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INTRODUCTION TO PHILOSOPHY OF SCIENCE

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Философский постпозитивизм, развивавшийся в формате истории науки, вырастал из естествознания: его создавали физики и математики, приобретшие вкус к философии и интерес к социокультурным предпосылкам науки. Западная философия науки возникла на гребне знаменитого лингвистического поворота, но первыми его совершили не лингвисты, а инженеры. В отличие от этого, отечественная философия науки заметно склоняется к классической теории познания. Предложить в этих противоречивых условиях наиболее общее объяснение предмета, метода и основных подходов и проблем современной философии науки является целью настоящего учебного пособия, представляющего собой конспект двух лекций по философии и истории науки. Две эти части вошли в состав книги "Truth – *cor cordium* of gnoseology" (Novosibirsk, 2019).

Предлагаемое учебное пособие предназначено аспирантам-иностранцам, обучающимся в КГЭУ по всем естественнонаучным и техническим направлениям подготовки. Оно призвано послужить необходимым материалом при подготовке аспирантов-иностранцев к сдаче экзамена кандидатского минимума.

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INTRODUCTION

The proposed textbook is intended to help foreign graduate students studying at Kazan State Power Engineering University in all natural science and technical specialties. It is to be used as a necessary material in the process of preparation of foreign postgraduate students for the PhD exam in philosophy.

If philosophy as a whole views the relationship between a person and the world as its main subject, then philosophy *of science* studies the relationship of a *scientist* to what s/he explores, and in what way.

Philosophy of science is: 1) philosophical trend that views science as an epistemological, methodological and sociocultural phenomenon as its main subject matter; 2) special philosophical discipline the subject of which is history of science(s).

The term "philosophy of science" first appeared in the work of E. Dühring "*Logic and Philosophy of Science*" (Leipzig, 1878). Dühring's intention to build up the philosophy of science as a significant expansion of the sphere of logic was not implemented by him, but this terminological innovation turned out to be very timely.

The problematic of philosophy of science, basically the structure and development of scientific knowledge goes back to Plato and Aristotle. With the formation of the science of modern times, the philosophy of science in unity with the theory of knowledge becomes the most important area of philosophical research in the works of F. Bacon, Descartes, Leibnitz, d'Alembert, Didro, Kant, Fichte, Hegel, and later in F. Bolzano. The state and significance of the modern philosophy of science is determined by the place of science in society, in the world view, and also by the set of its internal, historically formed concepts and problems.

As a special direction, philosophy of science is formed in the writings of J.S. Mill, A. Comte, H. Spencer, J. Herschel. Its birth marked the distinct formulation of a normative-critical task: to bring scientific and cognitive activity in accordance with a certain methodological ideal. The prerequisites for the movement of this task to the fore were the sharp increase in the social significance of scientific work, the professionalization of scientific activity, the formation of its disciplinary structure in the 19th century. At the first stage of the development of philosophy of science, the focus of its attention was on the problematics associated with the study of psychological and inductive-logical procedures of empirical knowledge. The content of the second stage of the evolution of philosophy of science (1900–20) was mainly determined by the understanding of the revolutionary processes that took place in the foundations of science at the turn of the XIX and XX centuries. Both philosophers and prominent scientists – E. Mach,

M. Planck, A. Poincaré, P. Dueham, E. Cassirer, A. Einstein, etc. – became the central figures of this stage. This predetermined the fact that the main subject of the analysis was the substantial foundations of science, and first of all the theory of relativity and quantum mechanics. The next period (1920–40) can be designated as analytical. It was inspired in many ways by the ideas of the early L. Wittgenstein and determined by a program for analyzing the language of science developed by classical neopositivism: the Vienna Circle and the Berlin Group (M. Schlick, R. Carnap, F. Frank, O. Neurath, G. Reichenbach and others).

As far as the Methodology of science is concerned, the second main subject of Philosophy of science, its subject is the scope of methods for obtaining scientific knowledge and scientific activity. Besides, methodology studies the levels of scientific knowledge and the forms of its existence.

Methodology of science performs two functions. 1. It reveals the meaning of scientific activity, that is, it considers science with society, culture, practice, and person. 2. It solves the problems of improvement, rationalization of scientific activity, going beyond the bounds of philosophy, although relying on the ideological and general methodological guidelines and principles developed by it.

Today, two main orientations can be distinguished in the Methodology of Science: 1) critical-analytical and 2) design-constructive. Realizing the first orientation, the methodologist acts as a researcher of thinking in one or another discipline. At the same time, s/he must realize a reflection of a special kind: critic and research. By implementing a design-constructive orientation, the methodologist helps the specialist to rebuild and develop his subject.

An important result of the methodologist's critical activity is the "distribution" of concepts and other disciplinary representations. In the framework of the design-constructive orientation, the reverse procedure is carried out: "objectification", that is, the construction of new concepts and ideal objects. Since the methodologist is focused on building a new subject or discipline, s/he argues for the need to build new concepts, identifies the tools and methods necessary for this, develops a plan and strategy for action, and sometimes creates the first fragments of a new subject. In order to move from the existing state of activity to its new state, the methodologist is forced to reflex and "overcome" the objective point of view and ways of thinking. It shows what they are based on, where their boundaries are, what kind of cognitive attitudes caused them. Both reflection and other forms of methodological work are being built today with the conscious use of scientific and projective ideas and methods. This means that methodological work is implemented, on the one hand, as a special kind of research, and on the other as a kind of intellectual design.

The development of scientific and projective orientation in methodology of science led to the formation of the so-called "general methodology" in contrast to "special methodology". The general methodology develops the basic principles and means of methodological work (approaches, concepts, schemes). At the same time, both the experience of private "methodologies" and knowledge about thinking and activity are used.

The task of special methodology is the methodological provision of specific activities in certain sciences, disciplines, and various practices. In the field of general methodology of science, the methodologist studies and constitutes the laws of thinking and activity as such, considering thinking and activity as special quasi-natural processes.

The past century has demonstrated the present transformation of a long anthropological (essentially Kantian) turn into a linguistic turn. The rapprochement of *positivism* with its methodology is based on a heightened philosophical interest in language; as a result, the success of philosophy of language pushed aside classical epistemology and even general theory of knowledge. Philosophy of language joined with philosophy of science.

Philosophical post-positivism, which developed in the format of history of science, grew out of natural science: it was created by physicists and mathematicians, who acquired a taste for philosophy and an interest in the sociocultural prerequisites of science. Western philosophy of science originated on the crest of the famous linguistic turn; however, it was firstly created not by linguists, but by engineers: we speak of Ludwig Wittgenstein. Russian philosophy of science, though noticeably inclined to the classical theory of knowledge (as in late Stepin V.S.) was also mainly constructed by specialists in natural sciences, logic, and mathematics. Lately there joined specialists in sociology of science, sociology of knowledge, and philosophy of language. To follow this complicated history is not an easy task. The purpose of this tutorial is to present in these manifold conditions the most general explanation of the subject, method, and basic approaches and problems of the modern philosophy of science.

Not to stay alien to epistemology which ought to be viewed as the theory of *scientific* knowledge prone to logicism and impersonal objectivism, despite of its tendency to involve subjective motifs as the so-called *virtue* epistemology does, – and of course not to stay away from philosophy of science – this textbook includes corresponding chapters: Part I "Specifics of Philosophical-Scientific Knowledge" and Part II "Main Approaches in Philosophy of Science".

According to M. Schlick, founder of Vienna Philosophical Circle, the problem of cognizing the essence of being is meaningless. Schlick was the first to announce that philosophy was not a science, but it could be scientific and non-scientific. Non-scientific philosophy is engaged in worldview and meaning-of-life

issues and thus it is similar to theology. Scientific philosophy makes science its sole object understood as a set of statements, i.e., it is language of science. Between philosophy and science there spreads a neutral zone, or "no man's land": and this is *philosophy of science*. It uses logic and focuses on physical theory as a standard of scientific knowledge.

According to a "critical negativist" K. Popper, methodological *essentialism* in science is generally not applicable; there is no answer to such questions as "what is atom?" It is only *methodological nominalism* that is applicable; for example, the question "under what conditions does atom expulse light?" – *has* its scientific sense. The newest positivists, philosophers of science, and also analytical philosophers *replace* truth with "the domain of definition of meanings", and at best with "sense" and / or "value". In the first case, the origin of any philosopher of science from *natural sciences* is clearly affecting; in the second case, a hobby for socio-humanitarianism is pulled up.

The achievements of positivism are great, but it was precisely these achievements that led us away from the worldview problems to epistemology, methodology, *philosophy of science* and its derivatives.

In the grateful memory of the noble epoch of "Modernity", at the beginning of this textbook we give one excited monologue of a scholar, not so far back in past as the era of Enlightenment itself. Actually, the article with this monologue was published not even a century ago, in 1927.

"Our god Aoyog [read: λογοσ. – *E.T.*][1] is perhaps not a very almighty one, and he may only be able to fulfil a small part of what his predecessors have promised. If we have to acknowledge this we shall accept it with resignation. We shall not on that account lose our interest in the world and life, for we have one sure support… We believe that it is possible for scientific work to gain some knowledge about the reality of the world, by means of which we can increase our power and in accordance with which we can arrange our life. If this belief is an illusion, then we are in the same position as you. But science has given us evidence by its numerous and important successes that it is no illusion… She is reproached for the smallness of the amount she has taught us and for the incomparably greater field she has left in obscurity. But, in this, people forget how young she is, how difficult her beginnings were and how infinitesimally small is the period of time since the human intellect has been strong enough for the tasks she sets… No, our science is no illusion. But an illusion it would be to suppose that what science cannot give us we can get elsewhere"[2].

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[1] Note: "The twin gods Aoyog [Logos: Reason] and Avdyxt [Ananke: Necessity] of the Dutch writer Multatuli".

[2] Freud, Sigmund. *The Future of an Illusion*. Newly translated from the German and edited by James Strachey. https://archive.org/stream/sigmund-freud-the-future-of-an-illusion/sigmund-freud-the-future-of-an-illusion_djvu.txt

PART I. Specifics of Philosophical-Scientific Knowledge

Philosophical materialism persistently preserves its orientation towards sciences, and existential materialism based on a postulate of the essential unity of being and knowledge, unlike some other varieties of existentialism, is not afraid of science; it welcomes science, relies on it and serves it, like any materialism.

If philosophy as a whole views the relationship between a person and the world as its main subject, then philosophy *of science* studies the relationship of a *scientist* to what s/he explores, and in what way. Existential materialism has its own gnoseology, but it does not have its own philosophy of science; however, there is an opportunity to express its own understanding of the existing philosophy of science in the following synopsis.

In the beginning of this century, modern English philosopher Jonathan Bennett studying the work of Locke, Berkeley and Hume, wrote in his book "*Learning from six philosophers*":

> "On the naturalistic side we have the concept of *cause*, and inquiries into the *origins* of various aspects of the human condition; and much of this belongs to *empirical psychology*. The normative side is concerned, rather, with *logical* relations, requiring us to engage in conceptual *analysis*; and there is an emphasis on the *philosophy of mind*. …I presented this dichotomy by contrasting 'genetic' questions about where our thoughts and beliefs come from with 'analytic' ones about what they are, the latter being a needed preliminary to discovering what might justify them"[3].

It is not difficult to understand these intelligible explanations; especially important is the last maxim regarding the acquisition of the test criteria. With one remark.

Between the "ontological" approach about cause and origin of knowledge (in fact, it is *natural-philosophical*) and *epistemological* ("analytical") approach about how it is acquired and what might justify it, the *gnoseological* question of *what is truth* dwells: namely, what our thoughts and beliefs are – in respect of *true knowledge*.

Bennett believes that epistemological questions (about what..., discovering what might justify...), lead to philosophical-scientific inquiry (what reasons move people to believe). He examines the dilemma of the naturalistic and epistemological:

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[3] Bennett, Jonathan. *Learning from Six Philosophers*. V. 2. Locke, Berkeley, Hume. Ch. 32. Hume's "Ideas".
§ 236. – Clarendon Press. – Oxford. 2001. – P. 199.

"A statement about what causes someone to believe that P, where the causes do not involve anything that he takes to be reasons, has no link with anything normative; and a statement about what reasons there are for P is not in itself a causal one" (ibid.).

And then in the beginning of the first chapter the author briefly mentions the fact which we called "embarrassment of the second level" (although, it seems, Bennett does not consider this an embarrassment): the problem of compatibility of knowledge about object and knowledge about this knowledge.

"So the causal inquiry can stand on its own, as can the normative one; but when we ask not just what reasons there are for P, but *what reasons move people to believe it* (*italicized by me. - E.T.*), we are in territory that involves both logical and causal relations" (ibid.).

Nowadays, remarks Bennett in passing, these kinds of arguments do not contradict each other: "none of these is controversial these days".

No they do not; however, the judgments including both kinds of arguments lie at different levels and are expressed "in different languages" – namely, objective and meta-language, as we know from Russell. These are judgments about objects of different levels of abstraction, different "floors", on which the "signification lift" stops: it is the language of speaking about the subject of thinking (1) and the language of speaking of the language of speaking (2). But, unlike the lift stops, the second stage contains the first one. They have a common terrain, or range of values. And, of course, they have a common source: the primary "body", the truth-maker, which is conceived and denoted (Ockham's "bird"; *sicut vox ex institutione supponit pro illa re, ita ipsa intellectio ex natura sua sine omni institutione supponit pro re, cuius est*). It is denoted twice, and designation No. 2 is usually marked somehow, including some modal operator. Although this may not always be the case; "The king of paradoxes", consisting in its limit of just two words "I lie", demonstrates this difficulty.

The far-reaching separation of approaches to cognition led to the physiognomy of the newest Western philosophy perhaps as vividly as the opposition of "philosophy of life" and "philosophy of science", or even more. And this distinction goes back to the teachings of David Hume. The wording of the "fundamental question of philosophy", associated with Feuerbach, Engels, or some "*gelehrtere*" university philosophers, – in a word, rather with the German tradition, – in reality was prepared by Humism.

Let us recall for one last time this classically-established formulation for the twentieth century: The great basic question of all, especially modern philosophy, is the question of the *intercourse* of thinking and being, spirit and nature. The "first

side", or the ontological formulation of the question, raises the problem of genesis. (Socrates: "And, if you like, understanding [*gnōme*] might mean considering the genesis of things [*hōnes nomēsis*]..."). The second, "gnoseological side", opens discussions about the principle of reflection. It would seem that everything is clear. In fact, few philosophers today (except probably theologists) consider the ideal genetically primary compared to the material; even "agnostic" Hume did not doubt the primacy of the objective as a naturalist. All complexity, not to say perplexity, is concentrated in the second formulation of this question.

IF a philosopher *does not* attribute truth to KNOWLEDGE, but refers it to REALITY, – like Heidegger, – THEN the basic question of philosophy is not raised at all, it can only be immediately solved. At the same time, the "ontologization" of truth automatically removes the gnoseological side of the basic question.

IF, now, a philosopher *attributes* truth to KNOWLEDGE, not to reality, "does not ontologize" it, – THEN s/he must, firstly, automatically recognize the principle of reflection (which, surprisingly, does not occur; the "theory of symbols" plays an alternative to the theory of reflection), – and secondly, inevitably move from gnoseology to *methodology*: *How* do we verify that *Denken* is *Bewußtsein*?

The certificate is provided by evidence using language. From here, the following transition is easily possible: the assignment of truth not to being and not to consciousness, but to LANGUAGE.

This is what positivism performs in many varieties, with its general epistemological lurch. And the next stage will be, which is also logical, understanding of truth as satisfying the truth conditions of a statement, and in the short term replacing truth with meaning (sense), meaning with the use of signs in the statement, gnoseology – with epistemology, logic and methodology, then dispelling and disintegrating of "theorizing" and the emergence of postpositivistic philosophy of *science as a set of practices and techniques*. Science understood as "what a scientist does in his laboratory" and not otherwise, leaves no chance for the classical theory of knowledge.

Sad but true: having accomplished this *prescission*, modern philosophy, as if waking up, found that theory of knowledge gradually became positivistic-humanless, and great many epistemologists threw all their forces on the reconstruction and study of the socio-humanitarian background of science, its socio-cultural framing, "personal", "hidden", etc., knowledge, marginalia, background, or backcloth… Was it worth it?

The question, of course, is rhetorical. There was no actual discredit; instead there was a talk on the topic of debunking the ideals of the Enlightenment: the "unfinished project of Modernity", which was introduced to the contemporary

generation of young philosophers in the light of the unfinished knowledge of it. But no professional scientist, even fascinated by critical philosophy ("criticism of critical criticism"), is able to join any scientific discourse without "big words," that is, metaphysical categories, let alone concepts of a lower level of abstraction. Nor did the peculiar hunger of fundamental socio-humanitarian theories disappear, and it could not disappear; on the contrary, it increases.

It is clear that not a single philosopher is disingenuous when speaking about sincere belief in the revealed truth, but at the same time no one hopes that this very doctrine is the ultimate truth that can draw the whole reading world into it. It seems necessary to withstand the golden proportion of the naive ("native", innate), realistic and critical, 3: 4: 5. This will support the natural harmony inherent to gnoseology in expressing the relationship between man and the world.

Both epistemology and philosophy of science have much narrower subject than general gnoseology; but their pretentions are great. In western philosophy, epistemology has the ambitions to replace what was called classical gnoseology of the past; c.f. what is claimed by Sven Bernecker and Duncan Pritchard in the very Preface of *The Routledge Companion to Epistemology* (2011):

> "Epistemology has always been one of the most central and important areas of philosophy, one which overlaps and intersects with all the different regions of our ancient discipline. More recently, however, epistemology has gone from being a solid mainstay of the philosophical landscape to being right at the forefront of contemporary debate"[4].

These eminent authors, as many others, are proud of this discipline and genuinely think it is omnipotent.

However, it is not. Or rather, besides of being just *dull* with all its annoying abbreviations like CC, PT, SW, with all its F-s, M-s, p-s, q-s and T-s (I beg your pardon, but Aristotle did his perfect logic without those formulae); with "cats on the mats", red roses red iff red, green grass green iff green, and raining iff raining, — treats upon the "truths" of propositions or utterings, but not of Truth itself. Even Gettier cases' analysis and discussions of intellectual virtues, though bringing some entertainment into epistemology, does not really make it deep and broad enough to be a rival to general gnoseology. My view is that epistemology should better remain what it is: namely, theory of *scientific* knowledge, striving for a "formally account for the logical behavior of truth", in righteous wording

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[4] *The Routledge Companion to Epistemology*. Edited by Sven Bernecker and Duncan Pritchard. – First published 2011 by Routledge, New York. Simultaneously published in the UK by Routledge.

of Michael P. Lynch[5]. And logical behavior is not the only power and not the singular property of truth. Of course such an account serves accuracy of discourse; however, we will show in the closing chapter that an accurate account of truth is possible with another means: that of (Pythagorean) mathematics.

Philosophy of science, on its part, seems more wide and interesting than "pure" epistemology in its choice of topics. At the same time, I share the view of a Russian scholar Vladimir Przhilenskiy: this discipline is still in the process of self-determination. Its relationship to theory of knowledge and sociology of knowledge, to epistemology and methodology is extremely complex. This is especially true of Russia, because of its unusual sociocultural context, national intellectual traditions and the difficulties of transition from Hegelian to Kantian views[6]. In the West, philosophy of science is an *alternative* to the classical theory of knowledge, which alternative arose on the crest of the famous linguistic turn. And in the USSR, postpositivistic texts were always, from the very beginning, translated and discussed as *gnoseological*.

Since the 60s – 70s of the twentieth century neopositivism faced harsh criticism in the USSR; and postpositivism grew out of polemics with it, too. So books about paradigms, research programs and scientific revolutions were accepted in our country favorably, and they became interesting to discuss. At the same time, serious differences in the "platforms" from which criticism was conducted were ignored: *dialectical materialism* grown from *Hegel* and one of the variants of *Kantianism* (neopositivism) versus *another* variant of Kantianism (postpositivism). I mean that positivism, all positivism is based on Kant.

The term "positivism" in the broader sense is a complex cultural trend of the "era of peace" in Europe (and in the USA): its development continued since 1840-ies to almost World War I. In the narrow sense of the term positivism is the special trend of contemporary philosophy that has passed four stages in its development.

The first representative and father-founder of positivism was Auguste Comte with his philosophical project called "*On human evolution, individuality and solidarity*". Sociology was born – and it was born as social physics. So I would rather call Positivism # 1 – *sociological*. John Stuart Mill and Herbert Spencer contributed to it, and their views were characterized with optimism and belief in progress.

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[5] Ibid.

[6] See in detail: *Lectures on philosophy of science*. Training manual / ed. Przhilenskiy. – M.: IKC "MarT", Rostov on / D: "MarT", 2008; *Classical philosophy of science*: Reader / Ed. Przhilensky. – M .: IKC "Mart"; Rostov on / D: "MarT", 2007. Kokhanovskiy V.P., Przhilenskiy V.I., Sergodeeva E.A. *Philosophy of science*. 2nd. Ed. – M: IKC "MarT", Rostov on / D: "MarT", 2006 /All in Russian/.

The end of nineteenth – beginning of the twentieth centuries was marked with crucial worldview change. The so-called scientific-technological revolution evolved; and Positivism # 2, or empiriocriticism, answered its challenge. It may well be called *physical* or *physiological*. Ernst Mach defining a thing as a complex of sensations; Henri Poincare, an expert in methodology of science, with his dictum "No geometry can be more true than another; geometry can only be more or less convenient" and ideas about "free agreement" or "disguised agreement" that underlie cognitive activity; Richard Avenarius with his fundamental presupposition about inter-connection and in-separability of the "***I***" and its surrounding (*empiriokritische Prinzipialkoordination*) – were all great European scientists. Only, as Lenin wrote, New physics *bowed to positivism* (which, in essence, is subjective idealism).

Next comes the third stage of transformation, which was initially called *logical syntax* and later *logical semantics*. Russian commentators call this stage neopositivism, or Positivism # 3, and it is based on the logic-epistemological approach to the study of science which was developed in line with western logic and methodology of science.

The main problem for neopositivism is that of scientific method and empirical basis of science. Its main assumption is radical scientism. Its main abstraction is considering science as a text consisting of certain sorts of statements.

The initial ideas of neopositivism are as follows.

1. Epistemological phenomenalism.
2. Methodological empiricism.
3. Formal logical analysis.
4. Physicalism.
5. Reductionism.
6. Dichotomy of analytic and synthetic knowledge.
7. Dichotomy of theoretical and empirical.
8. Verification principle.
9. Juxtaposition of science and philosophy.
10. Juxtaposition of the context of discovery and that of justification.
11. Elimination of philosophical problems.
12. Elimination of the problem of scientific knowledge development.

Neopositivism has deep kinship with Kantian philosophy, Berkeleianism, and Humism. As is known, it appeared and emerged in the so-called Vienna Circle, in Austria. Another geographic center of the third Positivism was Lvov-Warsaw School leaded by Alfred Tarski.

The Vienna Circle was influenced by Russell's teaching, mathematical logic, and theoretical physics. Several students of Moritz Schlick (father founder of

logical syntax) – R. Carnap, O. Neurath, Ludwig Wittgenstein, H. Reichenbach – came out in 1929 with a program composing "*Wissenschaftliche Weltauffassung*" and founded their own journal "*Erkenntnis*", "*Cognition*", propagating the idea of Unified science. When Wittgenstein wrote his famous "*Logical-Philosophical Treatise*", it became like a Bible for Vienna Circle. *International Encyclopedia of Unified Science* was the main work of neopositivists.

During the Second World War, practically all those scholars immigrated to many English-speaking countries: USA, England, New Zealand, except Schlick.

Schlick was first to announce that philosophy was not a science, but it could be scientific and non-scientific. Non-scientific philosophy is engaged in worldview and meaning-of-life issues and thus it is similar to theology. Scientific philosophy makes science its sole object understood as a set of statements, i.e., it is language of science. Between philosophy and science a neutral zone spreads, or "no man's land": and this is *philosophy of science*. It uses logic and focuses on physical theory as a standard of knowledge.

Being ten years older than Schlick, Carnap survived him by 35 years. He introduced the principle of verification of knowledge. It clarifies the basic concepts of philosophy and science with the help of the apparatus of symbolic logic. Carnap used the term "protocol propositions" – analogous of "atomic statements" of Wittgenstein.

Science for Carnap is a set of meaningful, verifiable, protocol statements. In general, statements can be meaningful (true and false), non-meaningful (non-scientific, e.g., philosophical) and meaningless. All protocol statements are absolutely reliable, for they adequately reproduce the sensory experiences of the subject (sense-data). Later Carnap changes his rigorist stance on verification: it breaks down into the "verifiability" and search for the conditions of truthfulness of meaningful propositions. Truth no longer communicates with the verifying agent.

Carnap dealt with problems of inductive inference, quantification of modal logic; later he turned from syntax to semantics. Logical semantics explores the relationship between propositions and their subject area – meaning.

Otto Neurath was a physicist, sociologist, and economist. He practiced radical physicalism, believing that the only criterion for validity of protocol statements was their logical consistency.

Of Wittgenstein as one of the most influential authors of our time it is said too much already. He was treated upon in our previous *Essays*.

In general, philosophy of science was to establish the unity of knowledge. Here we are mostly interested in the third and fourth positivism.

Karl Popper, who called himself rather critical negativist than positivist, was one of the heralds of the end of the naive faith in the great and heroic systems like Marxism or Freudism ("grand narratives").

Philosophy of Karl Popper, intermediate between the "third" and "fourth" positivism, maintains continuity with the previous stage of positivism, but refuses of many its ideas. For Karl Popper the following ideas are unacceptable:

– phenomenalist interpretation of nature as the empirical basis of science;

- – descriptivism; Popper rehabilitates the explanatory function of science;

- – verification principle; Popper replaces it with the principle of falsification;

- – opposition of methodology of science to all other aspects of its analysis. The latter raises the problem of relationship of history and methodology of science.

However, the philosopher maintains:

- – methodological empiricism;

- – dichotomy of analytic and synthetic statements;

- – dichotomy of the context of discovery and the context of justification;

- distinction between formal and factual sciences;

- – demarcation of science and metaphysics.

Popper, too, stakes on the formal-logical analysis. His initial idea arose as a result of contemplating over the consequences of the collapse of the most grounded theory: namely, Newtonian mechanics.

"*Logic of Scientific Discovery*" was published in London in 1959; "*Objective knowledge*" – in the Oxford University Press in 1972.

In his work "*The Open Society and Its Enemies*" translated into Russian in 1992, Popper gave a battle to "methodological essentialism", or "realism", according to which the global message of science is to disclose and describe the essence of things using definitions. This fight was given from the position of "methodological nominalism" – the legal son of British empiricism.

And in 1962 "*The Structure of Scientific Revolutions*" was published in Chicago, and Thomas Kuhn joined the discussion with Popper. Positivism # 4 or *postpositivism* was born. It can be called *historical-scientific* positivism.

Kuhn announced: if some new discovery contradicts the received picture of the world, standards, opinions, or ideas – it will never be recognized until this picture of the world changes, and this worldview leaves together with its supporters.

The first book written by Kuhn was "*Copernican Revolution*"; it was published in 1957.

In his most famous "*Structure of Scientific Revolutions*" Kuhn outlined his conception of the historical dynamics of scientific knowledge. "The term "*normal science*" means research based upon one or more past scientific achievements that certain scientific community recognized as the foundation for its further practice, for considerable time". These achievements are set out in textbooks since

the beginning of the XIX century; before that it had been "*Physics*" of Aristotle, "*Almagest*" of Ptolemy, "*Foundations*" and "Optics" of *Newton*, "*Electricity*" of Franklin, "*Chemistry*" of Lavoisier, "*Geology*" of Lyell, and others.

Such scientific achievements are called *paradigms*.

The focus of criticism of neopositivism (*logical-linguistical* positivism) on behalf of postpositivism concentrates on the "cumulativistic" concept of scientific knowledge seen as a joint effort of getting "pieces of absolute truth" for the general piggy bank.

Science does not develop as a whole, although scientific theories *are* developing; old and new pictures of the world are in-commensurable; leaps and revolutions do not bring us closer to a kind of dogmatic absolute truth.

The new – for positivism – concept of the growth of knowledge emerged in the 70-ies. It is associated with the assertion of the existence of leaps, catastrophes, *revolutions* in science, although "normal" evolutionary development of science was also regarded. It was not new for revolutionary Marxism, of course; but for philosophy of science it was a novelty.

Besides, for postpositivism in contrast with neopositivism, the most important assumption was that of principally in-commensurable paradigms that change in the course of scientific revolutions.

Paradigm brings researchers together into a certain scientific community. It is a way of scientific production.

In the discussion of Kuhn and Popper, Kuhn was right in accepting the idea of *progress* of scientific knowledge, since the idea of revolutions in science is much more fruitful than the idea of discarding the old knowledge under the principle of falsification.

Somewhat later, the line of Karl Popper, his critical rationalism was supported by a Hungarian-born British philosopher Imre Lákatoş. They worked together with Karl Popper in the 60-ies in London School of Economics.

Lakatos gave his own interpretation of falsification principle in methodology of scientific research programs.

He wrote that both Kuhn and Popper deny the model of "absolute truths" accumulation. But if, according to Popper, science is a process of "permanent revolution", and its driving force is rational criticism, then, according to Kuhn, revolution is an exceptional event. In a sense, it goes beyond science; during periods of "normal science" criticism turns into a kind of blasphemy... Only in rare times of crisis is it allowed to criticize the dominant theory and propose a new one.

In the dispute of Kuhn with Lakatoş, the latter was right: the idea of shifting scientific theories while maintaining its main ideas was reminiscent of cognitive ascent – and thus of dialectics.

Lakatoş wanted to unite the ideas of Kuhn and Popper in one model of regular shifts in scientific theories. In this model, such characteristics of science as progress and rationality are preserved, and respect to the actual history of radical conceptual changes in science is shown. History of science is a competition of theories, the best of which are those that are most productive. A research program is a sequence of building theories and their "living". It has a solid or "hard" core, negative heuristics and positive heuristics. A hard core unites all those hypotheses that any theory belonging to this research program must share. These hypotheses are immune to any revision (as advocates of the program believe). The process of sciences' development presented in Lakatoş as a competition of conceptual systems forms the "inside history" of science. Such systems are imbued with the fundamental principles of the research program. The hard core is conventionally accepted, and it consists of metaphysical assumptions "external" to science.

It is negative heuristic which limits any refutation, thus creating a kind of "protective belt" around the hard core which absorbs all potential anomalies pointed out by opponents.

How the program will develop is determined by positive heuristic. It provides for a consistent growth of scientific knowledge.

1. It defines the field of study.
2. It dictates the choice of problems for research programs.
3. It highlights the protective belt of auxiliary hypotheses.
4. It foresees anomalies.

Scientist sees the anomaly, but until the program sustains, s/he is free to ignore them.

Positive heuristics is the most rapidly changing part of the program, because it is faced with reality of empirical facts.

If the theoretical growth anticipates empirical, then progress is being made.

If one program explains more than the other, the latter is displaced.

When the program meets more and more difficulties, constructing *ad hoc* hypothesis, its hard core is blurred, which leads to a collapse. It is called "saturation point". A research program is progressive as long as it yields novel predictions. It becomes regressive (degenerative) when it starts to offer only *post hoc* accommodation for facts.

The most famous works of Lacatoş are "*Proofs and Refutations*", and "*The history of science and its rational reconstructions*"; also, "*Infinite regress, and the foundations of mathematics*".

Finally, against Lakatoş and in general against the rationalistic method, the Austrian philosopher Paul Feyerabend came out in 1975. The era of post-positivism flourished in philosophy of science.

Paul Feyerabend developed the so-called pluralistic epistemology. His main work is called "*Against Method*", and he was an "enfant terrible" of the classical methodology. Instead of "*two Dogmas of Empiricism*": (1) reduction as a description of consequences of the proposed primary science and (2) value of descriptive terms as a source independent of the reduction, Paul Feyerabend put forward the other (contrasting) two:

1) "anything goes" principle;

2) principle of tenacity: "Rejection of the introduction of any alternatives and persistence of the existing theories".

One of Feyerabend's conclusions of anarchist demonstration against method is a judgment "no formal and objective interpretation of the explanation can be formulated". In Feyerabend, I recon, positivistic (philosophy of science) and postmodern existential thought (philosophy of life) come together.

Another area of criticism of "objectivism" and "rationalism" was set by Michael Polanyi who published in 1958 his famous work called "*Personal knowledge: towards a post-critical philosophy*" reprinted later in England and in the USA. As has been said already, it treats on the epistemological concept of "tacit knowledge" based upon the rootedness of all forms of cognitive activity, including scientific research, in everyday practical experience and physical organization of human being.

You cannot de-personalize science. Tacit knowledge is not so much a set of propositions expressed in language ("focal" knowledge), but human experience ("backcloth" knowledge): perception of schemes, practical skills, ethical codes, aesthetical preferences, ideological press as well as unconscious worldviews. Implicit knowledge is transmitted from teacher to student, forming tradition.

These are, in summary, the basic Western trends of philosophy of science, mid-nineteenth – early twenty-first centuries.

The "third" and "fourth" positivism has much in common: methodological empiricism and nominalism; understanding of objectivity as intersubjectivity; dichotomies of analytical / synthetic, science / metaphysics, context of discovery and context of justification, etc. But it should be born in mind that completely different traditions of posing philosophical and scientific problems and models of their solutions were adopted "with the West" and "with us" in Russia. However, such details did not prevent "us" from joining the discussion of the new "philosophy and history of science", since it treated upon *the growth of scientific knowledge*. As a result, we introduced postpositivists to the circle of friends-gnoseologists, or at least the friends of gnoseologists. As a Russian expert on Western philosophy I.S. Narsky wrote once: "In Kuhn's discussion with Popper about understanding the progress of scientific knowledge, Kuhn was more right,

since the idea of revolutions in the sciences is much more fruitful than the idea of discarding previous knowledge under the influence of the principle of falsifiability. The idea of changing scientific programs while preserving their "core", with all the concessions of Lakatoş to phenomenalism and even conventionalism, still resembled the idea of cognitive ascension"[7].

As Russian authors from Rostov and Stavropol emphasize, in the twentieth century, the updating of the classics went here by connecting the problems of synergetics, global evolutionism, structuralism, and semiotics. Philosophy of science coincided with epistemology for a long time: there went a classical search for the philosophical *foundations* of science, the fundamental *laws* of the development of scientific knowledge, its *theoretical support*, that is, the characteristic problems of the theory of scientific knowledge were solved.

In the West, however, these ontological, gnoseological, epistemological and methodological problems *are not included in philosophy of science*. The fact is that the latter, as stated in the analyzed works of the Russians, was disciplined during the famous linguistic turn. The origins of the *western* philosophy of science are seen in the critical tradition, in hermeneutics, philosophy of language, sociology of knowledge and sociology of science.

The credo of the western philosophy of science is the rejection of a preliminary choice of a theoretical-informative "platform" and, in general, rejection of any theory: "If the first conceptual revolution (from classical to new) made the transition from logic to the theory of knowledge, then the second (from new to the newest) means replacing theory of knowledge with philosophy of science"[8]. But, as it seems, in this quotation some significant stages are missing that we have already indicated: the transition was first made, in positivism, from classical gnoseology to *methodology* by means of prescission of worldview problems, then to *epistemology* by concentrating the scientistically (*have you heard of scientism – a positivistic trend?-E.T.*) oriented philosophers' attention on the *theory of scientific knowledge*, then this was manifested in the disavowal of the general gnoseological "platforms" and problems and, as a result, in positioning philosophy as a ***non***-science, and science (and philosophy) ***not*** as a theory or ***not*** from theoretical positions.

The main subject of such a philosophy is the study of really existing and acting, at-hand present science, science "on the march", or a multitude of traditions and practices united by the term. Its purpose is "to see behind theoretical schemes

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[7] Narsky I.S. *The dialectic of relativity and absoluteness of truth* // "Philosophical Sciences". – 1978. – # 5. – P. 34–36.

[8] Przhilenskiy V.I. *Introduction to*: *Lectures on philosophy of science*. – P. 5

and concepts <some> pre-theoretical and practical sequences of actions that work effectively in science and constitute the content of academic life"[9].

Its criterion of truth is *know-how*, the ability to solve situational problems. Its motto is: *It doesn't matter what you know, it only matters what you can do*. Competences instead of knowledge. Intersubjectivity instead of objectivity. Method instead of theory. Phenomenon instead of essence. *Sense* instead of truth (with a general lack of clarity of the term "sense")… familiar motives. This is a certain extreme connected with the formulation of such ideas about theory, which often do not allow distinguishing theory from non-theory.

However, in Russia, before and up to this day, the leading philosophers have the task of building a *general theory* explaining and revealing the mechanisms for the successful functioning of science. The main theme of the Russian philosophy of science, *following the previous methodological path*, was "the search for laws of development of science in the historically changing world", which fully finds itself in the mainstream of *methodological essentialism* (in Popper's wording). As the best Russian specialist in philosophy of science once put it: "Science sets its ultimate aim to foresee the process of transformation of practical objects... into relevant products. This transformation is always determined by the essential connections, laws of change and development of objects... Therefore, the main task of science is to identify the laws in accordance with which objects change and develop"[10]. On this path, classical dilemmas of material and ideal, being and consciousness, object and subject, truth and error, sensual and rational, essence and phenomenon are kept, as well as the high status of scientific theory.

And today, from the point of view of the universal characteristics of consciousness, science is still defined as rational-objective activity, and theory with its ideal objects, its methods and statements are still the subject of philosophical and scientific thinking. According to Frege, some logical propositions are considered as axioms and do not require proof in view of the obviousness of the thought contained in them; all other propositions are considered as consequences of the original ones. Some kind of technology or a mechanism of coming to conclusions must be so effective as to allow all the content of science to be obtained from the basic premises. It can be – and even should be! – investigated independently of any theory; and method itself can and should be presented as a theory.

Theoretical system is a set of theses, laws, categories of a science in which they are interconnected. It is impossible to properly understand any of them in isolation from all others. In their totality, they should give some definite and

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[9] Ibid.

[10] Stepin V.S. *Theoretical Knowledge*. – M: "Progress-tradition", 2003. – Pp. 39–40. /in Russian/.

holistic interpretation of the subject matter of this science; a system must be conceptual. If a theory or concept has never been stated by anyone, it simply does not exist. Presentation makes existence of a theoretical system. Something can act as an object only if there is a subject of cognition and transformation; these are correlative concepts. But the cognizable object exists according to its own laws and is not determined by what the subject is, unless it is a *constructed* object.

From the point of view of epistemology, theory is "a developed form of organization of scientific knowledge, implying constructing and deriving knowledge, that is, logical consequences deduced with necessity from a system of axioms or reliable premises"[11]. The main requirement to it is as follows: at least one element of the theory (as a whole consisting of mutually coherent elements) must have an independent basis of its reliability.

It is necessary to emphasize once again that in Russian literature the image of philosophy of science is still closely connected with epistemology, or at least with the scientific-theoretical system, one or another, and not only with the practical, technical activity of a scientist in the laboratory. Good or bad, this is it. As a result, we are mistaken in our assessment of the activities of the so-called postpositivists calling themselves historians and philosophers of science, believing that their criticism of neopositivism (logical syntax and logical semantics) brings our positions closer to them. In fact, the philosophical platform of "our" epistemology was Hegelianism, and Kantianism was the basics for philosophy of science and, within its framework of positivism, *of all positivism*. These grounds cannot match. Although Kant was a classical rationalist, while positivism is essentially empiricism, however, the Kantian basis of philosophy of positivism, in particular the post-positivist philosophy of science, is undoubted. Hegelian philosophy is the science of the identity of the ultimate foundations of being and knowledge (this was also in Aristotle, though the latter considered tranquility for perfect state, and for Hegel it was movement). And Kantian and any neo-Kantian philosophy is the doctrine of "disintegration", of the dramatic separation of mind and "thing-in-itself".

What is of note: if a Russian philosopher who has passed from the platform of Hegelianism / Marxism to the position of (neo) Kantianism, accepts at the same time, instead of the principle of unity (of the foundations of being and knowledge) the opposite principle, the effect is ambiguous. As it has been repeatedly emphasized, theory of knowledge, namely, general gnoseology is brought to the theory of *scientific* knowledge, which is epistemology, and to methodology with

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[11] Mikeshina L.A. *Philosophy of Cognition. Polemic chapters*. – M.: Progress-Tradition, 2002. – P. 31. /In Russian/.

the truncation of metaphysical worldview problems. These transform into logic and methodology of science = philosophy of science; and that in turn – to the positivistic "linguistic philosophy". Further, a "loss of the subject" is revealed, of sociocultural genesis, life-sense desires, beliefs, rituals, excusable mistakes and necessary errors, together with all other losses and "deaths": of "author", "transcendence", "theory"; "true", "rational", "objective"; "social", "personal", "non-everyday". Expelled at the door, worldview together with sociocultural and all other humanitarian problems appears pathetically in the windows, returning to their very roots, for their friends... one wonders if it was worth bringing the matter to the postmodern "death of philosophy", so that later, regretting the concomitant total death of the "big concepts", to galvanize them, starting with the resurrection of the subject? Was it worth putting an end to classical gnoseology? Rebounding from it and acquiring specific subjects, all the mentioned individual disciplines are not able to exhaust it or cancel it, just as the birth of physics, chemistry, linguistics or sociology from philosophy does not cancel its original power and heuristic power. This is precisely what explains the "humanization" of epistemology, which has shifted from personless analytical philosophy to the so-called "virtue epistemology". Moreover, two-valued Aristotelian logic is also colored by numerous modalities, virtuality, polysemy, etc.

Now to our credo. Philosophy, "Mother of All Sciences", cannot but be a science: Mother-of-pearls cannot but be akin to all pearls. Naturally, science cannot but be a science; a pearl cannot but be a pearl. Hence philosophy of science cannot be but philosophy – *and* science. It is still more oriented to natural science knowledge; this is not very correct. Philosophy was originally formed as a humanitarian science. A person *theoretically*, philosophically proves, reasonably accepts one's worldview. Philosophy of science, as has been said, studies the relationship of a man of science to the world of science. *Science appears as a subject of philosophical reflection*.

I share the conviction that science, including humanitarian science, as well as philosophy itself, is capable of giving objective truth, including absolute truth. This is its prerogative and its cognitive, intellectual function, combining description, explanation and prognosis.

Now it would be a good point to discuss *what science is* from the point of view of philosophy.

There is a wording that *science* is a social system consisting of professional communities whose main purpose is to obtain, disseminate and apply *scientific knowledge*. Some tutorials say so. The circle in such definitions is obvious. It is possible to do without tautology: science is a form of social consciousness; it is a worldview, *and* productive and social force. Actually, philosophy is the same thing. And also art. And even religion, producing a wide variety of relationships, actions and texts. So there is an error of too wide a definition.

Modern literature devoted to philosophy of science often proposes to consider its reflectivity and self-reflection as its characteristic feature: that is, "focus on itself, studying of the process of cognition, its forms, techniques, methods, conceptual apparatus"[12]. However, it is unlikely that this property can be considered definitive: after all, reflection is inherent in the entire philosophical worldview; art also reflects; the ideal, becoming human consciousness, implies reflection, too; more precisely, reflection is a mechanism for the realization of *consciousness in general*. Alternatively, the definition is formulated as follows: the goal of science is constructing mental models of objects and their evaluation based on external experience [thanks a lot! This is how any cognition happens, this is how consciousness acts in general]. The same applies to "rational-objective activity", to which, for lack of the best, sociologically-oriented definitions of science appeal: it appears as a task for people organized into the corresponding professional communities who are engaged in the dissemination of scientific knowledge in various forms: books, articles, computer programs. But does not, let's say, practical-political activity fall under this definition?

Dictionaries also give different definitions; for example, such one: "Science is the process of building a systematic picture of a part of reality focused on identifying its general properties"[13]. It would have been nice if this definition could not be attributed to anything other than science.

In the Statis Psillos's "*Philosophy of Science*" highly valued by us, neither the definition of philosophy, nor the definition of science, nor even the definition of philosophy of science is given. Rather, they are wisely given in accordance with the establishment of authorship. Well, should we abandon the application of the first, basic, respectable operation, with which logic began as a science, *in logic and methodology of science*? Namely, I mean clarifying and justifying the content of concepts ("and this is the very occupation of philosophy")?

It is clear that not everything can and should be determined; that the most fundamental concepts of metaphysics, categories, are indefinable through gender and species' difference (only all of them through all of them, this is their hermeneutic circle); that at least one basic element of the theory must have self-justification. The latter concerns axioms, not concepts. However, this does not concern such abstractions as "man", "knowledge", "sign", "meaning", "language", "society", "nature", or "science". These are high abstractions, but not categories. In

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[12] Jegutanov B., Strelchenko V., Balakhonsky V., Hon G. *History and Philosophy of Science*. – "Peter", Moscow, St. Petersburg., Nizhny Novgorod, Rostov-on-Don, Yekaterinburg, etc. – 2006. – P. 242. /In Russian/

[13] Dictionary of philosophical terms / ed. V.G. Kuznetsov. – M .: INFRA-M. – 2005. – P. 347.

relation to them, a real definition is not only possible, but necessary. If the representatives of the respective special sciences themselves, intuitively or consciously acting on the basis of Gödel's theorems about incompleteness, refuse to define the basic element of a theory, then it is still quite possible when the special science goes beyond a higher general scientific level, and from it to the philosophical level. And there exists a metalanguage for philosophy itself! Does the lack of understanding between philosophers of science themselves in the absence of a generally acceptable, even so called "working" definition of their object not distort, not block all discussions regarding nature, essence, main characteristics and the role of science? If so, the discussion falls down either in controversy, uncompromising and "topically endless" war, or in a dispute similar to a religious one, in which opponents only describe their positions without any hope of mutual understanding and constructive work. Such is the logic of dispute!

Research should be continued.

Science can be understood as a system of interrelated experiments and theories. The very first and correct approach to it is purely philosophical, *gnoseological*. It appears as the sphere of perfect (as far as it is available and at the same time necessary), the most important knowledge, as the works of thousands of years of research, objectively true in content and formally properly constructed. Russian expert in the field of logic, methodology, history and philosophy of science I.T. Kassavin, well-known in the western academic world, founder of social epistemology, believes that the task of science was originally to justify the power of human mind. He indicates, for example, that "social and humanitarian knowledge took shape of the system long before all natural sciences, as soon as it had to regulate political, legal, economic, personal relations"[14]. This philosopher emphasizes that social and humanitarian knowledge existed in two faces: the sacred (magic) and the profane (technology); heaven and earth served as a prototype for this division. From here arose binary oppositions of order and chaos. It seems convincing that natural philosophy and natural science that emerged from it really were formed from magical technologies to use the hidden forces of nature. I.T. Kasavin explains: "The opposition of the heavenly (regular, perfect, self-sufficient) and earthly (spontaneous) worlds formed the basis of the opposites of order and chaos, cause and effect, essence and appearance, law and fact, truth and error, exact and approximate.

The sky with perfect movements of the luminaries became an ontological prototype of a *scientific theory*, and philosophical-scientific orientation to the

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[14] Kassavin I.T. *Traditions and Interpretations: fragments of historical epistemology*. – M.-SPb: RHGI, 2000. – P. 24. /In Russian/.

rationalization of the cognitive process led to the emergence of it. Earth with its diversity and imperfection served as a prototype of empirical knowledge. The prototype of the ratio of theory and empiricism was the same correlation of sacred and profane"[15]. The proposed cognitive model explains a lot about the structure of scientific knowledge. In a certain sense, it echoes the following doubly oriented assessment of the specifics of science. The *two distinguishing features of science* are as follows: 1) study of the laws of transformation of objects; hence the objectivity of scientific knowledge; 2) outbreak of science beyond the framework of objective structures and industrial development; hence follows pleasing philosopher independence of cognition of objects from their immediate use. We can recall Confucius: a noble man is taught by truth, a small one is taught by use.

Over time, philosophers moving away from mythology at a distance sufficient for criticism, proceed from the dilemma of the observed and the unobservable. Thus, Plato, through words of Socrates in the dialogue "*Phaedo*" says this: "These latter [many equal particulars] you could touch and see and perceive with the other senses, but those that always remain the same can only be grasped by the reasoning power of the mind…" [79a][16].

And Epicurus in his letter to Pythocles places emphasis on the sensible and perceivable: "...Not on the basis of empty [unproved] assumptions should investigate nature, but in the manner required by visible phenomena. ...If someone preserves one and the other, to the same extent consistent with visible phenomena, rejects, he obviously leaves the field of any scientific study of nature and descends into the field of myths"[17].

The first scientific method was *theoreia*, a consideration that is carried out not with the eyes "in the forehead" but with the "eyes of mind". Scholastics provided invaluable services to epistemology. That Boethius has created language of science as a special functional style has already been mentioned. And William of Ockham has constructed in his "*Epistemology*" the following classification of the types of knowledge demonstrating more and more refinement, from the general-gnoseological understanding to the philosophical and scientific one (which has also been mentioned)[18]. Science:

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[15] Ibid., p. 24–25.

[16] Plato. *Phaedo*. El. resourse: http://cscs.res.in/dataarchive/textfiles/textfile.2010-09-15.2713280635/file

[17] *Epicurus greets Pythocles* / Letters and fragments of Epicurus / Materialists of Ancient Greece. /In Russian/. Transl. by S.I. Sobolevsky. – Moscow: State Publ. House of Polit. Liter. 1955. – P. 198. /In Russian/.

[18] William of Ockham. *Epistemology. Selected works.* – Moscow: RAS IF, Editorial URSS, 2002. – P. 81. /In Russian/.

1) … is undoubted knowledge of some truth. And in this case, some [truths] are cognized by us only on the basis of belief {*sic sciuntur aliqua per fidum tantum*}: ["Rome is a big city"]. Since we adhere to the truthfulness of this without a doubt, we say that we know it;

2) ...is obvious knowledge. ...We directly or indirectly recognize a certain truth on the basis of uncompounded knowledge of certain terms, even if no one speaks about it;

3) …is an obvious knowledge of something necessary. And in this case, not contingent [facts] are learned, but the beginnings {*principia*} and the consequences derived from them;

4) …is an obvious knowledge of necessary truth, obtained as a result of a syllogistic reasoning from an obvious knowledge of necessary premises.

Only this last type of knowledge is science, *proprie vocatur*.

The merits of the great scholastic before epistemology cannot be overestimated. Let us consider only several plots. This is how Ockham codified the status of scientific knowledge: this is learning, the possession of a rational soul, or its internal form.

"…*Scientia vel est quadem qualitas existens subiective in anima, vel est collectio aliquarum talium qualitatem animam informatium*. [Science is either a certain quality which exists in the soul, or a collection of several such qualities, constructing the internal form of a soul]. *Quia impossibile est contradictoria successive verificari de aliquo, nisi sit alicubi mutatio, scilicet acquisitio aliquis rei vel deperditio vel productio vel destructio vel motus localis*. [Because it is impossible without any contradictions to successively verify something different, unless there is some change, namely the acquisition or loss or some production or destruction or local movement]; *sed nulla tali mutatione existente in aliquo alio ab animi rationali; potest anima aliquid intelligere, quod non prius intelligebat* [but none such changes exist in the rational soul; so it can in some or other understand something, that it did not know before], *per hoc* [thanks to that] *quod vult intelligere aliquid, quod non prius intellexit* [it wishes to cognize something that it did not know before]; *ergo anima habet aliquid quod prius non habuit* [hence the soul possesses what it did not possess earlier]" ("*Epistemology*" 2.1).

One can recall the famous poisonous questions of the cynic: "What are you looking for, what are you looking for, Socrates?! For Truth?! And how do you hope to find it? After all, either you possess it, then you search in vain; or you don't possess it, and then you won't recognize it, which means you can't appropriate and possess it!" – Socrates: "I don't possess the truth. But when I find it, I recognize it, because the soul is capable of having that which it did not possess before!" Something like that.

Et per consequens eadem ratione habitus scientiae est talis qualitas, vel aggregans tales qualitates. [Consequently, and for the same reason, possessing science is such a quality or a collection of such qualities].

In addition, soul that possesses only what it had previously is capable of acting no more than before. But our experience clearly shows that if someone has thought a lot, then he is later more capable of similar reasoning than before; therefore, he now has what he did not have earlier {*habet nunc quod prius non habuit*}. But it can only be possession; consequently, possession is quality {*habitus est qualitas*} ("*Epistemology*" 2.1). And, therefore, and even more, possession, which is knowledge, is the quality of the soul[19].

In terms of discussing the basic syntagma of gnoseology, Ockham, like new Protagoras, aphoristically formulates a real pearl: abstract knowledge {*notitia abstractiva*} is that by virtue of which, concerning a relatively contingent (non-necessary) thing, it cannot obviously be known whether it does exist or not. And thus, *abstract knowledge is abstracted from existence or non-existence*, because by means of it, *as opposed to intuitive knowledge*, one cannot obviously know about an existing thing, that it exists, and about a non-existing thing, that it *does not exist* ("*Epistemology*" 2.4).

Extrapolating to science the teaching of Aristotle on four kinds of causes, the great scholastic explained the difference following Aristotle but in his own manner. Scientific knowledge has only two causes, since it has no formal and material causes. This is so because the material cause in the true sense of the word belongs to the essence of what it is {*causa materialis est de essentia illius cuius est causa*}, and the subject of knowledge, which is reason, does not belong to the essence of knowledge, – which is "quite obvious" ("*Epistemology*" 2.1).

Besides, Ockham wrote in his "*Summa totius logicae*":

> As for 'subject', first you have to know that, as Damascene says in his Logica, Ch. 8: 'Subject' is said in two senses, one with respect to existence and the other with respect to predication. With respect to existence, as a substance is subjected to accidents… But with respect to predication, the subject is a particular… Something is called a "subject" because it really substands another thing that inheres in it and really accrues to it. In this sense, 'subject' is taken in two ways. [In one way, it is taken] strictly, and in that sense a "subject" is so called with respect to the accidents really inhering in it, without which it is able to subsist. But everything that substands [something] else, whether the thing it substands is a really inhering accident or whether it is a substantial form informing the thing to which it accrues, is called a "subject" in the broad sense. In this sense, matter is called a "subject" with respect to substantial forms. But 'subject' is said in another sense [too]. For [in this other sense] it is the part of a proposition that precedes the copula, of which something is predicated[20].

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[19] Ibid., p. 72.

[20] Quoted from: Paul Vincent Spade. *William of Ockham, From His Summa of Logic*. El. resourse: eBooks@adelaide.edu.au

What can be empirically observed has the right to serve the subject of science.

Or – the object of science?

That scientific knowledge is always logically formed; in fact, it is not even discussed. Ockham himself suggests that in a sense, the object of scientific knowledge is its "matter", and the difference between the parts of science is the "form" {*improprie vocatur*}. However, an important conclusion regarding scientific knowledge, as it was understood by ancient and medieval philosophers, must be approved here: this is the highest kind of knowledge, and, like everything perfect compared to the imperfect, it is the best and most essential embodiment of knowledge in general.

Knowledge in general was characterized in our previous texts as discovery and acceptance of being, participation of a person in the concrete existence of an object by presenting it and designating it in an ideal way. An adequate definition of *scientific* knowledge today is still a philosophical problem.

Often for the definition of scientific knowledge such explicts are used as *systematic* or *methodical* correctness. Sense-generating, in scientific knowledge, is subject to regulatory requirements and must be obtained in a completely specified way. "Prophetic dream", for example, may come true; in general, some parascientific discoveries, like the notorious "proverbial wisdom", the wealth of common sense and everyday life, may even be true, – that is, have an objective referent. In virtue epistemology it is called "epistemological luck". However, methodical insufficiency does not and will not allow this information to appear as a science. Of course, this must be accepted, because it has already happened, and gnoseology has never attempted to dismiss methodology. Moreover, dialectics, for example, is itself a universal *method* and a universal *methodology*. However, *systematic* and *methodical* is not enough. A telephone directory or cookbook, in general, any catalog is well systematized; by the way, they are often objectively true, but they are not necessarily scientific treatises. The now overgrown typology of methods, based on instrument readings on the lion's share, comes to the fore as a definitive characteristic distinguishing *scientific* knowledge from knowledge *in general.* For example: "*Scientific knowledge* [is] knowledge obtained and fixed by specific scientific *methods* and means (abstraction, analysis, synthesis, conclusion, proof, idealization, systematic observation, experiment, classification, interpretation, its particular language formed in a particular science or field of study, etc."[21] In sum, it says: scientific knowledge is scientific method. Good or bad, this "methodologism" today is a common place. But this fact does not negate the tasks of gnoseology in relation to science.

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[21] *Philosophy of Science*. – M .: Triksta, 2004; M .: Academic Project, 2004. – P. 25.

After the expansion of philosophical dictionary, from Boethius to Ockham, we consider one of the generic characteristics of science to be its *ratio*nality, the most interesting concept for philosophical and scientific analysis. Rationality has always been one of the highest values of European culture. But today, this value is beginning to be re-discussed in the light of humanitarian bias in epistemology and philosophy of science, as well as the invasion of engineering practices and technologies into social theory. New questions are raised: "Can rationality be understood as only technological (or techno-scientific)? What is the place of rationality of understanding and rationality of dialogue in the modern world? Are there limits to rational foresight and action?"[22]

Rational thinking and rational knowledge are broader concepts than scientific thinking and scientific knowledge. All scientific knowledge is rational, but not all rational knowledge is scientific. Many layers of philosophical knowledge are rational, but non-scientific. Quite often understood as reasoning and the ability to contemplate, rationality etymologically means the ability *to count*, a sense of *proportion*. "Ratio" in Latin means not "mind", but "score".

In the time of enlightenment, Hobbes, for example, viewed deduction as calculation: "to reason means the same thing as to add and subtract", and he considered the truths of mathematical knowledge to be linked not with direct sensory experience, but with language.

G. Leibniz expressed the idea of the need to create a new system of signs: the language of science, synthetically including the calculus of statements.

Leibniz moved forward ideas of *Mathesis Universalis* as a unity of *characteristica universalis* (artificial language of science) and *calculus rationator* (calculus of reasoning). The forerunner of linguistic and logical positivism Gotlob Frege revived these in the nineteenth century. Language begins to be regarded as calculus, analogous to mathematical theories. Mathematics refuses to understand truth as a certain adequacy between knowledge these theories produce – and reality. Consistency of consequences derived from the original postulates becomes the criterion of truth.

The main thing in the statement, from the time of Frege, is not language means of expression, not linguistics, but logic: it is the sense contained in them. By that "sense" started to be understood, from the point of view of a "classical" gnoseologist and semiologist, as "exact to the opposite": *not* as variable individualization of the invariant social meaning, *but* as a systematic connection of truths. The "truth conditions of the utterance" were declared to be determining

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[22] Lektorsky V.A. *Rationality, social technologies and the fate of man* // Epistemology & Philosophy of science. – V. XXIX. – No 3. – M .: Alfa-M, 2011. – P. 46.

sense, depending on the role they play in establishing its truth value. Frege replaced the subject and predicate in judgments by function and argument. The functional part does not have its private meaning and is understood as something that proposes truth value to the arguments included in the statement. For example: "Hydrogen is lighter than carbon dioxide". "Lighter than carbon dioxide" is a function that assigns the argument the value "truth".

In logical syntax and logical semantics, as is well known, language of science has become the object of research. But even among scholastics, science was understood as a combination of statements. William Ockham believed that all sciences deal with utterances, not real things; all sciences treat not upon individual objects (and Ockham, as later the English empiricists, does not allow the real existence of the general), but upon statements constructed from general terms that replace real things in the statements, which statements our reason approves or disapproves of {*assentit vel dissentit*}.

However, science is not limited only to propositions and their combinations: the scholastics interpreted science gnoseologically, as a mental (spiritual) image. And the neopositivists of the Wienerzirkel declared science to be a *text* which is free from everything personal, historical, ethical, ideological, etc. This text consists of four types of basic protocol statements that can and should be analyzed from the standpoint of logic. These four types are: 1) propositions of subject (questions); 2) propositions of method (norms); 3) propositions of fact and 4) propositions of theory. Interrogative logic examines the first type, the logic of norms and estimations deals with the second one. Values of truth and falsity are already applicable to propositions of facts; however, the probability coefficient includes values from 0 to 1. And only the propositions of theory can be evaluated in two-values logic, which means we take them as either true or false. {*…nulli assentimus per intellectum nisi quod verum reputamus, nec dissentimus nisi quod falsum aestimamus*} ("*Epistemology*" 2.1).

In the twentieth century, the famous verification principle was put forward as a method of establishing the meaning of an utterance. M. Schlick, the last philosopher of the "second" and the first philosopher of the "third" positivism, was the one to formulate the principle of verification: all true scientific knowledge should be reduced to sense data; the criterion of truth is the solution of a problem, and the criterion for solving a problem is its reducibility to possible experience. Experience determines the truth and falsity of statements; experience "verifies" statements. Schlick reduced science to the totality of statements of a special functional style, the activity of a philosopher – to the analysis of scientific language, and *theory* of knowledge – to *method*. The meaning of a proposition is the method of its verification, that is, reduction to an expression like "in such and such a place, at such and such time, under such and such circumstances, such

and such phenomenon is observed or experienced". To understand this, we have to demonstrate under what circumstances a certain proposition is true – or false.

Given that scientific theories should have definite empirical content, Schlick argued that this content is acquired when the deductive system of the theory is applied to the physical phenomena. Schlick developed a structuralistic understanding of science, what he called the "geometrisation of physics", where all content is left out leaving only pure **structure**, – Stathis Psillos writes about Schlick's lectures on form and content. Each observer contributes his content, assigning thereby the unique meaning to the characters, and he "fills the structure with content in the same way that the child paints a picture where only the outlines are drawn"[23].

It turns out that it is meaningless to say that *someone else* may know the meaning of the statement verified by *my experience*; this is the "darkness of uncommunicability". We are doomed in our observations to a serious lonely joy of a scientist, who, receiving a statement of theory foreseen by experience, thereby gains a sense of accomplishment, and particular satisfaction... thus the joy of cognition is the joy of verification.

Discussions about rationality do not stop for decades and even centuries. Philosophy of science after Popper argues that rationality of a statement is related to whether it can be criticized, whether it is able to get a demonstration, whether this intellectual construction has a practical output. The source of rational knowledge has long been considered not to be sensual experience as such, not *πύρ τεχνικών* – the fire of artistic imagination, not religious and mystical revelation, not existential passions, but only *thinking* – either in the form of constructing abstract objects of the world of "pure entities" (ideal world) or, as a result of the success of British and all other empiricism, in the form of building *abstract models* of sensory experience. The rational knowledge obtained as a result of the activity of thinking should, according to contemporary Russian philosophy of science, meet the following necessary and sufficient requirements: 1) *conceptual and language expressibility*; 2) *certainty*; 3) *consistency*; 4) *logical justification*; 5) *openness to criticism and change*[24].

In this regard, agreeing in general, it is necessary to say the following.

What is the novelty of this "new" philosophical approach to rationality?

The *first* requirement is clear: this is an ancient, if not the most ancient, philosophical idea about the connection between thought and word. It should be added: and their subject. It is only important to emphasize the semiotic character of this epistemological postulate, and also the mistake of an overly broad definition

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[23] Psillos, Stathis. *Philosophy of Science A – Z.* – P. 224.

[24] *Philosophy of Science*. – P. 25.

made in it. Not only rational, but any other state of consciousness is excellently manifested in language. Generally speaking, linguistic expressibility should be included in the definition of truth.

The *second* requirement is another wording for the Aristotelian *law of identity*, that is, the main condition of rationality, according to which a thought must be clear and definite; in the extended interpretation: it is impossible to pass off the same thoughts as different ones; It is impossible to identify different thoughts. Impossible – or forbidden.

The *third* requirement, consistency, could be considered the brainchild of modern times, but one is free not to do that. In traditional terms, this is a manifestation of the law of contradiction and the law of the excluded middle responsible for the sequence of thinking, *taken together*. This has a theoretical meaning, since it allows one *to understand* something in a consistent manner by integrating this new *something* into the existing frame of reference. This also has an adaptive-practical sense, since it forms the necessary basis of behavior always involving and making a certain choice between A and non-A.

Further, the *fourth* is the requirement of logical validity which speaks for itself. This is Leibniz's law. True, in Leibniz himself it was ontological, and not just logical: Everything that exists has a sufficient basis for its existence. The philosopher meant God. This law is responsible for the seriousness, argumentativeness, "ground-foundedness" of thought.

Finally, the *last* requirement reminding of Popper can also be considered as the brainchild of the twentieth century, or of *all* past centuries, because barely born philosophical, that is theoretical, thinking was reflective-critical. Consequently, this explication can be considered at the same time as modern (in the end of the twentieth – the beginning of the twenty first century!) – and as the "school" classical one.

We can also cite the classification of types of rationality that is present in the same work of Russian specialists in philosophy of science.

Logico-mathematical rationality: [characterized by] ideal objectivity, constructive unambiguity, formal proof, analytical verifiability. *Natural-scientific rationality*: empirical objectivity, observational-experimental unambiguity, partial logical argumentativeness, experimental verifiability (proof and falsification). *Engineer-technical rationality*: "thingly" objectivity, constructive consistency, empirical verifiability, system reliability, practical efficiency. *Socio-humanitarian rationality*: socio-value objectivity, reflexivity, integrity, cultural validity, adaptive utility[25].

[25] Ibid. P. 26.

Therefore, the rationality is different to rationality, and this "discord" depends on the subject of knowledge and the method of its development.

The novelty of this classification is the same as the novelty of explication.

Didactically, however, the understanding of scientific rationality as "enhanced" rationality and "proper" rationality was consolidated in modern literature on philosophy of science. There are, however, few successful definitions of it; quite often in the same edition we find tautologies like "scientific rationality is a specific kind of rationality characteristic of science". [thanks a lot! – *E.T.*] With the general lack of clarity of the concept of "science" it helps very little. C.f.: "Science is a social system consisting of professional communities whose main purpose is to obtain, disseminate and apply scientific knowledge..." [thanks a lot! –*E.T.*] Here explicative itself, *scientific knowledge,* remains an indefinable concept.

Many seemingly good definitions are unsatisfactory because they are more than usual replaced by divisions. In our "*Philosophy of Science*" classifications are given instead of definition: "The most important types and units of scientific knowledge are: theories, disciplines, areas of research (including problematic and interdisciplinary), fields of science (physical, mathematical, historical, etc.), types of sciences (logical-mathematical, natural, engineering, social, humanitarian)"[26]. This again is not wrong; but it is not enough. Would it not have been better then to uphold the medieval definition: Scientific knowledge in the proper sense is the obvious knowledge of necessary truth, obtained as a result of a syllogistic reasoning from the obvious knowledge of necessary premises?

Well; it would not have been better because there is also inductive and "traductive" reasoning, not only syllogistics.

True, in the same manual one can find an attempt to distinguish between species and genus; c.f.: scientific rationality "differs from general rationality by a stricter explication of all the basic properties of rational thinking, by striving for the maximum achievable definiteness, accuracy, evidence, objective truth of rational knowledge"[27]. BUT there are all the same generic features that characterize the "ordinary" rationality. This is once again confirmed by the list of characteristics, or basic properties, of scientific rationality, which must be treated critically:

– empirical/theoretical objectivity [non specific. – *E.T.*];

– unambiguity [hardly possible except for the closed narrow classes. – *E.T.*];

– proof [verificational/falsificational principle? – *E.T.*];

– empirical / analytical verifiability [meant to be a criterion for truth – *E.T.*];

– ability to improve[28].

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[26] Ibid., p. 26.

[27] Ibid., p. 27.

[28] Ibid., p. 26.

The latter property should be attributed either to the class of metaphors in fiction (with the lack of clarity of the concept of "improvement"), or to the universal ability of being to dialectically evolve.

The last bastion: scientific rationality differs from "rationality in general" by one and only property: science is capable of giving *objective truth*. What a surprise! What about the experience of the twentieth century? Conventionalism? Coherentism? Romanticism of physics with its "red and green" leptons, "enchanted and strange" particles, "black", "white" and "worm holes", "hedgehogs" and "strings"? With its six inconsistent pictures of the world? And what about the social sciences and humanities, with their self-contained and total interpretation, and the European philosophy itself, which refused from this feat, – the achievement of objective truth?!

We can state the following with all certainty: yes, scientific rationality is enhanced rationality. BUT: reinforced with what? With argumentation? By no means. It is enhanced and strengthened by conviction; by subjective (not religious!) belief: I believe that snow is truly white.

For the authors of our "*Philosophy of Science*" it is important to emphasize that the implementation of each of the above-mentioned properties can be achieved and *is* achieved in a unique, substantially different way in different types of sciences (logical-mathematical, natural, engineering, social and humanitarian), but the very methodology of these achievements remains behind the scenes. For all the obvious involvement and adherence of this text to classical epistemology in the reasoning of modern philosophers of science we are discussing, we see concessions to the postpositivistic views: "Scientific rationality always has a historical and concrete character, being realized and consolidated in paradigmatic ideas about the ideal of scientific knowledge and of means to achieve it for a given field of scientific research"[29]. (*Quod est intentum et erat demonstrandum*. – E.T.)

Every scientific conclusion obtained in any way should receive understanding and confirmation of the interested community of scientists. If, instead of approval, a scientific conclusion is faced with a negative assessment, this means that it (the conclusion) did not get into its social space, which, being finally found, will confirm its correctness, objectivity and rationality.

We are apparently doomed to a virtually endless discussion about the nature of the rational. And this is actually happening.

Yet something related to the field of rationality can be considered firmly established in the form of scientific truth.

A scientific theory is strong with a visionary force, a train of consequences, and not with the old-time ability to appear at dusk, after the battle, and begin to explain what has already happened.

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[29] Ibid.

The minimum of rationality is *logic*, just as right is the minimum of morality. The basis of this quality of consciousness, logical thinking, is the ability of abstraction: it is to distinguish a predicate from a subject (in other words, a property of a thing from the thing itself as a bearer of its properties and relations) and establish the presence or absence of this property. In the "elementary" case (existential judgment) it is to establish presence or absence of the thing itself. There *is* or there is *not*; it is *one* or these are *many*... But the pinnacle of elementary logic is the rules for deriving new knowledge from existing one. It is clear that epistemology, methodology, philosophy of science operate with larger blocks of knowledge than the fundamental forms of knowledge. These are well-known *idea, question, fact, problem, method, hypothesis, theory, concept, law*... But no progress of any science is possible outside the intellectual framework defined by the theory of knowledge.

The logical standards were, of course, formulated by Aristotle, but none other than William Ockham in his "*Epistemology*" proposed a set of general rules of conclusion, making the logical literally tangible. The number of these rules is large, but finite:

1. Truth never follows from a lie (but not vice versa).
2. If a certain conclusion is valid, then the opposite of the antecedent follows from the opposite of the consequent.
3. Everything that follows from the consequent, follows from the antecedent.
4. Everything that is an antecedent for an antecedent is also an antecedent for a consequent.
5. Everything that is compatible with the antecedent is also compatible with the consequent.
6. Everything that is incompatible with the consequent is incompatible with the antecedent.
7. The contingent does not follow from the necessary.
8. The impossible does not follow from the possible[30].
9. Anything follows from the impossible {*ex impossibili sequitur quodlibet*}.
10. Necessary follows from anything {*necessarium sequitur ad quodlibet*}.

However, the intellectual framework is not the whole of science. Apparently, it is necessary to take into account the experience of transformations of those disciplines that made science their object, and this experience requires diversification. Science, previously understood solely as *a collection of serious, solid, objective true knowledge*, today appears in several other aspects, hypostases and qualities. They are closely interrelated, but not limited to each other.

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[30] However, in the case of *ut nunc* output, the following is quite possible. Thus, we assert: "Every existence exists, therefore, man exists," and, nevertheless, the antecedent is necessary, and the consequent is contingent. Ex .: *Omne ens est, igitur omnis homo est.*

PART II. Main Approaches in Philosophy of Science

The main hypostases of science arose as a result of different approaches to the explanation of its essence and role. Contemporary philosophy of science is developing by means of four approaches:

1. Logical-epistemic.
2. Historical-critical.
3. Sociological.
4. Cultural.

Through their prisms, the following hypostases of science are visible:

1. Science is the subject of philosophical-gnoseological comprehension.
2. Science is a specific system of knowledge united by a single logic and methodology.
3. Science is cognitive activity of scientists.
4. Science is a network of social relations and institutions.
5. Science is a sphere of culture.

In fact, one should speak separately about *gnoseological*, the very first approach to science, and separately about *logical-epistemic* approach to science. Epistemology is the "state in the state" of theory of knowledge. And new approaches to science – namely, historical-critical, sociological, and cultural – can be easily merged into one, *social-philosophical*, without risk. Then only three main approaches will retain their significance. But this simple division is not yet widely known and, consequently, commonly established.

In scope of the first approach science is considered to be the highest manifestation of the intellectual power of man and mankind, the central element of human spiritual potential. It represents the principle of production, the process and the result of a targeted acquisition of knowledge, the "pyramid" of cognitive values. Regarding the top of this pyramid in classical gnoseology there was a relative unity of views. This was the *objective truth* of scientific knowledge, because the need for it corresponds to the most important, basic cognitive interests of the human race and the general trend in the development of scientific knowledge. The "pyramid" proposed by Howard Davis is of some interest for philosophy of science. This scientist builds the following three-grade scheme: the top of the pyramid is *knowledge*; it is rooted in *information*; the base of the pyramid is made up of empirical realities (*data*).

Let us take a concrete example from the field of natural science: namely, physical geography. This, from our point of view, is the only science that can rightly use the criterion of evidence.

The work of a geographer begins with field research. Forest; river; lake; mountain; valley; ravines and beams; anthropologically changed landscape, field, fuming ashes, soil erosion, irrigation canals, natural-territorial complexes... geomorphological features, temperature, soils, vegetation, animal populations...

To begin with, generalizations are possible. For example, it is known about the nature of Tatarstan that our rivers are "breamly", our fields are "mously", and our forests are "finchly" (which means that the main fish is the bream, the main field-animal is the mouse and the main bird is the finch). But an absolutely necessary stage in the accumulation of scientific knowledge is the conscious acceptance of the principle of universal interconnection. In nature, everything is connected with everything. If there is a karst funnel in front of you, it means that there is a cold microclimate on its bottom. Karst itself is connected with the susceptibility of the slopes of brachyanticline to tectonic faults. If this is an inter-dune fall in the forest, wait for the blueberry-mossy pine forest. The dry-top willows in the boggy swamp mean a lack of copper in the soil. The depressed view of the linden trees in the underbrush means also a lack of nutrition in the soil; the linden is in general a capricious plant, and so is spruce, and ostrich-fern, a living "stone flower" from the Ural fantasy. Synousias of this plant are associated with streams of spring snow-covered water. Pine is interspersed with spruce depending on the alternation of sandy and sandy-loam soils. Lakes of elongated shape near Kazan, my native city, are formed from the ancient oxbow of the Volga River called Mituga. For example such is Lake Kaban in the center of Kazan. And such is the system of the lakes Tarlashinsky, Kovalinsky, Nikolsky, Lebyazhy, Raifsky and Bely, etc., situated around Kazan. Over time such lakes dry up, being divided into two. The fate of the upper, small lake is unenviable; it dries quickly and / or swamps. A larger lake will live longer; it is usually fed by underground sources, and at the bottom there are karst-suffusion craters. New ones are also being formed there. Literally after several decades, the deluvial cone can be transformed into a terraced loamy grown-over area, which process will require additional observations and new predictive conclusions. Such was the fate of the famous Raifsky Lake located to the west of Kazan, near the border with Mari El Republic. Raifsky Reserve is the southernmost taiga in the European part of Russia[31]. River Sumka which flows into the Raifsky Lake, quiet in other seasons, becomes an icy roaring stream in the spring flood, flowing at a speed of a serious mountain river: 3 m / s! You try to hold a water current meter; the almost five-meter-high bar with a hydrometric spinner bends like a branch, you have to

[31] There are four river valleys on the territory of Raifa; the main one is called Volzhskaya: depths reach up to the mark of -80 – -100 m. This is the center of the geomorphological structure of Raifa. Thalweg runs from west to east south of Raifsky Lake.

throw it at a sharp angle, it should stand upright at the bottom of the river, you should also maintain attaching the upper end to the railing of the walkway, the fragile bridge looks like about to be demolished... Spring flood lasts for a month; the solid and weighted pull material saturates the stream, the flow deepens, destroying the shores…

What changed nature most of all, however?

Human activity.

If the roads and dams cut across the watershed blocking the way of the melting waters, as was done with the Lebyazhy (Swan) Lake to the west from Kazan, this anthropogenic influence will quickly overlap the naturally occurring processes, and... no swans whatsoever. Most probably no lake, either.

Plowing of forests, construction of dams and road embankments, water intake, etc. contribute to the degradation of the lake and river networks.

For 50 years, lakes and rivers of the Prikazansky district, taiga of the Raifa forest along with the Ural and Siberian taiga and other boreal forests were studied by the outstanding geographer, Professor A.S. Tajsin. For a long time, under his leadership, we have compiled a large-scale map of the Volga-Kama State Reserve, especially detailed for the extrazonal landscape of the Raifa forest. Observations were always carried out in comparison: with the nature of the north of the European part of Russia, with the Middle and Northern Urals, Western Siberia, and in particular, Mountainous Shoria. In the course of making thousands of plans and profiles, of botanical moves, snow surveying, depth measurements, monitoring small rivers, taking hundreds of water samples in flood and low water, descriptions of layers and cuts of rocks and geological outcrops, of taiga plant edifiers, of subsequent office processing of the data it became clear: the object of geographical observations, nature, is a major climatological, geological and soil-forming actor, that is, a very active subject[32].

Nature is the subject of all changes. Not just taken for granted in school and university walls, but worked out during hard work, this principle, as it later turned out, is the basis of non-mechanistic philosophical materialism.

As is known, the description stage required in the study ends with creation of a set of typologies offering generalization to the initial “raw” material of observations. Typology is paradigmatics. However, neither classifications nor definitions closely related to them are the result: it is a launching pad for further scientific research. Next is the establishment of private laws inherent in the object of observation: this is syntagmatics. For example:

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[32] Tajsin A.S. *Raifa Forest as Part of the Boreal forests of Eurasia*. – Kazan: Kaz. State Univ. Publ. House. – 2008.

– with the advancement to the north, the simplification and shortening of the topographic-ecological series of vegetation is observed (Perm region);

– short of snow years are characterized by the alignment of snow cover in the forest;

– snowy winters are characterized by wind asymmetry;

– strip-stepped slopes of river terraces create ecologically equivalent conditions for easily detectable periodicity of natural-territorial complexes;

– depth of the loamy layer determines the composition of spruce-pine communities;

– in the mountainous northern Urals, the height of the forest border depends on the struggle between two elements: snow and kurums, etc.[33]

Θεωρία, which in Greek meant observation, is conducted with both types of vision: physical and mental. Not sensual experience as such, but its abstract models and work with them allow you to make discoveries. Let us show by example how the accepted theoretical model of an object influences the organization of scientific knowledge about facts.

In geography, there is such a term as "thermokarst". Huge ring-shaped structures, rounded, shallow, barely visible on the ground, with a characteristic flat bottom, called "alas" – witnesses of permafrost occurrence – can reach hundreds of meters in diameter; they are not easy to detect in the field observations. Aerial photography helps a lot. To assume the existence of alas at our latitude at 55 ° – and until now it was believed that they are located only in Yakutia – is a bold hypothesis, but this assumption is based on the worldview principle of the unity of the universe. Permafrost receded to the north only gradually. And on the southern territory of Tatarstan, its traces-signs remained: relict thermokarst forms, up to 20 of them *(in number*), the largest ones with a diameter of more than 2 km[34]. Straightened and flatted "craters" can be watched, but not defined as *alas*: only new methods of observation and a well-constructed theory can help organize these facts-observations for the directional study and explanation. And to really see Mituga – the valley of Paleovolga – among the hills and bushes is given today only to those whose trained vision is supported by speculation, intellectual intuition and good theory. My father saw it and showed it to us, his disciples. In his eyes, it seemed, the reflection of an eternal rainbow glowed, which stood for two million years above the greatest river of Europe, and seemed to shine like a rainbow over Niagara Falls...

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[33] Tajsin A.S. Op. cit., p. 3 and further on.

[34] Tajsin A.S. *Lakes of the Prikazansky District, their modern natural and anthropogenic changes*. – Kazan: 2006. – P. 17-18.

In a word, I see no reason against considering, as before, science *first of all* as the scope of tremendous *knowledge*. The gnoseological approach allows establishing the cognitive relationship, approving the activity of the subject and object of cognition even at the observation stage, recognizing the steps of cognition, ways of organizing knowledge at each of them, establishing classical criteria for testing its truth.

It would not be difficult for me to analyze other concrete examples of the scientific work; for instance, that of a specialist in the field of comparative historical linguistics, namely, in the history of the English language in the same way like examples from physical geography.

Let us take the Old English text about the travels of the rich Norwegian merchant Ohthere. It was King Alfred's translation from the Latin "World History" of the Spanish priest Orosio. Not only is the Wessex dialect itself of interest to the linguist. Adfred's own inserts contain quite rich geographical and ethnographic material. This is how the story of Ohthere begins about his first journey to the White Sea.

"Ōhthere sæde his hlāforde, Æflfrēde cyninge, þat hē ealra Norðmonna norþmest būde. Ohthere told his master, King Alfred, that he was the one from all the northern people who went the farthest north. (By the way: hlāford, lord, literally means "master of bread").

Hē cwæð þæt hē būde on þǽm lande norþweardum wiþ þā Weastsæ. He said that he was on that land in the direction north of the West Sea (Atlantic Ocean).

He sæde þēah þæt þæt land sīe swīþe lang norþ þonan; he said afterwards that that land stretched very far north; ac hit is eal wēste, būton on fēawum stōwum stycce-mælum wīciað Finnas, on huntoðe on wintra and on sumera on fiscaðe be þǽre sǽ. However it's all deserted, but Finns live here and there in some places hunting in winter and go fishing in summer."

We can see how ancient and strong are the verbs of being, the designations of the seasons and the main occupations of northern people.

Further comes a story about how many days the journey took, about its route, about the big rivers "entering the land" from the sea (this turn is found later in the famous 16 Icelandic sagas about kings, "*Heimskringla*", "Circle of Earth"); the story also mentions different people met by Ohthere during the journey. One detail can excite a linguist: "Þā Finnas, him þūhte, and þā Beormas spræcon nēah ān geþēode"[35]. Finns, he thought, and Permians speak almost the same language.

It is Ugric-Finnish.

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[35] A.I. Smirnitsky. *Reader on the History of English from VII to XVII century*. – M .: Publishing house of literature on foreign languages. – 1953. – P. 25-26. /In Russian/.

These observations were made not in the nineteenth century by Wilhelm von Humboldt, the ancestor of comparative historical linguistics, but in the *ninth* century AD.

So can it be surprising that Wittgenstein, in the *twentieth* century, "discovered" the family kinship of languages...

However, these my examples are not the last aim in themselves; they should serve to affirm the fruitfulness, or, as they say, the productivity of the **gnoseological approach** in philosophy of science.

Not all authors suggest discarding the classics. Many philosophers reflecting on the problems of knowledge speak of the possible continuation of the existence of classical gnoseology in the aspect of its improvement. It is proposed, for example, to apply "modern ideas about the existence of ideal entities and virtual realities" (L.A. Mikeshina)[36]. Then "subject-object differentiation" will stop interfering with "living" knowledge, conservatism and naturalism of gnoseology will be overcome, as well as its "fruitless helplessness" before the problems of the twentieth and, it seems, of the twenty first century.

An unequivocal criticism of theory of knowledge as "philosophy of faith" (Popper) was carried out with the concomitant suggestion of abandoning it; and such philosophers as M. Heidegger, J. Dewey, L. Wittgenstein actually made this refusal without getting into discussions and replacing gnoseology with their *ontology*.

Meanwhile the **logical-epistemic** approach prevails in contemporary western philosophy of science.

In the "West", as it is known, *only epistemology* is considered legitimate which we see as the theory of SCIENTIFIC knowledge. The paradox is as follows. The old image is abandoned because gnoseology considers everything that goes beyond the framework of the basic cognitive subject/object relationship as irrational and, therefore, non-scientific. And the critics' demand for the modernization of gnoseology consists precisely in returning everything "alive", i.e. irrational, to the subject field: anthropological, hermeneutic, personalistic meanings; extra-scientific knowledge; everyday experience, etc.

Existential materialism has nothing against contemporary amendments of classical gnoseology; on the contrary, it offers its own contributions to it.

At the beginning of our book we pointed out two difficulties regarding truth: 1) its possible identity with reality (ontological difficulty); 2) possible identity of proposition and its truth value, that is, redundancy of the assessment (epistemological difficulty).

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[36] Mikeshina L.A. *Philosophy of Cognition. Polemic chapters*. – P. 28–29; 31–32. By the way, there is a good definition of *theory* suitable for *gnoseology* in her book: theory is a complex of views, thoughts, ideas aimed at explaining, interpreting knowledge and cognitive activity.

There are also difficulties of semiotic plan.

For example, logical ‘p’, symbol of *judgment*, i.e. of the form of *thought*, also means the form of language, a sign *expression*. As it was put in Roger Scruton:

> “Suppose I utter the sentence… (‘p’ for short). Not only have I uttered the sentence ‘p’; I have expressed a proposition that *‘p’*, which is in turn identical with the *thought* that *‘p’* … In expressing this proposition I may also be making *a statement*: the statement that *‘p’* ”[37].

Our ‘p’, therefore, can be a sign for sentences (maxims), expressions, judgments (assertions and denials), neutral “propositions” and so on, and so forth. Scruton continues:

> “In making the statement I may in turn be expressing my *belief* that *‘p’*. So here we have four (possibly five) things that can be identified by ‘p’: the sentence ‘p’, the proposition (thought) that ‘p’, the statement that ‘p’, and the belief that ‘p’ ”[38].

So, ‘p’ can arbitrarily be used in the science of logic, in other sciences, and in human activity in general by performing a variety of tasks and designating the structural elements of different worlds – the ideal and the material, as well as their conceptual content.

In many cases, it is not necessary to distinguish between these worlds and forms, R. Scruton says. For example, they are *indistinguishable in reasoning about truth.* And what makes them true is the actual situation, *the state of affairs* that ‘p’.

So, according to R. Scruton, epistemology as a whole is evidence of belief, or justification of belief[39].

Rarely, but still there comes forth identification not of a sign and meaning (expression and judgment), but of a sign (designation) and the object itself. Examples are fetishization of any symbol, sophisms, “playing” on the identification of an object-depicting language and metalanguage, generalization of the “Frege triangle” by bringing together the sides of this figure in abstract semiotics, when a triangle is sequentially converted into a “two-angle”, “one-angle” and a “non-angle” figure. We call the latter a “symbolic image”.

It is mainly for logicians that the object itself is considered to be the meaning of a sign. Thus we have a “two-angled” triangle. And in algebra, for instance, a formula is both what designates, and what is designated, and that by

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[37] Scruton, Roger. Modern Philosophy. – Mandarin Paperbacks, London, UK, 1996. – P. 16–17.

[38] Ibid., p. 17. However, these are possibly five; there is one more basic form: *the judgment. – E.T.*

[39] Ibid., p. 317.

virtue of which the designation occurs. The symbol envelopes and acquires an independent existence. Only in interpretation, – for example, in the application of mathematical or logical calculus to a physical theory, – does the reverse developing of the Frege triangle occur.

All these obstacles have the form of a broken (angled) helix: reality – consciousness – language. This simplifies our task methodologically. One can apply the basic semiotic law: "these three" are one, and in this sense they coincide, but they are not identical.

For gnoseology, *as well as for epistemology*, and *methodology*, there is a need to answer simultaneously two questions regarding truth: ***what*** (is true knowledge) and ***how*** (it is acquired). The substantive and functional aspects must be combined in a common vision. None of them can be ignored. One cannot stop on the incompatibility between "naturalism" and "analysis", either. We need to achieve compatibility.

Stathis Psillos, pointing out that such compatibility is possible, wrote the following about these two issues in the article "Truth" of his book "*Philosophy of Science from A to Z*"[40].

> "There are two strands in our thinking about truth. The *first* is to say that truth is an *objective* property of our beliefs in virtue of which they correspond to the world. Truth connects our thoughts and beliefs to some external reality, thereby giving them representational content. Truth is then an external constraint on what we belief. The *second* strand takes that truth is *evaluative* and *normative* concept; it summarizes of concrete assertion or belief; to say of a belief that it is true is to say that it is epistemically right, or justified, to have it. Hence, truth is an internal constraint on what we believe".

Actually, the second strand is epistemology, and the term itself is deep and far from random. The Greek ἐπιστήμη, the famous *episteme*, is not only opposed to "opinion" as true knowledge to subjective opining, and not only asserts the basis of this knowledge on some solid ground (ἐπι - on, στήμη - stem, basis), but also means "smart", skillful knowledge[41]. Semantically, therefore, it includes *method*, – a method of acquiring knowledge.

It is good that truth in the first sense is spoken of using the semiotic term "representation"; however, it is not enough because, according to our theory, consciousness as a whole and in all parts has the quality to *reflect*, that is, to [re]present an object. Therefore, this term does not allow us to discern whether true or non-true knowledge is involved.

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[40] Psillos, Stathis. *Philosophy of Science A – Z*. – P. 247.

[41] Slavyatinskaya M.N. *Textbook of ancient Greek language*. Part I. – M .: Philology, 1996. – P. 351.

"The difference between a non-epistemic and an epistemic conception of truth becomes evident if we think in terms of the Socratic Euthyphro contrast: are statements true *because* they are licensed as true by a set of norms or are they licensed as true by a set of norms because they are true? A moment's reflection will show that there is all the difference in the world in taking one or the other side of the contrast"[42].

Probably not as short as a moment's reflection, but *attentive* reflection shows all the difference between gnoseology and epistemology.

Indeed, you begin to feel sure that the early medieval formulas "believe to know" (or "I believe, and then I recognize", the Greek-catholic way) and, on the contrary, "know to believe" (or "at first I find out, in order to finally believe" , the Roman Catholic way), not counting the exclusive Tertullian's "I believe, because it is absurd" ("I have to believe, because man cannot know the absolute"), come in fact "from Plato" and "from Aristotle". Only, where did Democritus remain with the intended explanation of the *true* as *really existing*?

Let us dwell a little longer on Plato's dialogue "*Euthyphro*", to demonstrate exactly which initial reasoning gradually led to separation of epistemology from general epistemology and to the elliptical figure of truthfulness.

Socrates asks for the *definition* of *piety*: "I did not ask you to give me two or three examples of piety, but to explain the general idea which makes all pious things to be pious... Tell me what is the nature of this idea, and then I shall have a standard to which I may look, and by which I may measure actions, … and then I shall be able to say that such and such an action is pious, such another impious".

First definition that Euthyphro produces: Piety is what is dear to the gods, and impiety is what is not dear to them. Socrates amends it: what all the gods hate is impious, and what they love pious or holy; and what some of them love and others hate is both or neither. "And is, then, all which is just pious? or, is that which is pious all just, but that which is just, only in part and not all, pious?"

And then the crucial formula comes: Socrates wonders whether the pious or holy is beloved by the gods because it is holy, or holy because it is beloved of the gods. Analogies are drawn: a thing is seen not because it is visible, but conversely, visible because it is seen; nor is a thing led because it is in the state of being led, or carried because it is in the state of being carried, but the converse of this.

(Isn't it) because something good is loved by those who love it, because it is good, but it is good, because it is loved?

Socrates: It is loved because it is holy, not holy because it is loved.

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[42] Psillos, Stathis. *Philosophy of Science A – Z.* – P. 248-249.

Euthyphro: Obviously.

And then the dialectical, or paradoxical, Socrates makes preliminary conclusions:

1. The holy has been acknowledged by us to be loved of God because it is holy, not to be holy because it is loved.

2. For one (theophiles) is of a kind to be loved because it is loved, and the other (osion) is loved because it is of a kind to be loved.

Socrates: "Then we must begin again and ask, What is piety? … and I entreat you not to scorn me, but to apply your mind to the utmost, and tell me the truth. … I am sure, therefore, that you know the nature of piety and impiety. Speak out then, my dear Euthyphro, and do not hide your knowledge.

Euthyphro: Another time, Socrates; for I am in a hurry, and must go now"[43].

Not trying to back away, we can assert now that statements may be true *because they are recognized as true* (licensed by a set of rules and regulations) – or they are recognized (licensed by a set of rules and regulations) as true, because *they are true*. This perfect ellipse is in no way inferior in aesthetics to the famous hermeneutic circle.

Stathis Psillos, in his philosophical dictionary, points out that both the objective and the evaluative strands consider truth to be a substantive quality of truth-bearers (p. 248). In both cases, the questions "what" and "how" are combined. For us, this is already good, since both are opposed to relativism. Here, these two approaches are presented as equivalent, and only by some indirect evidence can one assume that this modern philosopher of science holds the second position.

And I hold the first one, objective and essentialistic. Incidentally, it was condescendingly criticized by *Hegel*, the greatest authority for us in theory of knowledge. In his "*Encyclopedia of Philosophical Sciences*" he wrote that the first relation of thought to objectivity is the *naive way of thinking*, and it contains the *belief* that truth is cognized by thinking and that it really reveals the objects. In this belief, thinking proceeds directly to objects, reproduces the content of sensations and notions from itself, makes them the content of thought and is satisfied, seeing it as truth. All the initial degrees of philosophy, – Hegel asserts, – all sciences and even daily activities and the movement of consciousness live in this faith.

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[43] In: Plato. The Complete Works. Translated by Benjamin Jowett. El. resourse: http://www.-cakravartin.com/wordpress/wp-content/uploads/2008/08/plato-complete-works.pdf

"Die erste Stellung ist das *unbefangene* Verfahren, welches, noch ohne das Bewußtsein des Gegensatzes des Denkens in und gegen sich, den *Glauben* enthält, daß durch das *Nachdenken* die *Wahrheit erkannt*, das, was die Objekte wahrhaft sind, vor das Bewußtsein gebracht werde. In diesem Glauben geht das Denken geradezu an die Gegenstände, reproduziert den Inhalt der Empfindungen und Anschauungen aus sich zu einem Inhalte des Gedankens und ist in solchem als der Wahrheit befriedigt. Alle anfängliche Philosophie, alle Wissenschaften, ja selbst das tägliche Tun und Treiben des Bewußtseins lebt in diesem Glauben"[44].

Despite of deep piety, we will not be afraid to take this naive ("native") position and start from it. For a start, this can be explained by the following consideration: in order to trust the rules and license certain judgments as true, using a set of norms, one must be sure that these norms are true (criterial validity). The fact is that every time an indication of certain signs-properties is included in the definition of the true. But in each specific case it is necessary *to be able* to decide whether it is true that these signs *are present*; that is, in order to establish norms and rules, they must first be recognized as... truly true. "…In einer Definition gäbe man gewisse Merkmale an. Und bei der Anwendung auf einen *besonderen* Fall käme es dann immer darauf an, ob es wahr wäre, daß diese Merkmale zuträfen"[45]. Behind these criteria, as well as behind the statements that they will "rule", should already be present an understanding of truth.

This does not mean that the second position – namely, epistemic one – can be ignored, at least because one the most influential strands of the twentieth century, analytical philosophy, is based on it. However, there is no doubt that the question of the truthfulness of the criteria themselves is not simpler, and therefore not "more primary" than the question of truth.

In his book "*Learning from Six Philosophers*" J. Bennett wrote:

About the belief in 'the existence of the body' there are two questions to ask. (1) 'What causes it?' Trying to answer this, we approach the belief in a naturalistic way, as something to be explained as we might try to explain the weather or an epidemic. (2) 'What, if anything, justifies it?' this invites a normative inquiry into the value of arguments or evidence for the belief… So there is a naturalistic, causal inquiry, and a normative, analytic one"[46].

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[44] Hegel, Georg Wilhelm Friedrich. *Encyclopedia of Philosophical Sciences.* Erster Teil. A. Erste Stellung des Gedankens zur Objektivität. Metaphysik, § 26. El. resourse: http://www.zeno.org/Philosophie/M/Hegel,+Georg+Wilhelm+Friedrich/Enzyklop%C3%A4die+der+philosophischen+Wissenschaften+im+Grundrisse/Erster+Teil.+Die+Wissenschaft+der+Logik./Vorbegriff/A.+Erste+Stellung+des+Gedankens+zur+Objektivit%C3%A4t.+Metaphysik

[45] Frege, Gotlob. *Der Gedanke. // Logische Untersuchungen.* Göttingen, Vandenhoeck & Ruprecht, 1993. – P. 60. El. resourse: http://www.gavagai.de/HHP32.htm#anfang

[46] Bennett, Jonathan. *Learning from six philosophers*. V. 2. Locke, Berkeley, Hume. – P. 198.

The second approach, the author emphasizes, in its turn, requires investigating content analysis, and not just inquiring about the method. Again, in both cases, the questions "what" and "how" are combined. As we see, approximately the same oppositions are present in "*Learning from Six Philosophers*" as in "*Philosophy of Science from A to Z*", but Bennett begins, so to speak, from a "zero", preliminary question (and not from the first one): namely, from (ontological) belief in existence of a "body". Somewhat below, this author will call a (gnoseological) question regarding the essence of our thoughts and beliefs, the "necessary preface" ("zero" in relation to the epistemic licensing criteria).

Estimating judgments were contrasted to the causal understanding in both Rickert and Windelband, and other modern classics (the trail of Hume and Kant). Actually, the first philosophers to focus on the evaluative judgments were skeptics. However, it is not very clear why Bennett directly binds the solution of the completely independent metaphysical question of existence ("*On the existence of the body*") to the question of the reason for existence (causal inquiry); after all, even in logic, the genetic definition is quite distinct from the existential one and *follows* it. This binding makes it possible to include the majority of scientific reasoning in the "empirical psychology" department. It seems to me that this is the "footprint of Hume".

Departing from the preliminary stage of an intuitive knowledge of existence of an object, one can take not only these two directions, the ontological questioning "why" and the epistemological questioning "how", but also the general theoretical-cognitive way to truth.

Let us return once more to the arguments of J. Bennett. Analyzing Hume's treatises, he draws the reader's attention to the disintegration and reverse integration of what may be called objective and subjective reasons.

> "The reasons which lead people to believe P can be causes of their doing so: 'He believes P because he believes R and takes it to be a reason for P' could tell us what causes him to believe P. Some philosophers have thought that if you are caused to believe something, that blocks you from believing it for reasons – as though causes and reasons were rival claimants to a certain role in the life of the mind"[47].

Most today will disagree with that, however, this author adds.

How can we stop the regressive withdrawal of the "evidence of the truth of the foundations of truth"; how do we know that criterion *c* is sufficient for knowledge?

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[47] Bennett, op.cit., p. 199.

In his "*Philosophy of Science from A to Z*" S. Psillos explains that such a strategy leads to a trilemma: either to infinite regress (…because I have used another criterion *c'*, or method *m*, or whatever), or to a circle (…because I have used criterion *c* itself), or to dogmatic breaking of movement (…because I find that criterion *c* is sufficient for knowledge)[48].

As will be seen from the next section, such attempts (bridging the gap) are undertaken by representatives of different theories of truth. However, with an unresolved problem of *the ideal*, they do not become generally accepted and convincing.

Let us now consider other than logical-epistemological approaches to science.

Science, it is said, is often defined as (rational-objective) activity. Its mission is constructing mental models of objects and their assessment on the basis of external experience. The intellectual factor basically embodies the transforming activity of consciousness, both individual and public.

Any activity:

- has a *goal*;
- has a *product*;
- has *methods* and means of obtaining it;
- is directed to some *objects*;
- represents the activities of *subjects*;
- by entering into certain *social relationships*;
- and shaping various forms of *social institutions*.

In all dimensions, science is significantly different from other spheres of human activity.

Its *main purpose*, as already mentioned, is *to obtain adequate knowledge of reality*.

Knowledge can be scientific, para- and quasi-scientific, non-scientific and unscientific. However, true knowledge can be obtained without recourse to science, only with the help of intuitive logic and common sense. Knowledge is acquired by man in all forms of activity, in everyday life, politics, economics, art, engineering, but this is not the main task in the mentioned areas. Serving art is not aimed at adequate reflection of reality; its ideal is expression of the artist's attitude towards the world. The goal of politics is to achieve conventions; efficiency dominates in economics; in engineering it is optimal use, and pragmatic benefit that counts. And only science makes knowledge its main purpose.

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[48] Psillos, op.cit., p. 222.

Products of scientific activity are not only knowledge and information. These are also numerous instruments and technical installations; this is a new style of rationality; these are great social values, including morals. Proponents of sociology of knowledge include here not only "proven by practice and logically adequate reflection of reality in human consciousness", but also axiological meanings, information stock – and misinformation, too.

Any research done in the framework of constructivists' program of science-study is characterized by the use of the so-called model of interests. It is based on the assumption that political, religious and especially professional interests of scientists have a significant impact on the content of scientific knowledge, particularly influencing the process of selection of competing theories. The crucial role of professional interests in making new theories is revealed in sociology of science.

Scientific knowledge, as well as methods for its production, organization, transformation, storage and transmission can be divided into *traditional* and *non-traditional*. This differentiation is well combined with the Parson's classification of traditional and modern social systems. Another classic of modern sociology, R. Merton, wrote his main work in 1949. Of note is that contemporary sociology of knowledge primarily represented by the Edinburgh school (D. Bloor), under the influence of the ideas of French post-structuralism went generally in the opposite, "anti-Merton" direction. In particular, Bloor criticized any universal principle of science from the standpoint of social constructionism, even the very idea of the normativeness of knowledge, and he also spoke out against the idea of "scientific rationality". In return, an additional sociological criterion of truthfulness of scientific knowledge was moved. The famous Strong Sociology Program of Science by D. Bloor and S. Barnes[49] set forth the following idea: scientific explanations must be *symmetrical*. This means that the same reasons should explain the emergence of both true and false theories or those considered as such. The physiologist explains health and illness with the same reasons; engineer – both work of the car and car breakdown, etc.

Knowledge can also be classified as *local* and *global*, *scientific* and *non-scientific* (everyday), etc. You can mention long lists of sub-classes: "facts", "generalizations", "skills", "competences", "forms [of existence of knowledge]", "methods [of their acquisition"], "norms and assessments", "argumentation"; development, application, means of management, ways of understanding information, the degree of civilization of society, etc. In this regard it is suffice to use classifications developed in such areas as sociology of science, sociology

[49] Bloor D. Knowledge and Social Imagery. – The University of Chicago Press, 1991.

of knowledge, epistemology, theory and methodology of science. You can specifically enter the column "*ability to self-study*": this is the main sign of intellectual talent. In countries with developed market economies, the skills that enable to independently, quickly, and systematically acquire new knowledge are of decisive, purely practical importance: when applying for a job, the ability to self-learn is rated higher than specialized information that rapidly becomes obsolete. Self-study, in turn, generates new abilities and new specific forms of knowledge.

Methods and means of obtaining scientific knowledge, at first place, are *logical*. "From a logical point of view, a person is completely free in the sense of what to reason about, and deprived of freedom in the sense of how to reason. The objective laws of logic limit the freedom of reasoning, just as the laws of nature and society limit the freedom of human actions"[50]. Basic logical methods and procedures are: analysis and synthesis, induction, traduction and deduction, abstraction and generalization, proof and refutation, systematization, classification.

Secondly, these are *general-scientific* methods, common to all disciplines, such as idealization, symbolization, formalization, mathematization, modeling, interpretation, etc.

Scientific methods are also divided according to the levels of obtaining and further existence of scientific knowledge: description, explanation, observation, comparison, measurement, experiment, and some other *empirical methods* inherent in the experimental level of knowledge. There are, further, axiomatic or genetic methods of constructing *theories*, as well as methods for their verification. Quantitative and qualitative assessments of the results obtained are given using special procedures, standards and instruments. Of particular importance is the measurement of time, distance and energy.

Thirdly, properties and characteristic features of the objects of knowledge and, accordingly, various cognitive tasks dictate the emergence of new specialized methods, characteristic for individual disciplines and for the individual areas of research.

There exist many classifications of scientific methods. C.f.:

I. Theoretical and empirical.

The empirical methods include: observation, measurement, description, experiment.

Theoretical methods include: formalization (model building), axiolization, hypothetical-deductive (building hypotheses, linking theories). Or:

II. a) general: analysis, synthesis, deduction, induction, classification, mathematical methods;

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[50] Bystrov P.I.. Riddles of Logical Reasoning // Epistemology & philosophy of science. – V. XXIX. – # 3. – M .: Alfa-M, 2011. – P. 124. /In Russian/.

b) general scientific representing a kind of intermediate methodology between philosophy and the fundamental theoretical and methodological provisions of the special sciences;

c) concrete scientific represented in special sciences.

The most important, prosodic (penetrating) means of scientific knowledge is the *language* of science itself, a special functional style characterized by terminated vocabulary, most high degree of symbolization, certainty of concepts, clarity of statements, striving for strict logic. In this language one of the criteria of truthfulness of scientific knowledge is best realized: namely, consistency. True knowledge must conform not only to the laws of nature and society, but to the laws of Aristotle's logic, in particular to the second one, which dictates: you cannot, without contradicting yourself, affirm and then immediately deny the same thing about the same, in the same relation or at the same time. Logical contradiction testifies either to delusion or to lie.

An important tool that is widely used not only in science, but also in socio-humanitarian knowledge, is *mathematics*.

It is characteristic that lately the so-called "exact" and natural sciences have begun to contemplate and talk about humanitarian, socio-cultural prerequisites and interpretations.

Any fragment of reality can be the *object* of science. It studies nature, society, man, culture, and even itself. In the last case, the object of thinking is its ideal objects, its methods and statements. Science starts from the postulate that everything in the world can be known from itself, on the basis of its laws. This distinguishes science from theology.

Russian philosophy of science was formed as the study of the general laws of scientific knowledge in its historical development and changing socio-cultural context.

The *subject* of science, the figure of a scientist is a special social value. These are or at least should be people of great culture, of wide and diverse interests. At this point, we can finally move on to one of the newest approaches to science, socio-cultural or, more precisely, **socio-philosophical one**.

"The person who knows", or the creative individual, is exposed in I.T. Kassavin's works very convincingly.

Today it is, above all, an inhabitant of an "individual cultural laboratory," in which the basic meanings and values are developed, and the attitudes to the external (premised-objective) and internal (operational-normative) sociality are determined. Accordingly, the cognizing subject, comparing these types of sociality, gets self-determined in relationship to the entire accessible culture,

choosing the most attractive forms, and establishes external social ties. Gradually, what is called a tradition comes out of this social circle[51].

People of science are organized in the relevant professional communities and institutions that record and disseminate scientific knowledge in the form of printed materials and computer databases, lectures and presentations at conferences and congresses of all levels. The community of academicians plays an important role among other professional communities. A special role in the transformation of society is played by the *scientific elite*. Through the intermediation of the scientific elite, the interrelation of science with society and the state is realized. It influences decisions-making on financing of science in general and its individual branches, material and technical support of research activities, it determines research areas of greatest priority, controls the implementation of scientific relations within society, manages scientific personnel and their reproduction, etc.

Numerous sociological approaches to the problem of identifying elites are developed. In one case, this is a narrow stratum of outstanding researchers, those who have special merits, who have achieved the highest results in a particular field of activity. In another case, they are holders of academic titles, positions, grants, awards, etc. The highest and most prestigious award in the field of natural sciences since 1901, and in economics since 1969, is the Nobel Prize.

The scientific elite do not exhaust, however, *the whole of big science*. The correlation and interaction of trail-blazers, leaders and masses is also a big socio-philosophical problem, going far beyond the scope of the present work. Here is the rendering of A. Einstein's words – the great authority can help confirm the highlighted thesis.

The temple of science is a multi-layered building. People who are in it and spiritual forces that brought them there are very different. Some do science with a proud sense of their intellectual superiority; for them, science is the right sport which should give them the sense of full life and satisfaction of ambitions. You can find other individuals in the temple: they sacrifice all the fruits of their thoughts only for utilitarian purposes. If an angel sent by God came to the temple and expelled those who belong to these two categories, the temple would be disastrously empty.

...I know well that we have just with a light heart expelled many people who have built a significant part of science; the decision taken would be bitter for our angel. But one thing seems certain to me: if there were only people like the

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[51] Excerpt from: Kasavin I.T. *Migration. Creativity. Text*. Problems of non-classical theory of knowledge. – SPb, 1998.

expelled, the temple would not have risen, just as a forest could not have grown out of mere climbing plants[52].

In modern Western sociology of science, starting from the middle of the twentieth century, it is customary to speak not about the *intelligentsia*, but about the *class of intellectuals* – knowledge class. R. Dahrendorf, J. Galbraith, A. Touraine were the first who began to write about it (the last author pointed, in particular, to the repressive role of this class). Main properties of the knowledge class are as follows: high status determined by scientific competence, high standards of education, independence from owners of the means of production, inalienable ownership of information and the ability to use it, exceptional mobility and relevance in all other layers and classes, dominant position in the post-industrial society and hence the ability to displace and press out simple live labour from production and serve as the basis for all other stratifications.

Theorists of the post-industrial society consider the class of intellectuals to be self-replicating closed communities[53].

Daniel Bell, founder of the concept of *informational* (or post-industrial) *society* also called the society of learning, built the following status hierarchy:

I. Class of professionals:

1) scientific class (academic and university science);

2) technological class (applied types of knowledge: engineering, medical, economic);

3) administrative stratum;

4) culture class (artistic and religious activities).

II. Class of technicians and semi-professionals.

III. Class of employees and sales workers.

IV. Craftsmen and semi-skilled workers ("blue collars").

The transition from traditional to modern society was accompanied by radical changes in all spheres of public life, political, legal and economic institutions, technologies and management methods. Important changes occur with person's inner world. A new human being is or should be characterized with:

- high adaptability;
- rationality of thinking;
- faith in the effectiveness of science;
- ability to choose, and making independent decisions;
- individualism;

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[52] Quoted from: *Philosophy and Methodology of Science*. In 2 volumes. V. I. – M.: 1994. – P. 13. /In Russian/.

[53] For details, see V.L. Inozemtsev. *"Class of intellectuals" in the post-industrial society* // SOCIS # 6. – 2000. – P. 67 and further on.

- desire for self-assertion;
- ambitions;
- interest in political issues;
- high degree of autonomy.

For Russia, the replacement of the traditionally understood *intelligentsia*, the "conscience of the epoch", with the extranatory "intellectual class" is fraught with spiritual impoverishment due to the erosion of ethics. Against the background of the urbanization processes of our ever-transforming society, this threat is quite real, and its execution is postponed only by the immaturity of the transformation itself. It is in Russia that the opposition intelligentsia / intellectual class is realized, starting with the works of N.A. Berdyaev, as an antagonistic contradiction. "People of spirit", "speaking class", are the bearers of the generic qualities of human essence, namely, freedom and creativity. Life, activity and a kind of mission of the Russian intelligentsia in the original sense of the word is a search for the own way, not western with its egocentrism and not eastern with its despotism.

I quote here, nearly in full, the article "*In search of Harmony*" by Aleksandr Ebanoidze, chief editor of the journal "*Druzhba narodov*" ("Friendship of peoples"), a Muscovite by birth, a natural Russian speaker with Georgian heritage.

"…Russia is embarrassed by the costs of protracted reforms and the grimaces of the economic crisis. Having indebted to pensioners and miners, teachers and doctors, who did not cope with militant separatism, having abandoned the old ideology and not finding a new one, she forgot about her role in the cultural and spiritual space of Eurasia. She is not up to culture. Language, as a communicative tool, is working for the time being, but Russia's intellectual presence is less noticeable. Russia leaves the cultural space of neighboring countries.

…When Russia tried in its time to throw off the bonds of serfdom and ease the oppression of autocracy, Europe improved the relations of private property, debugged the parliamentary system, and organized a consumer society. This subject of our today's admiration and absentee love turned out to be much more superficial, more primitive and more vulgar. But, listening to our complaints and explaining the Russian metamorphosis by the irrepressible step of civilization, Western interlocutors ask us the characteristic question: 'Why, do you know another way of social progress?'

The money factor, the "yellow devil", is slyly efficient in economics, but proves vicious and malignantly harmful in the sphere of moral and spiritual – all world literature and the brief experience of current reforms testify to this.

…I will speak out in no uncertain terms: I am outraged by social chaos, as a result of which the people who created EVERYTHING that is still working in this country are plunged into poverty, put in line for humanitarian aid, turned into targets for condescending ridicule, while the "new Russians" that fell on our heads and "oligarchs" with hangers-on, smart, cynical and toothed, snapped up what was not created by them, in a few years felt like masters of life and tried their best to legitimize an unacceptable social system.

...You should not deprive your people of hope. It is not necessary to deprive the hopes of conscientious people who stare with compassion into this strange country, whose thoughts differed from pragmatic worries and anxieties and seemed to return the hopes and impulses of youth. The task of Russian society (like any other) is to seek and nurture a better, fairer world order.

Not for that from century to century the lampion of reason burned and the voice of conscience sounded so that now the omnipresent lustful advertising eclipsed and drowned them out. The human race has suffered the right to something more reasonable and higher than the "consumer society". A fundamental paradigm shift is wanted. Past experience teaches: it is necessary to abandon both totalitarianism with its violence against person and equalization, and "ferocious liberalism" with its biological selection, destruction and grinding of weak individuals.

We need *a third way*"[54].

Oh well; the third way is needed, as always…

As to a commentary – the speaking class does not need it.

I beg pardon from the reader for the prolonged citation. But this entire situation cannot be expressed better, though twenty years have passed since the publication.

Many authors write about the ambivalence of the mental state and behavior of the Russian intellectual. There is an explanation to this contradiction, however; perhaps it is not the only one. Let us turn to another work of I.T. Kassavin. It draws an attractive figure of a modern creative individual: a "public intellectual", who, in his own way, copes with the *double bind of involvement and independence* (D. Tannen's term). "Given that [the definition] includes all the characteristics of a creative person, one feature distinguishes him: the migratory intention dominates over the settled one. He does not turn his ideas into traditions, and among the guises of a cultural hero the image of a trickster is closest to him"[55]. I must say it reminds of the "bubble" firms and even funds that are widespread, being created for a short time to solve only one, usually economic, task and then dissolve again. Somewhat earlier I managed to face the similar idea of a new man, a "privileged interpreter of social reflexivity where ambivalence is at work". Such a person must be "able to creatively redefine one's professions" and capable to conciliate opposite logics".[56] Ambivalence at work was explicated in the following "differences":

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[54] From: *The Word is Not a Sparrow*... // Ed. and comp. by Yu.T. Shilov. – M.: Paninter. – 2001. – P. 469-473. /In Russian/.

[55] Kasavin I.T. *Knecht and Dezinori*. *Socio-cultural role of human intellectual work* // Epistemology & philosophy of science. – V. XXIX. – # 3. – M .: Alfa-M, 2011. – P. 14-15. /In Russian/.

[56] From: *Social Knowledge: Formations and Interpretations* // International scientific conf. – "Tempus / Tacis". – Kazan: KSU. – 1996.

Conservation – innovation
Creativeness – business orientation, and
Creativeness – assemblage
Research – mass communication
Individualism – guarantism
Manipulation (Bourdieu) – emancipation
Globalization – fragmentation, etc.

With the help of these differences, such scientists as H. Davis believe, the social world is constructed, both external and internal.

It seems to me that, rather, the notable double bind, namely, the double bond of independence and involvement is at work[57].

The fact is that this contradiction is *not* a state of ambivalence of a modern educated person; such feeling appears as the sense of doubt, the lack of a solid assessment of the same situation, awareness of the presence of two paths to the same aim. This is *not* a conflict either, although this is how dialectic states the highest degree of sharpening of any contradiction. In a state of conflict, a person feels tossing or already torn between two alternatives. This is *a double twisted helix,* no less durable than DNA, and equally fundamental (D. Tannen). Like an ivory tower or barricade, serving "truth-*verum*" or "truth-*justicia*", culture or civilization, "people" or "power", like freedom and security, friendly and alien, familiar and "strange" are the opposite and united meanings.

However, I agree with another image from the text of "*Knecht and Diesinori*" (in a certain sense, not supported by I.T. Kassavin himself):

> "In serving culture, the intellectual consciously distanced himself from power and opposed it to himself. The same power over the minds that an intellectual can acquire in return, he is called upon to use not for his own personal benefit, but for the sake of developing the culture itself, as a means of developing the intellectual potential of the whole society"[58].

So, knowledge is a socio-economic force, along with labour, land, and capital. The objects of property are, *en mass*, primarily technical knowledge obtained through training in relevant educational institutions. In this sense, the basis of wealth and power is *intellectual capital*. Intellectual potential, being realized, becomes the ability of people to "make history". The dialectic of

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[57] Tannen, Deborah. *That's not what I meant! How Conversational Style Makes or Breaks Relationships*. – Ballantine books, N.Y. – 1987.

[58] Op. cit., p. 12. I just do not agree that for this he must start producing "mass culture". There will be simplification, but it will not be more than what we use for the sake of mutual understanding with colleagues or our students.

intellectual potential and actual creativity, no matter whether it is a theory or practice, is the same as the dialectic of treasure and working capital.

Sociological approach makes it possible to consider the intellectual potential as *working* capital, which is not unhelpful. Experts identify the following components of such potential: market assets, intellectual property, human and infrastructure assets. A trademark, a trade symbol and advertising, an account of groups of customers, a portfolio of orders, license and franchise agreements, business cooperation have their own value. A modern firm is most often a transactional contract concluded for a short, fixed term between a director, a producer, and a financial specialist. Intellectual assets proper include trade secrets and know-how. They are protected by copyright, expert systems, and patents. The intellectual property of a modern mobile and efficient small firm is a corporate capital investment. Traditional ideas about work today have changed dramatically, and workers in the third millennium will literally have a different mentality, as well as other psychometric characteristics. Education, professional inclinations, knowledge, skills, and overall professional qualifications are of paramount importance to human assets. For Russia there is a task today, to teach communication and corporate work in an atmosphere of mutual responsibility.

You can give the following definition of intellect as a capital. This is an integrative factor that unites all other elements of social potential into a special totality. This factor is of complex dual nature: it can act both in direct, *discrete* quality, such as experimental design, scientific theory, class schedule, a set of professional skills, a set of cognitive or management methods, a transactional contract, etc.; and in an indiscrete, *continual* quality, uniting, synthesizing, "sticking together" all other social phenomena. We say, then, that intellectual potential has prosodic value. It is actualized in the form of processes of the general intellectualization of society, and, quite possibly, this is the way to the "Society of Knowledge".

In connection with what has been said, the experience of evaluating intellectual capita undertaken in the monograph by E. Brooking "*Intellectual Capital. The key to success in the new millennium*" is of great interest. She writes that when a businessman invests in a new enterprise, he invests in people and an idea. Consequently, the initial capitalization of a business can be considered as the value of the people making up the team[59].

The book contains a set of witty, and sometimes deep, theses on the content and essence of intellectual capital (IC): in particular, the thesis about intellectual

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[59] E. Brooking "*Intellectual Capital. The key to success in the new millennium*". – "Peter" Publishing house, 2001. – P. 272. /Transl. into Russian/.

capital as a factor in strengthening the competitive advantage of a company; the thesis of the role of patents in terms of income level; a structural diagram of the audit of IC; requirements of continuous monitoring of IC; aphoristic judgment on the meaning of corporatism and cooperation, etc., all forty points. Note also the recurring thought that is found in the discourse of many modern Western sociologists, such as G. Davis (Great Britain), E. Brooking (USA), J. Humphrey (Australia), J. Feldhoff (Germany): *today it is not so important what you know; it only matters what you can do.*

As a brief comment, let us state the assertion that, in general, the trend of time required a certain turn back to values that seemed to be repressed by the procession of the scientific revolution. Despite the proclaimed highest significance of theoretical, fundamental science (however, official budget devotes a smaller share of allocations to it), criteria for assessing the truth of scientific knowledge have changed in postmodern society. If still in the 70s of the twentieth century it was fundamentally important what methods were used to obtain the result and in what forms scientific knowledge was "cast" – nowadays the only criterion is the *success of the case*.

The success criterion of the company is prosperity, and of failure – bankruptcy. The success criterion for a studio or a writer is fame. The criterion of success for a team of scientists is the number of grants won. From a socio-philosophical point of view, this could be called the historical reverse transition from *Homo sapiens* to *Homo habilis*, a skillful man, though on a new basis. This quite fits into the spiral dialectical model of social development, according to which the forward movement is necessarily connected with continuity, and the newest stage substantially resembles the old one.

Let us accept, however, that science is a system-forming factor for the intellectual potential of a person and society.

Science, since its emergence, has served as a model of intellectual activity. That is why its development has a positive effect on the development of society as a whole, because science within the framework of spiritual potential is the central element that links culture with labour and socio-political imperatives, and therefore is an integral characteristic of the development of the social system in general.

You can create *three* positions that can serve as a base for the analysis of actualization and manifestation of intellectual potential. In this regard we will not be too original, because the division of human life in the theoretical, productive, and practical parts was carried out by Aristotle. If we correct the content of these three concepts taking into account the realities of our time, we will see that the scheme itself has changed but little. Experts use it as a working platform, exploring the main functions of activity worked out by mankind throughout its history.

That which leads to the search for knowledge for its own sake is today called cognition; the production of material objects, goods and services, forms of culture, as well as social reorganization, experiment, any goal-setting sensually transforming activity is called practice; moral perfection is mainly given to the care of education and training. Each of these functions takes place under the condition that the corresponding potential is realized. Thus, the potential of the cognitive function can be described as spiritual, including intellectual, moral, and cultural, in the narrow sense of the latter. The potential of the productive function can be called labour in general, combining economic and socio-political parts. The potential of the teaching function is education within the framework of the relevant institutions. It is in the field of learning (the society of knowledge!) that the most profound synthesis of the rational, moral, cultural, spiritual in the broad sense is made. Of course, there are no impassable boundaries between the various areas and functions of vital activity distinguished for the convenience of analysis: all types of social activity actually exist closely superimposed on each other. In economics and politics, in health care and army, no action is taken apart from the work of intellect. Intellects, culture, practice, morals, are all integral characteristics of a social person.

Now we can say that intellectual potential is a *triad*:

1) "*productive potential of science*", which directly overlaps with the concept of labour potential; it has an outlet to practice and includes economic thinking;

2) "*productive potential of power*", or "administrative potential", which includes the organization and management and intersects with the socio-political potential;

3) "*potential for regeneration*", or "life world", opening up in the areas of ethics, culture, social ecology, which, by way of discussion, could also be called "potential of freedom" (concerning professions, theories, behavior, etc.)

The first component of the triad symbolizing science together with its applications, demonstrates best of all the content; the second, denoting the management structure, is form; and the third one is the vital and societal factors of stabilization of intellectual capital. These components themselves can also be deployed in triads.

1. The triad "productive potential of science", including both scientific and practical activities, is deployed in "business potential" schemes including exchange trade and financial processes and distribution schemes, "industrial engineering developments" including military science and engineering, and "academic research", for the so-called "big science" is truly a productive force.

2. The triad “productive potential of power”, or “administrative potential”, is revealed as state and municipal government, jurisprudence, activity of political or politicized public organizations.

3. “The potential for regeneration”, or the potential for freedom, is biased and non-engaged activities of persons of free professions, creative unions or freelance workers; this is the intellectual capital of libraries and museums, cultural institutions; these are also public hygiene and health plans and programs.

The potential of intellectual freedom does not mean independence from nature, including human nature, or from social being and forms of social and individual consciousness. At the same time, this is precisely liberty: freedom from the political superstructure, the rigid framework of law, from the world of “profit”, and consumerism. It is a sphere of life, *Lebenswelt*, including the life of spirit. Spiritual potential as a whole symbolizes freedom, to the extent that it is possible at all.

The complex of intellectual, moral and cultural potentials is spiritual potential; these are, as has been said, its types. At the same time, this relationship is not simple. If we accept our initial premise that intellect is an invariant component of all types of potential and an integral characteristic of the level of development of society, then it can be argued that intelligence is the quintessence of not only spiritual but also social potential in general, and therefore its development cannot be carried out beyond spiritual and – more broadly – social potential. If we consider this interconnection more specifically in relation to various areas of society’s life, then we can say that the area of realization of the intellectual potential itself is science and technologies which strive for globalization, and the area of realization of spiritual potential is culture and communication where universal dialogue is possible, but not universalization.

One of the aspects of attention of sociology of science is the problem of the social sources of replenishment of intelligentsia as an accumulator of spiritual potential in general. In Russian sociology of science D. Bell’s position is popular, according to which one of the most important indicators of social development is increase in social mobility. This implies the absence of a rigid “guild” self-reproduction of various social groups and their interpenetration. The process of replenishment is then due to diffusion and dispersion when representatives of one group move to another.

Scientific activity affects any other activity: work, socio-political fields, culture proper, especially in the era of modern technology, when making a film, defending a thesis, giving a lecture or recording a collection is impossible without a computer. Starting from the progressive German university in the end of the nineteenth century, the level of development of science determines the character,

content and level of education, since educational programs and the world outlook which they impose are the fruit of scientific research. Success of any practical activity today depends not so much on quantitative indicators, but on reducing costs, which also cannot be carried out without scientific developments. Scientific potential serves as a kind of breeding ground for the development of technologies in the economic, social, moral sphere, in art, religion, and philosophy.

For its part, the significance of material support provided for science is also quite obvious. The level of economic development affects the success of scientific activities to the extent that it is associated with material costs or the transformation of social interactions. The reasons for the unjustifiably low cost of intelligence in the current Russian society are connected, in particular, with the current state of property relations. The crisis that engulfed our society did not leave science aside. Scientists of different profiles and managers offer various ways to overcome it, but not many of them are based on scientific evidence about science itself; advantages in the formulation and study of such problems are still behind the sociological approach.

Development of intellect cannot be carried out only in the spiritual sphere, outside other areas of life, namely, socio-political and economical. Thus there is a need to analyze the mediating link between the productive potential of labour and the potential of knowledge able to combine the energetic "charge" of both, the ability to do some work. This mediating link must be created within the framework of scientific potential; its purpose is to serve the solution of technological and theoretical problems, namely, the development of mechanisms capable of combining initial knowledge and final product. This includes high-level engineering technologies, social technologies, etc. This component can be designated as projective-organizational. The need for this mediating link is explained as follows: new knowledge cannot be transferred directly to economics. The base for intellectual potential is laid in the conditions of educational potential; the development of intellectual potential is carried out within the framework of spiritual potential and mainly through scientific potential. However, this cannot be limited, since the scientific potential does not and cannot develop in isolation. It penetrates into the organizational-technological and only later into the economic potential, so that the latter, in turn, within the framework of the development of feedback, contributes to the development of logically preceding steps.

Transformation of modern science into a huge organizational system brought the problem of efficient and optimal management of it to one of the first places. Management can be considered rational and effective, i.e. intellectual, in case that it relies on a sufficiently complete knowledge of the controlled object, namely, science and its product: scientific knowledge.

Directly or indirectly, science is involved in the development and adoption of any management decisions. For its part, the state administers science. This consists in the following functions:

– revision of the financial support of science and education, both within budget and with extrabudgetary funding, for the sake of a clear picture of the amount of this funding;

– creation of technology for competitive selection of research topics, taking into account the fact that funding is currently targeted;

– development of a system of certification of research results and, in the future, creation of a database and exchange of scientific results;

– development of mechanisms for reimbursing research costs;

– development of a system of financial and economic measures necessary for the control and management of science in educational institutions.

The main purpose of any science is to obtain *new* knowledge, therefore, managing science means managing the process of generating new knowledge. The core of any modern science or humanitarian discipline is a system of interrelated theories. As for managers-from-science, they often think only in categories of payroll funds, production volume and number of employees. Questions about the distribution and functions of knowledge are regarded as having no direct relation to management problems. But theory is the most fruitful and effective research tool. Outside the framework of serious theory, attempts to identify and substantiate certain innovations are not scientific, but rather matter-of-taste or opportunistic in nature. For example, without a reliable social theory, it is not clear what kind of information about the processes taking place in society should be obtained. Despite the fact that theory performs in principle the same functions in natural science and in social science, when analyzing theories in sociology of science, much more attention is paid to their specific features than to clarifying the basis of their unity. The ultimate purpose of all science management mechanisms is to stimulate the work of researchers and teams, and therefore, in relation to the subject of scientific research, government is required to ensure good conditions for the research worker, to assess the quality of the results obtained and to incorporate them into the system of scientific knowledge. For that, certain measures must be taken.

1. Inclusion of the employee and the team in the legal system of society.
2. Their inclusion in the socio-economic system of society.
3. Creation of ergonomic conditions for performing scientific work.
4. Satisfaction of professional requirements.
5. Preventive measures regarding the leakage of personnel.

Taking into account world experience, sociologists of science identify three main concepts of state policy in this area. First, this is the concept of active regulation. In principle, nothing is impossible in that intellectual interstate

migration is regulated by legal, administrative, economic and other measures. This requires a combination of domestic and international legal acts providing for the return of migrants. Such a concept is vital for donor countries. Secondly, this is the concept of "non-interference" characteristic of recipient countries. Thirdly, this is the concept of orientation towards the future, towards international cooperation, while respecting the interests of both the migrants themselves and the states concerned.

This is the case today. Foreign and domestic investors are invited to either place production in a certain territory, or assemble with a share of domestic components of some high-tech products: computers, digital telephone exchanges, etc. This path does not lead to the desired changes. Modern production, for example, in the telecommunications industry, is 90-95% automated, end products are rapidly becoming cheaper, and the greatest contribution to its cost is not made by hardware itself, much less by assembly, but by software. Placing such industries for instance, in Russia is not particularly profitable, especially since foreigners have reasonable concerns about the feasibility of placing real estate in our country, taking into account the political and economic situation.

Imperfect tax laws, unresolved problems of capital outflow, lack of information about intellectual personnel hinder the implementation of such projects. With the help of well-known experts abroad, it would be possible to form teams of performers for specific orders. However, if the scientific potential in the form of its implementation is late in its development, then the technical reconstruction is delayed, scientific and technical progress focuses little on the state of affairs in the economy, and, consequently, does not affect its needs.

These ideas form the carcass of sociological approach to science.

Finally, recently philosophy of science has definitely raised the question of the extent to which the intellect is able to function effectively depending not only on the natural in man, but also on human culture. It is possible that this interpenetration primarily affects the accumulation and actualization of the intellectual potential of society and its individual representatives.

In relation to scientific knowledge culture performs two main functions: heuristic and selectively stabilizing. On the one hand, cultural heritage contributes to the generation of new scientific concepts within the framework of the given paradigm of thinking, i.e. it acts as a sociocultural program of scientific research. On the other hand, culture is the most important factor of social stability in the process of substantiating and choosing the optimal strategy for the development of science and the integration of new theoretical knowledge into the culture of the epoch, ethnos, and society. It is the level of culture that provides the level of efficiency in the implementation of science.

The level of culture is characterized in different ways: depending on traditions, language, and social memory. Culture levels are distinguished by the amount of information contained, the degree of complexity, the degree of crystallization, and their synthesis. Some specialists distinguish the following levels:

1. Vital. Here the "biopsychosocial" human needs are satisfied.

2. Creative. It is formed on the basis of the vital level. There is a noticeable increase in the efficiency of the intellect, its new potential possibilities are revealed as an element of the creative process.

3. Total. It expresses the essence of culture as the spiritual experience of mankind with maximum fullness. Here the dominant need is the need for another person, for the human environment itself. The meaning of the activities becomes the most important, and it determines the new possibilities of interaction and contact with intellect. Such a connection increases efficiency of work not only at the expense of increased meanings, but also by increasing the responsibility of a person. Man should care for the measure of self-realization in the interests of the development of human culture and the human being in general.

This is the division about which one can join discussion.

First of all, what is meant by the creative level cannot be at a lower level in relation to what is called by a philosophical (Hegelian) term "total". Actually, this "total" is such stage of spirituality which is called morality, or ethics. Here the contemplations over good and evil and corresponding relationships are dominant. The creative level is at a higher degree of "totality", and it does not at all exclude the need for another person, but only transforms this inner need, giving it a new form and content. After all, any creativity including science, in its products, is indirectly in contact, in dialogue with human culture and other creators, with "human" in man.

Science as a special sphere of culture is realized in the system of values that formed the modern civilization, which is also called technogenic, post-traditional, industrial, rational, liberal, modernist, post-religious and even global. This value system combines the natural-scientific ideals of accuracy and efficiency with the ethical humanitarian ideals of individual freedom and value of self-worth. It orients a person to self-determination of one's own destiny on the basis of a rational decision and moral choice; and these are the traditional values of philosophy.

The cultural matrix of technogenic civilization is laid in the Renaissance. Development of technique and technology becomes the most important basis for life activity not only through spontaneously flowing innovations in the sphere of production itself, but also by generating new scientific knowledge and introducing it into technical-technological processes. Now it is not culture that determines technology, but technical development increasingly determines the development of culture. The Age of Enlightenment proclaimed three main social ideas that distinguish it from previous eras:

1. It is necessary to reform public institutions on the principles of reason.

2. The main condition for successful reforming is the upbringing of new person, a free and responsible citizen.

3. A person can become free only by liberating internally, that is, by joining scientific knowledge.

Culture formed under the influence of scientific progress is very different from traditional cultures characteristic of all other civilizations. The disenchantment of the world, according to Max Weber, took place. Science not only changed the technical capabilities of man, but also produced a tremendous impact on society and its values. Change instead of saving becomes the main task of the new world. Freedom and equality were declared to be priority values of an individual, which the state and the whole society are supposed to protect.

If traditional cultures created existential orientation towards the past, the society of a technogenic civilization looks to the future. For traditional thinking, the future is a repetition of the past; for the modern, it is a continuation of the past in conditions of irreversible historical time. If the previous civilizations gave rise to technical adaptations, nowadays technique itself creates civilization determining the logic and pace of its development. Let us recall the popular model offered by S. Huntington.

Traditional society is characterized by:

– predominance of ascriptive, diffuse models of motivation;

– stability of social groups;

– limited spatial mobility;;

– simple and continuous professional differentiation.

Technogenic society is characterized by:

– predominance of “achievement” motivation models;

– social mobility, including “vertical” movement;

– highly developed profession system;

– egalitarian stratification based on achieved status.

Science and technology create modern civilization, promoting the development of communication. Infrastructural “intellectual assets” are connected today by consumer databases, social networking systems, etc. Work at a distance, planning the audit of intellectual capital including team building and documenting, developing of improvement strategies and knowledge management policies, enhancing intellectual assets through research programs is a manifestation of the development of civilization and the emergence of a new type of culture.

From our point of view, the optimism of the sociological approach in philosophy of science is brought to life (and has brought to life, here is the ring of interdependencies) by the principle “function from expectations”. Principle is not yet reality.

The generalized socio-philosophical approach has already borne fruit. The influence of socio-cultural factors on the structure and development of scientific knowledge, social and cognitive organization of scientific research, social consequences of the scientific and technological revolution, and social contexts of scientific research and discoveries have been studied. There came an institutionalization of the history of science as an academic discipline. Rethinking the very subject of sociology of knowledge led to the emergence in it of a new "constructivist" trend according to which scientific knowledge is the result of social construction of reality. The degree of difference between science, magic and religion, the criteria of scientific nature, the universality of the provisions that are considered to be true, etc. may vary greatly among different philosophers of science, but they have a common approach. The latter differs from all others, and above all from the epistemological one, in that it does not develop certain general scientific canons of "knowledge as such" and compare them with real scientific knowledge. Sociology is to study everything that is considered as "knowledge" in this society, which people of this epoch understand as knowledge, regardless of how this knowledge relates to the modern canons of rationality. But since in the process of social construction of reality the activity of a scientist is directed not at nature, but at work with statements, we cannot say it is really opposing epistemology. And that is enough about the constructivistic approach.

Resuming, we can remember the classic of postmoderninty Evandro Agazzi's plenary speech offered at the World Congress of Philosophy in Seoul, 2008. Pasted here is an excerpt from it. The celebrity stated that modern philosophy of science was, initially, an epistemology of science based on the logical analysis of the language of science. It was superseded by a "sociological epistemology," according to which the acceptance of scientific statements and theories depends on conditionings coming from the social context and powers, and this view has fueled anti-scientific attitudes. These negative consequences arise from the fact that the sociological turn still goes ahead in the framework of epistemology, where the most extreme claims are exaggerated and unsubstantiated.

On the other hand, the sociological approach has its dignity: it has made it especially clear that science is not just a *system of knowledge*, but also a complex *human activity*, which enters the network of interactions with the social context. From this point of view, all discussions about the ethical, political, social, religious nature regarding technoscience, which are often perceived with suspicion as a threat to the freedom of science, are legitimate if they concern "doing science", with all conditions and consequences. Therefore, we must "rethink" philosophy of science accepting in it also an *axiology* of science that could enable us to retain the cognitive value of science and at the same time to make techno-scientific activity

compatible with satisfaction of a great variety of values that inspire our societies. To do this, philosophy of science must be ready to use concepts and tools taken from the whole spectrum of philosophy, not only from logic, philosophy of language and ontology, and also be ready to enter into dialogue with the non-philosophical aspects of human culture[60].

Hegel would react like this:

"An reineren und trüberen Gestaltungen der Wahrheit haben wir, kann man sagen, *genug* und *zum Überfluß*, – in den Religionen und Mythologien, in gnostischen und mystizierenden Philosophien älterer und neuerer Zeit; man kann seine Freude daran haben, die *Entdeckung* der Idee in diesen Gestaltungen zu machen und die Befriedigung daraus zu gewinnen, daß die philosophische Wahrheit nicht etwas nur Einsames, sondern darin die Wirksamkeit derselben wenigstens als Gärung vorhanden gewesen. Wenn aber der Dünkel der Unreife, …an das Aufwärmen solcher Produktionen der Gärung gerät, so erhebt er sich leicht in seiner Trägheit und Unfähigkeit wissenschaftlichen Denkens solche Gnosis zur ausschließenden Weise des Erkennens; denn es ist müheloser, in solchen Gebilden sich zu ergehen und an sie assertorische Philosopheme anzuknüpfen, als die Entwicklung des Begriffs zu übernehmen und sein Denken, wie sein Gemüt, der logischen Notwendigkeit desselben zu unterwerfen"[61].

"It might be said that we have enough configurations of truth, and all too many of them, some purer and others more cloudy, in the religions and mythologies or in the gnostic and mystery-making philosophies of ancient and modern times. One may feel delight in the uncovering of the Idea in these configurations, and one may in this way satisfy oneself that the philosophical truth is not something merely solitary, but that, on the contrary, its effective action has been present – at least as a ferment – in these configurations. But when the conceit of immaturity undertakes a rehashing of these productions of the fermentation,… that conceit, in all its laziness and incapacity for scientific thinking, can easily exalt a gnosis of this kind into the exclusive mode of cognition. For it is less of a strain to let oneself go in these [symbolic] patterns, – and tie one's philosophical dicta onto them, than to take up the development of the Concept, and submit one's thinking, ones whole heart and mind, to the logical necessity of the Concept"[62].

Of the concept of Truth, if I may.

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60 Evandro Agazzi. Rethinking Philosophy of Science Today // Journal of Philosophical Research. Volume 37, Issue Supplement, 2012. Selected Papers from the XXII World Congress of Philosophy. – Pages 85-101.

61 Hegel, Georg Wilhelm Friedrich. *Encyclopedia of Philosophical Sciences.* Vorrede zur zweiten Ausgabe.

62 Hegel, Georg Wilhelm Friedrich, 1770-1831. [Wissenschaft der Logik. English] Part I of the *Encyclopaedia of philosophical sciences with the Zusätze* / G. W. F. Hegel; a new translation with introduction and notes by T. F. Geraets, W. A. Suchting, H. S. Harris. – P. 16. El. resourse: https://-rosswolfe.files.wordpress.com/2015/05/georg-wilhelm-friedrich-hegel-encyclopedia-logic.pdf

CONCLUSION

At the end of the nineteenth century, the problem of empirical and theoretical grew from the dialectic of the sensual and logical. This led to the emergence of the theory of scientific knowledge, *epistemology,* which recognized itself as a normative, methodological knowledge. In the twentieth century, philosophy focused on values and meanings; this axiological roll enriched epistemology and gained a relative completion in the teachings on prerequisite, historically loaded knowledge; also, in the emergence of such disciplines as cultural studies, social epistemology, etc. Earlier, *philosophy of consciousness* gave way of a significant part of its influence to *philosophy of language*. However, in parallel, in post-positivism which developed against the general background of the culture of postmodernism, there happened a dethronement of classical ideals. The emphasis on programs of action led to the operationalistic, instrumentalist roll, and the new nominalism in methodology triumphed in contemporary *philosophy of science*.

Today, it seems, any hymns to reason and science, in these decades of postmodernity, will no longer be officially performed. The XX century known as "information age" during which, according to some estimates, up to 90 % of scientific discoveries were made, in the face of postmodern "classics" – French at first, and then German, Russian, and American – paradoxically abandoned the ideals of the centuries of Reason. Kuhn and Feyerabend, too, were involved to discredit the ideals of "Modernity"; and even analytical philosophy to a certain extent holds disbelief in Truth and merely analyzes the coherence of subjects and predicates in propositions. The paradox is that at the end of the twentieth century advanced Great Britain and its philosophical sociologists began talking about the emergence of a new type of society: the "society of *knowledge*". And this talk is not about "knowledge" only; not only about knowledge. For example, the English social philosopher and sociologist Howard Davis, speaking of the tendency towards the synthesis of "big theories" and the expert ability to explain real social changes, stressed that one of the highest contemporary values, education, is a necessary but insufficient component of modern societies: learning has a broader meaning than study, since it provides, in addition to the obvious, also the so-called hidden, implicit knowledge, and skill of action, and the "competences" extolled today. Theory should be viewed as *clarification* (the ability to clarify real facts). Along with the third component, professional ethics (labour ethics), it is a *know-how* that is not only necessary but also a sufficient link, a leading factor in the effectiveness of modern intellectualized labour in the society of learning, the *society of knowledge*. The latter term belongs to M. Scheler.

Philosophy of science akin to analytical philosophy of language refused to be a theory in general, having lost, it seems, in the academic rigor that has been inherent since the time of the first maxims formulated by Aristotle.

Epistemology refers to the modern Western philosophy of science as semantics to pragmatics. Semantics that studies the relationship of signs and meanings is the most "theoretical" and rigoristic part of semiotics; it contains the highest abstractions, strict logic, definite levels, forms, etc. It is aimed at disclosure and cognizing the *essence* of the knowable. Pragmatics deals with the *content* of communication; it studies the relationship of sign-symbolic systems to a real empirical person. It has more games, liberties, singularities, more situationality than systems. The first and second stages of the development of a linguistic turn (the "early" and "late" Wittgenstein) also correspond to this division. There is a transition from gnoseology / epistemology to *methodology* that subsequently displaced worldview philosophical problems to the periphery and even beyond the brackets, and *philosophy of science* was the last stage of this turn.

From the Greek words λογοσ, λεγειν comes the Latin term "intellect". These are important and ambiguous words. Here are just some of their meanings: "collect", "select"; "speak"; "word"; "speech"; "think"; "argument"; "Law and order" and even, in antiquity, "world order", or perfect beautiful cosmos which resists chaos. The multioriginal "mind", "reason", and "rationality" are the closest synonyms of the term "intellect". In Russian, mind and reason (ум, разум) are related to the words "skill", "skillful"; they clearly show practical wisdom, worldly wisdom and the ability to do something, to make, to settle; this ability is English "common sense". Reason capable of making judgments is the ability to assess certain events or phenomena including political, ethical and aesthetic, etc. Intellect, reasoning and rationality are close synonyms; moreover, intellect in the narrow sense of the word is rationality; in the broadest sense, it includes ethical component and gift to design. The best use of intelligence is science.

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