototypes and intuitions of the divine mind. “<...> The universe dissolved into an infinite multiplicity of infinitely different movements, each circling around its own centre, and all held together both by their relationship to a common cause and by their participation in one and the same universal order. The same is true of spiritual being” [23, p. 28].

There is a hidden paradox in this: personification of the transcendent in the normative cognition structure, in order to avoid naive anthropomorphism,

requires dismissal from the *transcendent* in that form in which it is imagined by a human being in alternative goal-setting. It is known that Nicholas of Cusa solved this contradiction by means of mathematical symbolization of *categories*, turning them into obviously incomprehensible for understanding, but free from specific content. After a series of attempts from R. Descartes to B. Russell to build the normative structure of cognition to the rules of calculating the reliability of deductive inference, this dismissal of categories from the content was recognized as the main function of the symbol to attract new experience, to develop [3]. “The number in the Platonic-Pythagorean experience was therefore “*everything*” that encrypted, or digitized, the secret meaning of “*everything*” in itself, in R. Descartes it is no longer “*everything*”, but can become “*everything*”, because purified to emptiness, now it is a pure *tool* applicable to anything by means of “rules for operation” [13, p. 373].

At a later time, postmodernism will qualify this structure of cognition as a “discourse of representation” – a set of measures imitating the elevation of particular events and their semantic content to the original “transcendental significatum” to cause its presence (re-presentation). Since the extent of this transition is eventually determined by the *categorization* as the organization of content into the predicative structures, categories (“the concepts of mind”) generated under these conditions – such as “existence” or “idea” – according to G. Deleuze, have no certainty and are not even defined as “an unlimited singular plurality of concept identities”. However it is this non-identity (*sans fond*) makes it possible for them to reduce the never-ending opportunities of representations (*difference*) to a self-sufficient mind that replaces the transcendent Logos [24].

Under worldly conditions the reproduction of the ideas of the divine mind is limited to the *reproduction of the mode of action* of Providence when taking control over the flow of things, for this purpose methodological principles (identity and contradiction, continuity, sufficient basis, universal relationship), methods and normative structure of cognition are designated [32]. This methodology of human comprehension of the transcendent acquires the status of universal metaphysics of the modern worldview by its ability with the necessity to combine unique apriori and any experiential preconditions. It is obvious that in the course of this reflection a certain invariant of transforming activity can be established, its universal scheme, reasonable for different

types of activity, when studying various types of objects. In this case, we are talking about “methodological” (“wisdom of the head”) rationality contrary to “operational” (“wisdom of the head and hands”), having an empirical or special nature [19]. But the current problem involves the need to supplement the idea of rationality as a sequence of patterns of activity with certain directions of possible and the framework of the impossible, proportionate to human life in terms of its relationship to himself and the world they created.

Insofar as scientific activity has long ceased to be commensurate with the abilities of some *scientists*, their personal motivation and subject-cognitive activity are equally mediated by a whole range of professional norms ensuring the differentiation of labour and generational bridge. Therefore, the sense-bearing and life orientation of rationality promised to detect some regularities useful for improving the predictions or argumentation only on a generalized scale of entire scientific societies. Thus, there appeared the models of *historical* development of knowledge in the practice of philosophical reflection on science (K. Popper, T. Kuhn, M. Foucault, G. Holton etc.), these models covered external factors and revolutionary overthrows in the basics of science – the scientific picture of the world, the style of thinking, and the ideals of rationality. On the other hand, what is the measure of this appearance and revolutionary character: should we take into account any goals and values *or* only those that have been mastered by socio-humanitarian science in subject, reproducible, verifiable knowledge as a buffer zone between science and irrational *non-scientific* fields (myth, magic, arts, politics, spiritual traditions)?

### 5. Rational basis of educational paradigms

The history of science certifies that these questions are not new: the Romantics (F. Schleiermacher, F.-R. de Chateaubriand etc.) at the turn of the XVIII–XIX centuries denied the Enlightenment course on the establishment of scientific mind as the universal driving force of history. To be more precise, it referred to the subordination of the entire discursive knowledge to the mythological origins of *tradition*, which had to provide the disclosure of the creative potential of human existence, individual *self-determination* within the context of the meaning of his life, and so on [9, p. 340]. According to phenomenology, mathematical science, using the method of idealized entities, contributed to the scientification of the “life world” of cultural values, which resulted in the suppression of the

subject's creative ability and the whole European culture to a symptomatic disassociation from reality, escalating again the Cartesian "doubt". At the same time, to eliminate this longing for absolute truth, it is suggested to *eliminate* the problem of the identity of existence and thinking and the "understanding" perception of a scientific object – as a text without a transcendent referent, with open alternatives to reasoning.

The elimination of the dichotomy of subject and object in the structure of experience inevitably introduces the *event conditions* of thought into the implementation of the subject essence, so that the predicative structure of the categories used is determined by the linguistic and semantic context. It is these subjective conditions of thought that are absolutized in the philosophy of irrationalism of the XIX century, having the aim of set an *individual* free from the dictates of Mind, winning back her ability to look beyond the discursive forms of cognition; especially since cognitive goals are considered herein as derivatives of thirst for power, sexuality and the suppression of thoughts about the inevitability of death.

Subsequently, this emancipation meant the opening of the theory of rationality as a formalized system. The correlation of various elements of human spiritual experience, the implementation of "existentially motivated life-spiritual synthesis" within the context of consciousness served as one of the incentives for the development of a new concept – *open* rationality, where the final basics (as opposed to "initial" basics of analytical method) remain probabilistic. Thus, the absolutist idea of complete removal of experience by relevant theoretical means was denied, because they do not have a place for the unique conditions of existence and will peculiar to the socio-humanitarian object. This refers to the opposition, well-known from the time of S. Kierkegaard, of rational general and irrational individual on the basis of the ability to self-determination. The mind is transformed from the master of reality into a guiding principle of cognition, the tradition and logic of which are established to the extent of interaction between the participants of knowledge and are developed in the pragmatic context of the task chosen [16]. It means the loss of guarantees that logical and ontological determinism are isomorphic: the world does not have to have a subject-predicate structure, consist of substances, be simple and mathematical.

Therefore, modern European irrationalism is notable not so much for the internal unprofitability of mystification as for the object prediction, first

and foremost the objects of particular practice and communication, rather than cognition – the features of uncertainty and backwardness. Moreover, if rationality is defined in the traditional epistemological aspect as a degree of conformity of discursive expression of knowledge to the existing forms of thinking, then the boundary between rational and irrational should be considered relative, having variable intermediate forms. As the criteria of scientific knowledge and their generalization in the forms of scientific rationality become mobile, derived to a great extent from what is now mastered by theoretical science, there is an argument from irrationalism about the permanent underdevelopment of fundamentally new phenomena. They not only supplement the potential of scientific knowledge, conflicting with reality and truth as these notions are recognized in current forms of thinking, but in equal measure – the arsenal of scientific means, offering new goals and values, in the long run of which current science and rationality seem to be insufficient.

Therefore, the epistemological strategies of the XX century, especially positivist models of scientific knowledge, appeared to be more focused on relative *criteria* of rationality: systematic, semantic or methodological internal coherence in combination with the principles of fallibilism and historical relativism – as the form of objective (discursive, paradigmatic, epistemic) reduction of rationality standards. Thus, the Marxist methodology in the management of cognitive activity provided to use a reflexive *level* in addition to the subject one, which should establish the spiritual and practical prerequisites for the formation and development of categories and epistemology in general. At present time, such values may have totally different sources with unexpected sociocultural and existential meanings, not necessarily related to positive transcendence of scientific reason. For example, the philosophy of postmodernism provides passing all the boundaries outlined by the great ideals (“metanarratives”) of the industrial age in order to ensure free cultivation and unlimited development of human subjectivity. The search for truth, especially according to the model of classical scientific rationality, loses the status of the most important tendency among the inexhaustible variety of its dimensions.

In this respect the glorification of the sphere of the unconscious (inclinations, instincts, intuition, faith, tacit experience) does not exclude the humanistic tradition, causing changes in social and cognitive situations, in particular, the review of educational *paradigms*. Although the latter are

detailed in a variety of expedient practices (“methodic”, “technologies”), they themselves, as well as the scientific content they broadcast, are always involved in a broader context, the basis of which (except for current worldview human images, moral values, political interests, etc.) is the way of orientation in the world. In European intellectual history, there are only three ways of this orientation – contemplative (traditional), activity (objectiv) and modern – dialogue (subjectiv) [18, p. 89–90].

The components of existence and their reflection in the consciousness of the subject appear to be identical within the context of the *contemplative* world perception, having regard to their initial proportions. Although their empirical identity is not necessarily performed, the effect of the reflection is considered to be a well-defined parameter of this existence. In the projection on the socio-cultural organization the contemplative way of orientation in the world is represented by the conventional system with the imperative-mandatory educational paradigm peculiar to it.

*Activity* world perception contains a cognitive *vector* of evaluative and transformative activity, directed from the subject to the *object*, into which the component of existence previously irrelevant now turns. The educational paradigm in this case is interpreted as an *activity* related to the implementation of the social order, development of an individual’s typical model, and subsequently – as a consistent projection of this model on the sphere of the object of education. It is related to the class-and-lesson system of education, frontal-reproductive acquisition of knowledge, curricula as a substantive development of the social order, universal principles of pedagogical interaction and other basic principles of the such pioneers of scientific pedagogy as J.A. Comenius, J. Locke, J. Herbart etc. [12].

The new generation of ideologists of this paradigm (M.J. Adler [20], J.S. Bruner [21] etc.) presupposes the possibility of the individual to surpass the cultural heritage acquired by him/her through fundamental scientific knowledge and, consequently, to receive distinction and social preferences. On this way, it is provided to specify educational goals in the lists of knowledge, skills and attitudes in order to be able to develop an individual academic schedule and management of self-education [22]. At the same time, the guideline for the comprehensive transfer of social goals into educational ones makes itself felt in the maximum technologicalization of the pedagogical process (tests, training, algorithms, computer programs)

up to the interpretation of the educational result as an “extended behavioral repertoire” of the individual [39].

*Dialogue-based* worldview, which as a matter of fact, originates from Socrates’ maieutics, in the most general form abandons the privileged intellectual position of the external observer, and apriori meaningful goals, meanings, tools of cognition and interaction as well. It corresponds to the multidimensional and decentralized socio-cultural situations of the information age, when orientation in the world is mediated by temporary circles of communication, and entering the society loses guarantees of social status and professional qualification in favor of personal *self-determination* and its progressive amendments [37, p. 360].

In the process of education this is reflected in the moral parity of the relationship between the tutor and the learner (“subject-subject education” by S.L. Rubinstein and A.N. Leontiev; “Cooperation pedagogy” by S.N. Lysenkova and V. Shatalov, Waldorf pedagogy etc.): it is not the person who fits into the educational order of society, but education fits into the *person’s* vital needs. In this way, the new requirement of its humanistic significance and naturalness regarding didactic material is rewarded with the prospect of being learned to the full extent, which seemed to be problematic under the conditions of the “educational conveyor” of the object educational paradigm [34]. However, its individual features acquire a constructive meaning only as a part of the mentioned *ability* of self-determination, and the development of the latter requires any kind of participation of a young person in the presentation of subject matters as certain components of sociocultural existence, in particular, experiencing the conflicts of their formation history and particularity detention of their own interests and beliefs. “In the same way, the purpose of education is transformed, the implementation of which involves at present time not only the learning of socio-cultural experience of mankind, but also the process of personal self-formation, his self-realization through the production of experience having a dual nature – individual and socio-cultural experience of the mankind” [10, p. 228].

Therefore, the use of the subject paradigm is possible and efficient depending on the level of initial subject and reflexive psychological training of both parties of the educational process. This particularly shows the (in)ability to work in groups (discussions, statistical modelling, laboratory projects), otherwise the educational goal of personal development is replaced by the means of professional training

and under the guise of modern forms, a conservative monologue (traditional or object) *complex* of character education is dominant, which under the conditions of mosaic post-industrial mass culture turns into nihilism in its consciousness, transferring the level of authority from tutors to mass media, and educational motivation from cognitive to pragmatic or hedonistic [8; 35]. Thus, the idea of science as a provider of educational content seems to be selective, limited by the rapid visual efficiency, which is, first, provided by its technical applications. In this form, scientific rationality falls back to the images of New Age mechanics, and the respective gaps in its humanistic significance are compensated by the reasonable irrational culture of the New Age.

The theories of nonlinear dynamical systems highly-demanded in recent times can become the ontological basis of the subjective approach in modern education. Models and concepts of synergetics, chaos theory, etc. acquire high heuristic value beyond the original physical chemistry, cybernetics and nonlinear dynamics, creating applications in both technical and socio-humanitarian fields of knowledge. Therefore, educational applications of nonlinear theories in science determine the priority of dialogic, problem-based, content-integrative and individual forms of education. In this regard a classical scheme of “the right question – the reference answer” is broken, which results in a value balance in the didactics of the logic of concepts and chaotic components. Standing together, they form a network of associations of individual experience and serve as centers for the memory organization, understanding of knowledge and individual’s practical competence [7].

### 6. Conclusion

Classical scientific rationality, which still often defines the “face” of science in public opinion, provides a mechanistic image of nature as a reproducible apparatus deprived of inwardness, which under the condition of accurate “geometric” description can be represented by the human mind in the form of unambiguous scientific *laws*. The latter are presented as an ambivalent tool, and the scientifically-based process of obtaining them – as one that on its own terms is deprived of humanistic significance. The review of classical scientific rationality, which became imminent under the influence of new ontology (historical and evolutionary, quantum-mechanical, non-linear objects) and the increasing measure of abstraction of its representation (non-euclidean geometries and other alternative theoretical models), found its way into the



weakening of the objectivist verifiability *criterion* of in favor of the subjectivist one, when blurring the dualism of inert matter and mind activity, when breaking the partition wall between the science of nature and science of spirit.

Modern European worldview attitudes have, to a large extent, broken through the modern image of rationality and scientific-cognitive expansion and these attitudes are compatible with humanistic values primarily by means of sociologization and historicization of scientific rationality criteria. Contrary opinions in everyday awareness are caused by the ambivalent practice of post-industrial educational paradigms or by the greater inertia of the educational institution in the translation of cultural codes. *Post*-nonclassical scientific rationality and the *post*-industrial educational paradigm have a common denominator of *duality* of discursive standards and personal immediacy, which in classical terminology were contrasted as natural rational and accidental irrational. Nowadays this *duality* is presented in the philosophy of science as humanistic *complementarity* of scientific and non-scientific, and when translating scientific achievements in education – as a *dialogics* of the subjects of education. The impossibility to remove social determination from the operation of social institutions of science and education represents on the one hand, a reason for recurrences of archaic ways of orientation in the world – mechanistic paradigm in science, monologue approaches in education – and, on the other hand, the condition of *individual's* personal level of development, while the latter happens to have creativity towards fundamental scientific knowledge and existing forms of social life in general, and by means of abovementioned – to himself.

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