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THE DEVELOPMENT OF NON-LINEAR KNOWLEDGE: NEW RISKS, VULNERABILITIES, AND HOPES*

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Abstract. The article considers the non-linear knowledge as the result of the 'arrow of time' effect (I. Prigogine) that determined the new realities in which everything develops increasingly quicker and in a more complex way. The author extends the impact of this effect to the dynamics of knowledge and shows that the modern knowledge acquires the quality of reflexivity and takes on a completely new vector of non-linear development within the so-called 'turns' in the history of science. The transition from linear to non-linear knowledge determines more complex manufactured risks including the threat of dehumanization described in the article. The monitoring of these risks implies that the value-oriented non-linear knowledge should be taken into account not only by natural, technical and social sciences but also by the humanities. Among new challenges to the humanity there are vulnerabilities manifested in the increasing structural dysfunctions of complex social and/or techno-natural systems in the form of 'normal accidents', 'collateral damage', etc. The author believes that key challenges of such vulnerabilities are determined by the dominant pragmatic values of modern knowledge. There is also a new type of development in the form of metamorphosis leading to non-linear transformations, which aggravates the complex character of modern risks and vulnerabilities. The author finds answers to these challenges in the humanistic turn that can ensure the valid knowledge of complex risks and vulnerabilities together with the grounds for better future that people want.

Key words: non-linear knowledge; 'arrow of time'; reflexivity; 'manufactured uncertainties'; risks; vulnerabilities; 'new catastrophes'; 'normal accidents'; 'theory of metamorphosis'; humanistic turn

Today we live in the knowledge society. D. Bell argues that it is characterized by two basic phenomena: 1) "the sources of innovation are increasingly derivative from reach and development (and more directly, there is a new relation between science and technology because of the centrality of theoretical knowledge"; 2) "the weight of the society — measured by a larger proportion of Gross National Product and a larger share of employment — is increasingly in the knowledge field" [12. P. 212]. This situation is the result of great changes in the nature of knowledge determined by the development

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of human civilization. The Nobel prize-winner I. Prigogine's theory of 'arrow of time' states that everything (material, biological and social worlds) develops increasingly quicker and in a more complex way: the emerging dynamic and self-organizing systems interact in the ways that strongly influence the probabilities of further events [37].

The effect of 'arrow of time' should be extended to the dynamics of knowledge that becomes a greater factor of change as a "generalized capacity to act and as a model for reality" [1]. In ancient times, knowledge was supported by oral communications in the form of traditions and rituals, that is why social changes were slow and mainly linear. Today knowledge circulates globally [24], its dynamics becomes more complex due to the points of bifurcation, gaps, and traumas, and the new type of knowledge (non-linear) develops with the help of skilled reflexive actors, whose main goal is wealth achieved by the changes in society and nature while choosing options from a set of alternatives. In the long run, risks can turn into chances with hopes and dangers, and produce vulnerable realities in the form of 'new catastrophes' and 'normal accidents' as side-effects of technical innovations, i.e. catastrophic futures will be widely accepted. However, other social goals and practices are also possible: value-oriented humanistic knowledge can become a major factor of the transition to the new trends of global development with hopes for better and secure futures.

THE ESSENCE OF THE NON-LINEAR KNOWLEDGE

Perhaps, the first evidence of the birth of the non-linear knowledge is the call of scientists to critical non-linear reflection. The famous American sociologist R. Merton acknowledged that science develops by standing "on the shoulders of giants" and by becoming 'non-linear': this is "the course taken by history in general, by the history of ideas in particular, and, in a way, taken in scientific inquiry as well" [32. P. xix]. He called to re-reading, reinterpretation of masters of science, and to accumulation of innovative non-linear knowledge. "I have long argued that the writings of classical authors in every field of learning can be read with profit time and time again, additional ideas and intimations coming fleshly into view with each re-reading. What is to be found in writings of the past is anything but fixed, once and for all. It changes as our own intellectual sensitivities change; the more we learn on our own account the more we can learn by re-reading from our freshly gained perspective" [32. P. 45]. Merton developed the idea of non-linear scientific knowledge with such concepts as unanticipated consequences and ambivalences [33; 34], codependence of functions, non-functions and dysfunctions, manifest and latent functions [31] that allow us to deal effectively with many challenges of the 'arrow of time' effect.

A valuable contribution to the theory of non-linear scientific knowledge was made by T. Kuhn who questioned the traditional model of the linear development of science and introduces the ideas of gaps of knowledge and scientific revolutions [30]. In every given historical period the content and functions of science are defined by the paradigm as a set of categorical principles recognized by a group of scientists. However, over time, the scientists begin to face growing anomalies that cannot be explained by existing theoretical and methodological approaches, which leads to the crisis manifesting in gaps

of knowledge and a scientific revolution; thus, a new paradigm is formed. The transition to the non-linear development of scientific knowledge by paradigmatic changes aggravated criticism of the existing knowledge.

One more step to the non-linear knowledge was made by the development of reflexive social sciences with more valid understanding of complex realities taking into account both objective structures and human agency and adding to the research improvisations and game strategies that are typical for non-linear knowledge. According to P. Bourdieu, scientists use certain strategies in the academic struggles for truth to win in the games that influence knowledge and ensure social conditions for better scientific results [14]. To succeed one must non-linearly develop innovative empirical, theoretical and methodological tools. No wonder that reflexive sociology achieved a better integration of empirical research and theory [15]. Bourdieu argues that agency produces both intentional and unintended consequences in an unsynchronized way. If traditional knowledge mainly results in intentional consequences and synchronized structures and functions, the modern knowledge due to its reflexive nature produces uncertainties and side effects of non-linear character.

Another representative of the reflexive social science is A. Giddens who describes the non-linear changes in knowledge as 'institutionalized reflexivity' and 'manufactured uncertainties'. Social actions become knowledge-dependent both on previous social practices and scientific and expert recommendations. As a result, on the one hand, people are free from structures, but, on the other hand, they face more complex uncertainties. "What I call 'manufactured uncertainties' is bound up more with the advance of knowledge than with its limitations" [25. P. 105]. The 'manufactured uncertainties' make scientists rely on the principles of non-linear knowledge.

The British sociologist J. Urry was among the first to connect the foundations of non-linear knowledge with 'complexity and resource turns'. Great changes in the material world, especially climate changes, and heavy environmental pressures due to innovative technologies prove that society and the material world are intertwined and constitute a unique social-environmental reality with absolutely new risks and vulnerabilities which are the product of global carbon networks that affect social and material world. These problems cannot be solved by any single science, that is why Urry calls to a 'complexity turn' based on a new synthesis of scientific knowledge: "I embed society, and hence sociology, as a subject within the analyses of climate change, and more generally within a world of objects, technologies, machines and environments. A strong claim is made here that the social and the physical/material worlds are utterly intertwined and the dichotomy between the two is an ideological construct to be overcome" [41. P. 8]. He also mentions a 'resource turn': "societies should be examined through the patterns, scale and character of their resource-dependence and resource-consequences" [41. P. 16]. These turns imply that to develop a valid non-linear knowledge in the complex social-natural reality we must take into account even the potential of 'insignificant factors' with the help of a new synthesis of sciences.

Finally, U. Beck developed the 'theory of metamorphosis of the world': modern turbulences cannot be conceptualized in terms of traditional changes (some phenomena

change while others remain the same); metamorphosis means non-linear transformations in which "old certainties of modern society are falling away and something quite new is emerging". The very theory of metamorphosis is non-leaner in character even if compared with Beck's earlier theorizing for it "goes beyond theory of world risk society: it is not about the negative side effects of goods but about the positive side effects of bads" [9. P. 3, 4]. The 'metamorphization' has already began, but it should not be overestimated: there are different types of metamorphoses — negative side effects of goods and positive side effects of bads, and their interdependence is a subject for further investigations. Anyway, non-linear realities are already here, and we need non-linear knowledge to act adequately.

Thus, one can see a dramatic shift in scientists' thinking that focuses on innovative knowledge and corresponding innovations: they are not to clarify or improve the existing tools, but to constantly 'rediscover' them under the transforming social and environmental realities. The need to interpret everyday life as a set of anomalies is determined by the global 'arrow of time' effects in societies and nature. The re-discovery of social reality becomes an indicator of valid knowledge [29. P. 27—36].

COMPLEX RISKS: A REQUEST FOR VALUE-ORIENTED NON-LINEAR KNOWLEDGE

In reflexive modernity, the development of knowledge is accompanied by the production of risks. U. Beck defines the risk as a systematic way of dealing with hazards and insecurities of modernization [11. P. 21] as a use of technical innovations based on permanent renewing of knowledge. Thus, "knowledge implies the risk of change. It confronts people without concern for their wants or what they believe are their needs. It throws the established intellectual and social world into turmoil" [19. P. 126]. The transition from linear to non-linear knowledge produces more complex risks that are staged in character: "'Staging' here is not intended in the colloquial sense of the deliberate falsification of reality by exaggerating 'unreal' risks" that leads to non-linearity between anticipation and reality. "It does not matter whether we live in a world that is 'objectively' more secure than any that has gone before — the staged anticipation of disasters and catastrophes obliges us to take preventive action" [10. P. 10, 11]. Mass-media mainly expressing everyday knowledge dramatizes events and adds performances facilitating the staging of risks. According to J.C. Alexander, the author of the theory of performance, "Internet technologies are a means of symbolic production, devices that allow for rapid circulation of performance and drama" [2. P. 7], i.e. the risk script and its performative staging add to the complexity of risks.

Scientific non-knowledge is an important component of the non-linear knowledge. Speaking about the catastrophe in Chernobyl U. Beck argues: "The nuclear explosion was accompanied by an explosion of non-knowledge... What used to count as knowing is becoming non-knowing, and non-knowing is acquiring the status of knowledge" [10. P. 116]. Similar 'explosions' occur more or less regularly in all sciences — yesterday's 'universal' knowledge in the form of a 'true' paradigm today is too 'old' and produces scientific non-knowledge which is not ignorance but a kind of knowledge

presupposing hypothetical risks. In everyday life, we have a paradoxical combination of various kinds of knowledge and non-knowledge increasing the number of 'old' and new risks.

New knowledge phenomena determined the new complex risks that differ from the 'old' ones. U. Beck believes that the new types of risks that promote global anticipation of global disasters and catastrophes have three features: 1) "delocalization: their causes and consequences are not limited to one geographical location or space"; 2) "incalculability: their consequences are in principle incalculable; at bottom they involve 'hypothetical' risks based on scientifically generated non-knowing and normative dissent"; 3) "non-compensability: ...the logic of compensation is breaking down and is being replaced by the principle of precaution through prevention" [10. P. 52].

Beck's approach fails to take into account the complexities of dehumanized effects of risks. Almost all risks are ambivalent and manifest both positive and negative forces. A. Giddens argues that active risk-taking is a core force of the innovative society, renewal of social life and democracy [23]. Wealth and achievements are eventually due to the people's choice of knowledge alternatives and values. Thus, professional risks are usually portrayed as heroic and socially important. But some risk-choices are made within the values of well-being that increase growth and consumption by all means. As growth is a "function of inequality" [3. P. 73] there are complex risks of new segregation. The risks of modern societies confront the industrial social-cultural values and the logic of formal rationality, according to which the pursuit of welfare is rational. However, further growth of production and consumption of goods will inevitably lead to even more complex manufactured risks that can undermine human relations. The monitoring of these risks implies that linear knowledge with a pragmatic goal of wealth and comfort should be replaced by the value-oriented non-linear knowledge based on the achievements of natural, technical and social sciences and also humanities. This synthesis will lead to more valid knowledge of complex risks of dehumanization and to better risk-management.

There are already changes in the perception of our abilities to confront inhumane aspects of modern knowledge. Z. Bauman emphasizes that some human actions lack proper humane characteristics: he metaphorically compares human actions and reflexivity with the birds' ones arguing that 'Twitter' is what birds produce when they tweet. Tweeting plays two roles in the life of birds: it allows them to keep in touch and to prevent other birds from transgressing on their territory. Human Twitter has the same functions: "Once face-to-face contact is replaced by a screen-to-screen variety, it is the surfaces that come in touch. Courtesy of Twitter, 'surfing', the preferred means of locomotion in our hurried life of instantly born and instantly vanishing opportunities, has finally caught up with interhuman communication. What has suffered as a result is the intimacy, the depth and the durability of human intercourse and human bonds" [5. P. 18, 19]. The lack of humane phenomena is also expressed in manufactured risks of 'moral insensitivity', 'heartless kind of behaviour', 'simulating friendship'. Z. Bauman and L. Donskis say that "the function of pain to be an alert, a warning, and a prophylactic tends to be all but forgotten, however, when the notion of 'insensitivity' is transferred

from organic and bodily phenomena to the universe of interhuman relation, and so attached to the qualifier 'moral'. The non-perception of early signals that something threatens to be or is already wrong with human togetherness and the viability of human community, and that if nothing is done things will get still worse, means the danger is lost from sight or played down for long enough to disable human interactions as potential factors of communal self-defense" [8. P. 13, 14]. These complex risks of dehumanization have appeared not by chance — they are the product of human actions and of the inadequate role of humanities in the mainstream knowledge.

There are two risks of dehumanization due to the 'arrow of time' effects. First, the speed of acquiring formal and practical knowledge to create wealth is much greater than the development of humanistic orientation Without the proper human ethics the knowledge as a model for better reality is often opposed to major principles of civil society and even destroys them (the Occupy protests, the social uprising in the Arab Spring, Black Lives Matter, etc. were determined by 'staging performances' of 'happy life' and 'real justice'). As one can see the 'choreographed' agency is based on the rapid acquisition of the dispersed knowledge of unsynchronized individual 'liberation' without ethics. Second, individual actors still do not know how to manage the non-linear development of social-natural systems that function on different principles. "The complex systems world is a world of avalanches, of founder effects, self-restoring patterns, apparently stable regimes that suddenly collapse, punctuated equilibria, 'butterfly effects' and thresholds as systems tip from one state to another". Order and chaos are in a certain state of balance: "the components are neither fully locked into place but yet do not dissolve into anarchy. They are 'on the edge of chaos'" [42. P. 237, 238]. This is a fundamentally new interpretation of social order, in which norm and anomie are combined and humanistic approaches are needed to deal with complex risks. Under the complex risks the restoration of social order almost always leads to unsynchronized emergences and unanticipated consequences pushing society and material world from the equilibrium. The humanity have come to the threshold of the capacity to reflect transient events, to act adequately and rationally, and to make decisions based on humanistic goals.

VULNERABILITIES OF COMPLEX SYSTEMS AS CHALLENGES TO HUMANITY

Until recently, scientists tended to find causes of disasters among external forces such as natural processes or human activities. Now disasters and catastrophes can be caused by internal factors such as 'normal' interactions of people with complex social, technical and environmental systems. In such complex systems, internal factors can get out of control and produce vulnerabilities as increasing structural dysfunctions of complex social systems (social-cultural order of the city) and/or techno-natural systems (nuclear power plant, water and food production), which under the influence of the external agency including high-scale knowledge and technology can make internal forces express their own 'will' as a sort of reflexivity destructive for society. This phenomenon manifests itself in a potential threat of a catastrophe and social fears about emerging uncertainties [27. P. 3—12]. It should be stressed that these complex systems

are the result of the non-linear scientific knowledge that produces social-technical-environmental hybrids changing modern societies. "Scientific knowledge has been accumulating for a very long period, and had a consistent if frequently unperceived effect in shaping the fundamental character of human societies" [20. P. 72]. Societies with such complex systems become turbulent and vulnerable to catastrophic uncertainties in time and space that depend on lots of factors including the system's ability/inability to withstand external and internal burdens of emergent nature. There are new catastrophes due to the non-linear knowledge accumulation, production of non-knowledge and knowledge explosions which manifest themselves in permanent staging of disasters and 'liquid fears'. The very discourse of vulnerability is a great challenge to the human-kind's security.

The American sociologist Ch. Perrow metaphorically named modern vulnerabilities 'normal accidents' — disasters caused not by false management but by everyday functioning of complex technical systems that fail 'normally'. Given the complex system characteristics, "multiple and unexpected failures are inevitable" even with the best management [35. P. 5]. In the book "The Next Catastrophe: Reducing Our Vulnerabilities to Natural, Industrial, and Terrorist Disasters", Perrow demonstrates that vulnerabilities become increasingly complex: "concentrations of hazardous materials, populations, and economic power in our critical infrastructure make us more vulnerable to natural disasters, industrial/technological disasters, and terrorist attacts" [36. P. vii]. At the same time Perrow stresses that a potential catastrophe is not caused by human errors but by the nature of complex systems — to minimize risks people shoud avoid creating such systems. "Normal Accident Theory (NAT) argued that if we had systems with catastrophic potential that might fail because of their complexity and tight coupling, even if everyone played as safe as humanly possible, these systems should have been abandoned. Catastrophes would be rare, but if inevitable, we should not run the risk" [36. P. xxii.]. Perrow calls for stopping the population growth in ecologically and technologically dangerous areas where the industrial extraction of natural resources is carried out simultaneously with the development of agriculture, fisheries, social and cultural infrastructure. To prevent terrorist threats he advocates closing "all holes in our open society" [36. P. 127]. However, he admits that it is impossible to eliminate 'normal accidents' as attributes of complex social-technical systems: "We are not safe. Nor can we ever be fully safe for nature, organizations, and terrorists promise that we will have disasters evermore. Let us minimize their consequences by minimizing the size of our vulnerable targets" [36. P. 325].

Today's complex systems produce great challenges to humanity, but the idea to abandon them as such or limit their functions is utopian for the self-realization of knowledge makes that impossible. Risks of 'normal accidents' should be minimized not by abandonning complex systems but by their comprehensive humanization on the basis of the integrity of social, natural, technical sciences and humanities. This synthesis should include traditional and even religious knowledge to preserve routine social practices and conservative ways of thinking that can balance or prevent pragmatic risky innovations (in human genetics, new means of conducting wars, etc.). Thus, key

challenges of 'normal accidents' are not potential catastrophes but rather formal rationality and pragmatic values. There can be complex systems based on the knowledge oriented on substantial rationality and existential needs.

An essential contribution to understanding the vulnerabilities of the climate system as a complex social-environmental hybrid was made by A. Giddens. According to him, climate changes are the result of pragmatic, mercantile exploitation of nature within the image of man as 'the measure of all things' and without taking into account environmental sensitivity. Giddens perceives man-made challenges to humanity as an effect that was called 'Giddens's paradox'. The traditional division of natural and social environment is no longer working: in traditional and industrial societies, challenges (different disasters) were mainly natural, now they are mainly determined by people themselves, while the linear thinking and knowledge of climate still prevail. In "The Policy of Climate Change", he argues that this leads to a false, distorted perception of contemporary activities of people: they "find it hard to give the same level of reality to the future as they do to the present" [22. P. 2], which concerns both everyday and global environmental problems. Thus, business and political elites are well aware of the postponed negative side-effects of their policies regarding nature, but due to the pragmatic values in modern knowledge they do not take necessary steps to change the situation for the better — such an 'organized irresponsibility' leads to climate changes that are irreversible. Therefore, the linear knowledge produced challenges for humanity.

The vulnerabilities of the climate system were also considered by J. Urry who proposed an interpretation of 'global warming': it is "a simplifying term since what may happen in different parts of the world may be very different, with possibly significant cooling occurring in some places. Indeed the problem of the term 'warming' stems from the sheer difficulty in predicting long-term future climates" [41. P. 23]. This is a non-linear interpretation of the vulnerabilities of the climate system, which emphasizes turbulence, unpredictability of climate change and possible unintended consequences of the self-realization of knowledge and innovative activities of humanity. Urry also notes the interdependence of climate changes and the destiny of civilizations advocating the study of complex causes of emerging vulnerabilities in the climate system within "a framework which emphasizes non-linearity, thresholds and abrupt and sudden change", and pointing to the limits of the linear knowledge: "it is noteworthy that historical analysis and science did not consider that climate played much of a role in the rise and fall of civilizations. Climate was typically viewed as immutable, not changing much and no being of great consequence for the ways in which special societies develop and change" [41. P. 21—22, 24].

New vulnerabilities have also emerged in the food system as a complex social-environmental hybrid. The functionality of the global-network agribusiness is predisposed to 'normal accidents' such as increasing production of genetically modified products and extension of 'dead land and water' [38. P. 149—210]. These vulnerabilities can be minimized by rejecting the obsolete dogma 'the more food — the better'. In fact, people need quality nutrition that support their physical and spiritual health, and provide them with adequate energy to prevent culture-bound syndromes — anorexia, addiction to fast food, etc.

According to Z. Bauman, there are new vulnerabilities in the form of 'collateral damage' of man's activity. This term was used in the vocabulary of military expeditionary forces but in the 'liquid modernity' it denotes unintended, unplanned effects of human actions in general: while producing knowledge and wealth people did not take in account the possible existential insecurity that accompanies life in the 'liquid modern' world. This insecurity is determined by the very life of the big city and expressed in mixophilia (attractions it can offer) and mixophobia (fears that force people into 'gated communities'). The side effects of these developments are vulnerabilities to existential needs of communicating: people pay a lot of money "to liberate themselves from unwanted company to be left alone. Inside the walls and the gates live loners". The need for security can become addictive: "Once you start drawing and fortifying borders, there is no stopping" [6. P. 65—66, 68].

To overcome these vulnerabilities people need humanistic decisions and actions with at least three basic grounds: (1) until now, the institutional regulation of scientific knowledge is supported by many societies not to overstep the edge of chaos, so the institutional control should take into account 'manufactured uncertainties' and existential needs; (2) the 'arrow of time' effects determine a fundamentally new interdependence of scientists in the form of strong ties allowing intensive interactions and weak ties that are of a particular importance in the networks of 'invisible colleges' [18]; their efficiency depends on the growth of not only number of arithmetic nodes but also of the social space the people are involved (in complex systems weak ties can have a greater impact on the humanization of scientific and technological innovations as network private insurance); (3) the subject of sciences is changing — more scholars consider new vulnerabilities as a part of life and a challenge for the security of humanity.

HOPES FOR BETTER FUTURES: IN SEARCH OF KNOWLEDGE BASED ON SOLIDARITY VALUES

Today scientists rediscover futures based on the non-linear knowledge and the demand for humanization. The general opinion is that there are no simple linear ways to the 'universal common' future of humankind. Not long ago the future was an optimistic 'progress' of all humankind, for instance the theme of the Third ISA Forum (Vienna, 2016) was "The Futures (plural!) We Want: Global Sociology and the Struggles for a Better World". Much attention was given to overcoming the 'global humanitarian crisis' and designing the future — as 'human', 'posthuman' or 'trunshuman' [21. P. 85]. The most important goal is to find humane ways to possible futures. The 13th Conference of the European Sociological Association (Athens, 2017) stressed the necessity of new solidarities in Europe that demands to overcome the limits of the existing knowledge: "The project of questioning reality began in Greece, and sociology from the start shared in this task of highlighting dominant forms of understanding in societies (and science) that limit knowledge, by working towards more fitting kinds of understanding" [43. P. 9]. To fulfill this task we need a humanistic vector in the production of knowledge based on culture and solidarity values for better futures.

M. Castells made a great contribution to understanding modern movements opposing "the cynicism and arrogance of those in power, be it financial, political or

cultural, that brought together those who turned fear into outrage. And outrage into hope for a better humanity... Hope projects behavior into the future. Since a distinctive feature of the human mind is the ability to imagine the future, hope is a fundamental ingredient in supporting goal-seeking action" [17. P. 2—3, 14]. The results of the study of the international research network on alternative economic practices and their cultural foundations (2011—2015) proved that there are social changes to another economy based on values opposing formal rationalism, pragmatism and mercantilism: "the value of life over the value of money; the effectiveness of cooperation over cutthroat competition; the social responsibility of corporations and responsible regulation by governments over the short-term financial strategies... we saw the blossoming of multiple experiences of innovation in organizing work and life: cooperatives, barter networks, ethical banking, community currencies, time sharing banks, alternative means of payments, etc" [16. P. 1].

However, many people fear the alarm discourse about future and turn to the past. According to Bauman, there is a 'global epidemic of nostalgia'. In "Retrotopia" he argues that its major factors lie in the optionality of human choices: the 'civilizing process' was designed as "a reform of human manners, not human capacities, predispositions and impulses"; "in the course of civilizing process, acts of human violence were shifted out of sight, not out of human nature"; "we seem to be settling for a prospect of a continuous and never conclusive war-to-exhaustion between 'good violence' and 'bad violence'"; "we live in a world in which pragmatism is the topmost rationality"; "our world — the world of weakening human bonds" [4. P. 14, 16, 25, 44]. To overcome the global epidemic of nostalgia people should reject the dogma 'there is no alternative' and realize "chances of success and defeat": "More than at any other time, we — human inhabitants on Earth — are in the either/or situation: we face joining either hands, or common graves" [4. P. 167].

U. Beck applied his theory of 'metamorphosis of the world' to support the idea of 'emancipating catastrophism' taking into account 'positive side effects of global risks'. He criticizes the pessimism of the linear approach to modern disasters: "We all know that the caterpillar will be metamorphosed into a butterfly. But does the caterpillar know that? That is the question we must put to the preachers of catastrophe. They are like caterpillars, cocooned in the worldview of their caterpillar existence, oblivious to their impending metamorphosis. They are incapable of distinguishing between decay and becoming something different. They see the destruction of the world and their values, whereas it is not the world that is perishing, but their image of the world. The world is not perishing, as the preachers of catastrophe believe, and the rescue of the world, as invoked by the optimistic advocates of progress, is not imminent either. Rather, the world is undergoing a surprising, but understandable, metamorphosis through the transformation of the reference horizon and the coordinates of the action" [9. P. 26].

The humanistic turn in science based on the synthesis of natural, social and humanitarian knowledge would result in the humanistic paradigm of the non-linear knowledge that allows to analyze complex social, technical, and natural realities. This implies a new type of scientific knowledge that considers societies and all matters through their complexity-dependence and human agency-consequences [26. P. 29].

The representatives of the Enlightenment opposed religious humanism with the secular humanism claiming the self-worth of existence, and reason and rationality as the main values. They advocated the need to overcome all forms of unfreedom defining the man as the measure of all things for his intelligence can produce only goodness and morality. In fact, pragmatic principles of humanism of the Enlightenment set the grounds for anthropocentrism that produced today's complex risks and vulnerabilities. The anthropocene (the current stage of the geological history) is characterized by "soaring carbon dioxide levels, a quantum step upward in erosion, wide-spread species extinction, ecosystem disturbance and acidification of the oceans" [40. P. 45]. These risks and vulnerabilities can be minimized only by overcoming all possible gaps in sociology [28. P. 29—37] and by ensuring the humanistic trend in the development and self-realization of knowledge. The humanistic turn deals with the 'arrow of time' effects of social-cultural and environmental dynamics, synergetically takes into account social and environmental risks and vulnerabilities, searches for new forms of humanism adequate for the complex economic, physical, technical, political and social systems of the contemporary world. The humanistic turn rejects ideas and practices of anthropocentrism, and reveals challenges of humanization of scientific and technological innovations to maintain the balance between them and key environmental processes so that the non-linear knowledge would produce controlled 'manufactured uncertainties'. Thus, the development of scientific ethos can set principles of substantial rationality in the non-linear knowledge as a realistic basis of hopes for the futures people want.

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СТАНОВЛЕНИЕ НЕЛИНЕЙНОГО ЗНАНИЯ: НОВЫЕ РИСКИ, УЯЗВИМОСТИ И НАДЕЖДЫ*

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В статье утверждается, что нелинейное знание рождается и воплощается в жизнь благодаря эффекту «стрелы времени» (И. Пригожин), согласно которому вся материя развивается все быстрее и все усложняющимся образом. Автор распространяет этот эффект на динамику знания, показывая, что современное знание обретает качество рефлексивности и совершенно новый вектор нелинейного развития, проявляющийся в так называемых «научных поворотах». Переход от линейного к нелинейному знанию производит более сложные риски, включая риски дегуманизации, которые и рассматриваются в статье. Мониторинг этих рисков требует учитывать ценностно-ориентированное нелинейное знание, которое включают в себя не только достижения естественных, технических и социальных, но и гуманитарных наук. Среди новых вызовов человечеству — уязвимости, проявляющиеся в усилении структурных дисфункций сложных социальных и/или техногенно-природных систем и принимающие формы «нормальных катастроф», «побочного ущерба» и т.д. Автор полагает, что основные уязвимости порождены доминированием прагматических ценностей в современном знании. Наряду с новыми угрозами в нашей жизни появился и новый вид развития — метаморфозы, или нелинейные преобразования, значительно усложняющие и без того сложный характер рисков и уязвимостей. Ответ на эти вызовы автор видит в гуманистическом повороте, который породит более достоверное знание о сложных рисках и уязвимостях на основе моделей лучшего будущего.

Ключевые слова: нелинейное знание; «стрела времени»; рефлексивность; «рукотворные неопределенности»; риски; уязвимости; «новые катастрофы»; «нормальные катастрофы»; «теория метаморфозы»; гуманистический поворот

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