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PERIODS AND FORMS OF SOCIALIZATION OF SCIENTIFIC INNOVATIONS

In this paper we consider inside-scientific and as well as outside-scientific periods of socializing scientific innovations, we analyze its following forms: knowledge, information, opinion, belief (as trust), program, etc. Socialization of natural sciences is discussed.

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The modern-day practice of the organization of research works, the historical experience of the use of results of scientific knowledge show that creative ideas are not just included into a scientific practice and find practical application. The novel word in science should be not only written/declaimed, but also heard, understood and, at last, met with a social recognition. Many cases are known, when discoveries were ignored or even were denied as absurd ones. It happened also that the trues, recognized suddenly, lost an interest to themselves in due course. A process of social recognition of scientific innovations refers to *socialization.*

Up until now the majority of researches on problems of scientific creativity is concentrated on a one aspect of this process, namely on the production of scientific knowledge. But in conditions of the information society (i.e. in conditions of the following aspects: (1) the acceleration of paces of technological progress, (2) the popularization of the scientist attitude, (3) the raise of the role of managers and organizers of scientific investigations, (4) the intensive development of interdisciplinary communications, (5) the raise of the role of prognostics, (6) the complication of connections between science and production, between science and education, (7) the transformation of computer into the major instrument of work), another aspect (namely a consumption of scientific product) is very important too.

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The problem connected to knowledge of forms and mechanisms of socializing scientific achievements and to removal of barriers, arising on this way, is obviously both theoretical, and practical. In this paper some aspects of the given problem are considered.

We can differentiate three ways, three periods of socializing truth: the truth "in itself", the truth "for us", and the truth "for everybody". The statement that is *true "in itself"* fixes a state of affairs regardless of agent's thinking, his perception, experience (regardless of any individual act of consciousness).

The *truth "for us"* ("for me", "for people") has a subjective aspect of its becoming and existence. The truth "in itself" cannot become true "for us" if the truth "in itself" is not reliable source from the standpoint of an (individual or group's) agent, i.e. if it is not authentic for him. Thus, the truth "for us" is a truth "in itself" which becomes evident within the framework of agent's conceptual system.

The *truth "for everybody"* is a final point of socialization. It is an obvious truth concerning the given subject domain. It is postulated within the framework of this area and it is necessarily accepted within the framework of a social community.

A necessary condition of transformation of the truth "in itself" into the truth "for us" and, further, into the truth "for everybody" refers the truth "in itself" to a 'conceptual skeleton' (K. Popper), that is to the available set of cognitive categories (preconditions of philosophical, scientific-and-theoretical, methodological and other features). The process of this transformation is connected to a special logical-and-communicative procedure, namely to an argumentation which problem is that the holder of 'conceptual skeleton' has apprehended, understood and, at last, recognized the truth "in itself", made it his own.

In logic it is lawful to distinguish two basic kinds of argumentation such as the objective argumentation and the subjective argumentation. In the first case, the ultimate goal consists in accepting (by the addressee) the existence of some relations in the nature, society or thinking. In the second case, the argumentation contacts the substantiation of acts of human activity. Here the question, inherent in the objective argumentation "What is the reason?", is replaced be the question "What is the aim?". The subjective argumentation has the activity nature. It is realized thanks to categories such as 'purpose', 'means', 'result', 'choice', 'motive', 'program', 'value', 'procedure', etc. Socializing scientific innovations is connected first of all to the second kind of argumentation.

Aristotle was the first who paid attention to the specificity of consider-

ing events and processes of the activity nature. Setting forth the doctrine about four reasons, he wrote: "Again in the sense of end or 'that for the sake of which' a thing is done, e.g. health is the cause of walking about. ('Why is he walking about?' we say. 'To be healthy', and, having said that, we think we have assigned the cause.) The same is true also of all the intermediate steps which are brought about through the action of something else as means towards the end, e.g. reduction of flesh, purging, drugs, or surgical instruments are means towards health. All these things are 'for the sake of' the end, though they differ from one another in that some are activities, others instruments" [1]. In classical philosophy, the activity hand of reality has been most deeply developed in German transcendental philosophy (Kant, Fichte, Schelling, Hegel). In Marxism this hand has received a materialistic consideration.

The **activity principle** is a constituent of the initial methodological base for some social sciences. It was used in Marx's theory of cost, in the F. Engels labor theory of anthropogenesis, it is also applied in modern psychology, pedagogics, ergonomics, etc. All the human history can be interpreted as activity of the person pursuing the corresponding purpose.

After the comprehension and expansion of nonclassical and post-nonclassical types of rationality[1], the activity principle is introduced into the methodology of natural sciences. In particular, requiring the precise fixing of features of supervising instruments, which interact with object, is put forward in quantum-relativistic physics as a necessary condition of the objectivity in description. Since the science as a whole, as the form of public consciousness, is a special sort of activity (receiving the novel socially significant knowledge is its major problem), the nature of science, its intrinsic characteristics cannot be revealed and disclosed outside of the explanatory schemas based on the activity principle.

In connection with a valuable feature of the question "What's the aim?" ("What's it for the sake of?"), it becomes explicit why the same fact receives the different interpretation (in dependence, for example, upon a historical context of activity). "Why does people study physics at school?" is a question requiring an application of the activity principle. It was more recently affirmed that the knowledge of physics is necessary first of all for the successful technocratic activity. But today there is another answer: the knowledge of physics encourages a self-realization and development of the personality of the pupil.

[1] *Editor*: Concerning the three types of rationality (classical, nonclassical, and post-non-classical), see the paper submitted by Y. Yaskevich for this issue.

In due course, Hegel has constructed the concept of activity within the framework where the central place was taken by the clearing up and rationalizing work of the absolute spirit. S. Kierkegaard paid attention to significance of the personal factor and, later, his ideas have found a continuation in Existentialism. A. Schopenhauer and F. Nietzsche have considered the will as the special basis of activity. At the end of the 19th century, the representatives of the Baden school of new-Kantianism have emphasized valuable components of culture, E. Cassirer has connected the essence of activity to the specificity of sign, symbolic structures. In Marxism, the activity is construed within the unity of its sensual-and-practical and theoretical forms, synthesized in the concept of practice.

The plurality of approaches to treatment of activity and its basis rendered essential influence on solving the problem, what results are worthy of acceptance by scientific community. Discussions on many problems between representatives of different scientific schools and directions were experienced with serious difficulties, and the truth "for us" in the one conceptual system was not necessarily accepted in other conceptual systems. L. M. Tomilchik and F. I. Fedorov pay an attention to a role of language factors in these conflicts: "Testing a novel idea in accordance with 'experienceability' actually consists in that, irrespective of the degree of its singularity and paradoxicallity ('a mad idea'!), its formal embodiment has appeared realized (at least, at the beginning) in terms of the traditional theoretical device for the given area of science. (...) At the same time, non-compliance of the aforementioned demand can result that the scientific community rejects or ignores during more or less long time not only fruitless, speculative, but also the substantial conception formulated, however, by the language, distinct from the standard one" [9].

The disorder of estimations of the same scientific results can be very wide, especially, if these estimations concern interests of people. For instance, the influence of ideological factors in social knowledge is well known. However, apparently, it should not be in the so-called exact sciences, but it happens even in mathematics. In due course, Th. Hobbes has noticed: "If the true statement *three corners of triangle are equal to two corners of square*, would contradict someone's right to authority or interests of those who already has authority, then the doctrine of geometry would be if not disputed, then superseded by burning all books on geometry, as it would be in authority of people whose interests are affected by this true statement" [4].

The history knows many instances of dependence of acceptance of trues upon circumstances, external in relation to exact sciences. For example, the following fact bewilders science historians: Galilei has ignored Kepler's

laws all time, has argued as if there are no new data on planetary orbits, though Galilei was in correspondence with Kepler and should know about his discovery. But this Kepler discovery that planets move around of the Sun on ellipses has conflicted to centuries-old tradition, has went against the submission which have implanted still in an antique science that the natural movement (respectively, the movement of planets) is the movement on circle. Valuing Galilei's standpoint, an American historian of science and art, E. Panofsky wrote: "There is an impression that he has bodily removed them [Kepler's laws – U. B.] from his thinking – something like automatic self-defense – as something incompatible with bases on that both his thinking and his imagination are based" [8].

The valuable actual material, regarding peripetias of perception, estimation, and recognition/acceptance of the discoveries, new ideas, theoretical and experimental achievements, is presented in the collective monograph 'Discovery and its perception', edited by S. R. Mikulinski and M. G. Jaroshevski (Moscow, 1971). Representatives of the most different spheres of scientific activity – mathematicians and physicians, biologists and chemists, psychologists and physiologists, engineers and medics – show a dependence of acceptance of scientific achievements upon the cognitive structures dominating in scientific communities. Thus influence of casual, psychological factors is not denied also. "If the scientific facts and theories in relation to the objective (independent both from the person, and from the society) content, fixed in them, are represented as reflection of the certain reality, then their perception is characterized by another parameter, namely, by how this content refracts through original features of life of scientific community in the given historical period, in the given social frame" [3] – it is a leitmotif of the mentioned book.

I. Kant was, apparently, the first who has designated the problem of recognition of the truth-validity of judgements and has proposed the corresponding classification. From his point of view, there exist three kinds of recognition of the truth-validity: opinion, belief, and knowledge. The *opinion*, according to Kant, is a recognition of the truth-validity on the cognitive basis which is not sufficient both subjectively and objectively. The *belief* is a recognition of the truth-validity on the basis which is also inadequate objectively, but is sufficient subjectively. The *knowledge* is a recognition of the truth-validity on the basis, sufficient both objectively, and subjectively.

Judgements of the famous German philosopher have not lost interest until today. However, they require the clarification and the further discussion. In particular, his classification is not complete. It does not mention cases which contact the term the *information* in the modern scientific lan-

guage, when the recognition of the truth-validity is performed on the basis, sufficient objectively, but not sufficient subjectively. Negative signs of sufficiency require a more detailed analysis, as they are expressed by means of the so-called negative infinite statements which are not giving descriptive characteristics of fixed subjects. At the same time, Kant's classification does not consider the allocated forms from the viewpoint of *public practice*. The subjectivity as the sign, basing the given classification, is considered in the individual-personal plan, and therefore the cornerstone question "What is it for the sake of?", defining the vector of socializing the developing knowledge, is absent in Kant's works. Consider some aspects of mentioned questions.

In logic, the statement (the set of statements) A is considered sufficient for accepting B, and B is considered reasonable if and only if the truth-validity of A guarantees the truth-validity of B, or, otherwise, the truth-validity of B follows from the truth-validity of A. For the spheres of knowledge, connected to experience, this definition is too rigoristic, as in these spheres many statements A have a statistical or probabilistic character and the relation of logical inference is understood more widely, including both logical (deductive) and probabilistic (reductive) inferences.

In experimental sciences the truth "in itself" is considered reasonable objectively if it is included in the system of the before-obtained statements and it is inferred from them with the high degree of probability. Such a truth by degrees becomes the *knowledge*. To begin the knowledge in a literal sense, it should pass the test on "durability" during checking. The history of science knows many cases, when the truth "for me" or "for people" did not bear this test. But since it has been subjectively justified, it has acted in a role of quasi-knowledge.

For example, the unforeseen conduct of water which has not followed the piston from the deep well, was regarded be Galilei from the viewpoint of Aristotle's physics, according to the statement that "the nature is afraid of emptiness". It was not essential that he has a little changed it, having assumed that "the nature is afraid of emptiness" not boundlessly, but only on 18 Florentine foots. Using the own authority, he has attempted to affirm the conclusion as socially significant knowledge, but it has appeared only true "for him". D. I. Mendeleev has proposed to consider a radio-activity as spreading "radio atoms". And I. P. Pavlov has addressed even to categories, with which struggled all conscious life, in order to substantiate "involuntary movements" of animals.

The truth "for me", having subjectively good reasons, is called *belief*. The subjective inadequacy may be classified into two kinds: i) partly groundless, ii) completely groundless. Actually the socially significant knowledge is

a certain ideal which is satisfied, perhaps, only by representatives of logic and mathematics. In the majority of cases the subjective recognition/acceptance stays at an "intermediate station" between complete well-foundedness and complete groundlessness. In such cases one speaks about an *assumption* of the truth-validity of some statements. An assumption is the major instrument of theoretical thinking. Without assumptions it is difficult to imagine proofs of theorems in mathematics, creations of idealized construction of the scientific theory.

If the statement is justified enough objectively, but not justified in any way subjectively, then it is an *information*. Operating the information, but not knowledge is a usual practice in the diversified spheres of human activity. F. Engels wrote: "The majority of people differentiate and integrate not because they understand what they do, but because they believe in it, as the result was always obtained correct till now" [7]. As we see, the acceptance of the information is founded on trust without logical reasons.

Being transformed into knowledge, the information is subjectivized, that is it is accepting by the individual consciousness and later by the public agent. In this process the main role belongs to his system of values, ideas, concepts. The knowledge is a product reflecting a real state of affairs in human interpretation.

The information, differently from the knowledge, is not connected to the agent, it is equally accessible to everybody, though possibilities to transform it into knowledge are different. Any text contains the information, to transform it into the knowledge means to understand this text. Considering the question on a ratio of the knowledge and the information in psychological plan, V. P. Zinchenko writes: "The knowledge is always someone's, belonging to someone, it is impossible to buy it, to steal it (unless together with a head), and the information is a neutral territory, it is impersonal, it is possible to exchange or steal it" [10].

Quite often one bases the trust in the information on authorities. A source of the existence of authorities is a limitation of possibilities of the researcher rationally to consider and to value all variety of subject display; in this connection he appears before necessity to trust authorities, i.e. those who has already obtained the reasonable and recognized results in their investigations. The science cannot develop without trusting such results. The chemist does not repeat Avogadro or Faraday's experiences; the ship builder trusts the Archimedes law and the Pythagoras theorem.

Kant has called the knowledge, belonging to authorities, the historical belief. He has affirmed that it is impossible to distinguish this belief from knowledge. "The so-called historical belief (...) it is not necessary to distin-

guish from the knowledge, because it (as the kind of theoretical or logical recognition of the truth-validity) itself can be knowledge. We can accept an empirical truth due to others with the same certainty as though we have achieved it by the facts of own experiences" [6].

However, speaking about a significance of authorities in science, it is necessary to mean that the homage for them should not be blind, superstitious. "Do not create to itself a substitute", as the Biblical maxima prevents. It is necessary to take into account that the authority holds only in a rather narrow, specialized sphere, and the carry of its influence to other spheres, its use in other conditions and under other circumstances sharply reduces the probability of truth-validity of result. The truth loses the property of concreteness. Therefore quite often the reference to authority is not considered as sufficient argument and it is used only as the auxiliary possibility for belief. The objectivity of consideration requires evidences in essence. The blind belief in authority as considering something true without using facts and logic is opposite to science.

The blind belief, or *belief* in the religious interpretation, has only subjective basis. It refers to objects which it is impossible to know or calculate their probabilities. The subject of belief assumes a recognition that is not defined objectively, independently upon truth-validity. It is the act of the 'direct consideration of true', not requiring a discursive (especially logical) substantiation. In A. A. Bogdanov's opinion, the belief "is the relation of a person to a recognized authority, the trust to him or the consent with him and as well as an attitude founded on *subordination*, on elimination of own idea and criticism, on the refusal from research, on suppression of all possible doubts, on the act of will directed to cognitive passivity" [2].

Objects of empirical, theoretical or practical (moral, legal) knowledge cannot be subjects of belief. It has no persuasiveness which could be transmitted to other and would require a consensus as the persuasiveness given by knowledge. Only for the believer the belief has the importance, and only for him, not being knowledge, it takes up a place of knowledge and even it happens firmer than any knowledge. It stabilizes the human behavior, abolishes an ambiguity of choosing life-strategy. Argumentum ad belief is convincing and weighty, as a rule, only for them who shares this belief or is seduced to its adoption.

The science development is incompatible with belief. Where the science begins, the belief expires.

The science generally begins with *opinion*. Kant has defined an opinion as statement which truth-validity is realized on the insufficient basis from the standpoint of the not only objective, but also subjective hand. This

definition seems to be correct. Before something is accepted and it is affirmed, it is necessary to have an opinion. Thus Kant precisely notices that the opinion is a prerogative of empirical sphere of knowledge. "Where does the simple opinion take place actually?". Kant answers: "Not in sciences containing the a priori knowledge, hence neither in mathematics, nor in metaphysics, in moral, but the opinion takes place in empirical knowledge, i.e. in physics, in psychology and so forth. In fact it is ridiculous to have an *a priori opinion*. Really, it would be very strange, for example, in mathematics to have just opinion. Here, as well as in metaphysics, and in moral, it is possible only either to know, or not to know" [6].

The opinion arises on the basis of probabilistic inferences about a state of affairs, but in conditions of shortage of a unequivocal and consecutive sight at these inferences. By virtue of the unreliability, the opinion is denied as a reason in scientific argumentation.

The opinion differs from the *hypothesis* as statement sufficiently justified from the subjective standpoint, but having probabilistic character from the objective standpoint. The hypothesis, as opposed to opinion, has even an objective basis and consequently comes nearer to certainty.

The socialization is a traditionally underestimated process in the theory of science (Wissenschaftslehre). Long time it was entirely based on a postulation of patterns of science development which sometimes are called Markov's: it was supposed that the state of science at present time is determined by probabilities of its possible transitions in new states, and the incompleteness of knowledge is a significant factor of its further development. Similar patterns have played an appreciable role in a science-theoretic consideration of science development.

However, today the limitation of Markov's patterns is obvious. In particular, the purposes of scientific research are not described completely within the framework of the science: they include external 'social order' for the knowledge, expressing comprehension of practical requirement for science solutions. The science itself does not provide social progress. It can prompt the scientist what he can investigate, but it is not capable to indicate him what he should investigate, what is actual at present time. Therefore, to organize the activity as significant socially, the researcher should be beyond the scientific tasks and comprehend a social background within of framework of which this activity is performed. It requires the high common culture.

Taking into account the factor of socialization, it is possible to establish that the scientific research, its purposes and setting problems are thoroughly determined already on the pioneering stage. Not any problem setting that is

possible within the framework of scientific community is scientific actually. The scientific character of problem setting means:

- the absence of a comprehensive (complete and true) solution in present-day knowledge files;
- its coherentness, i.e. the logical compatibility with earlier extracted knowledge;
- the connection with public needs for the solution of the given problem.

The selection of results of knowledge according to public needs means the affirmation of truth "for everybody" and, in the end, means the completion of socializing innovations. The innovations constitute a basis of priority directions of science development. During the further movement, they obtain forms of diverse general *programmes*, determine the character of scheduling, designing, adoption of administrative decisions in science.

However, the connections of researches with public needs should not be expounded too rectilinearly and unequivocally. In fundamental sciences these connections quite often have an indirect character. Developing according to the internal logic, fundamental sciences advance demands of practice and consequently they are not always valuated adequately in society. The history knows many cases when many valuable scientific achievements were denied by worldwide recognized scientists. The main reason of such a rejection is that these achievements do not correspond to dominant standards and ideals of scientific knowledge. So, it concerns, for example, Lobachevsky's geometry. Academician M. S. Ostrogradsky published the negative review for N. I. Lobachevsky's work in that he scoffed at his ideas.

In the beginning, A. L. Chizhevsky's researches were considered as unscientific results, but later he became the founder of heliobiology, the science about effect of cosmic processes, first of all, of solar activity on the mass phenomena and processes which proceed in the terrestrial biosphere, human body, and society. Chizhevsky's ideas are similar to astrology (the most popular and honored parascience in present day), but at that time these associations appeared one of the main reasons of denying these ideas by scientific elite.

The plurality of similar examples allows us to consider mechanisms of rise and existence of fruitful, but 'heretical' ideas in science as subject of the special methodological analysis. Their set is called deviant science. Its representatives, as a rule, are people with good education and sharp intuition, but for whatever reasons selecting subjects for research which are outside of dominant approaches and standard methods.

Certainly, not all new ideas, which are not recognized in scientific community, appear valuable and fruitful. Among them there is a lot of ridiculous.

But their selection occurs not at once. First, as a rule, they exist by the way as potentially actual statements and consequently require time for the check and introduction. Therefore the main methodological (and ethical) demand in relation to deviant innovations consists in an indulgence of scientific and social communities. "If someone goes not in march, then this means that he hears sounds of another march", in these words of the American writer and philosopher Henry D. Toro we see an admonition from actions, because of which there is a danger to splash out the child together with water.

Thus, it is necessary to survey two basic stages of socializing scientific innovations: firstly, the stage of their latent, 'intra-uterine' development, when their recognition/acceptance and popularity is not beyond corresponding scientific communities; secondly, the stage of the social recognition opening possibilities of their practical applications. The process of socialization has diverse forms. The key ones among them are knowledge, information, opinion, belief (as trust), program. The concepts of objective and subjective propriety are efficient instruments of their ordering.

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