**ІІІ. ФІЛОСОФІЯ НАУКИ**

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**VALUE OF THE BIOGENETIC LAW**

**IN THE FORMATION OF THE ARTIFICIAL SUBJECT**

*В статье рассматриваются аналогии между становлением человечества как субъекта и процессом возникновения искусственного интеллекта.*

***Ключевые слова:*** *субъект; искусственный интеллект; онтогенез; филогенез; таксон; биоэпистемология; технологическая сингулярность; телесность.*

*У статті розглядаються аналогії між становленням людства як суб'єкта і процесом виникнення штучного інтелекту.*

***Ключові слова:*** *суб'єкт; штучний інтелект; онтогенез; філогенез; таксон; біоепістемологія; технологічна сингулярність; тілесність.*

*The article discusses the analogy between the evolution of humanity as a subject and the process of artificial intelligence formation. There are common traits that are determined isomorphism in the formation of any intelligence. Artificial intelligence should be created by human civilization therefore it is thought may contain* *individual personality traits – characteristics of the social structures that provide socialization. There are also differences. They are determined less spontaneous and more reflective process of formation of the AI, as compared with the formation of the human intellect, as well as the possibility of transferring large data between computers.*

***Key words:*** *subject; artificial intelligence; ontogenesis; phylogenesis; taxon; bioepistemology; technological singularity; corporeality.*

Predicting the development of complex technical systems relevance consistently great. However, this question is associated with a high percentage of false, erroneous forecasts. If we look at issues, such as the creation of artificial intelligence (hereinafter – the AI), the optimistic predictions about its imminent appearance fixed from the 1950’s. For a long time, the creation of another technology or software was seen as the last step to consciousness, the missing element for the creation of high-grade artificial subject. For example, the first perceptrons fell short of high expectations [16].

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But by 1980 experience for the ever-increasing power of computers, the permanent creation of new software has accumulated. It has ensured the creation of the AI. Transition the amount of accumulated information in the software quality cannot be provided a simple increase in computing power. Skeptical views on creation of the AI [19] generally include references to the failed attempts.

**Analysis of recent publications showed** that each line of robotics or software, that claims to be the creation of AI, has its own set of «negative» arguments. For example, disadvantages of the evolutionary modeling are as follows (according to V. E. Karpov): adapting the prerequisites to the evolution of simple search procedures, as well as the contradiction between process of creating AI (single individual should be changed) and purely evolutionary approach (which resulted in the change species) [12].

Creating AI should be seen not as a one-time success or consequence of a single critical technology, but as a long process. It will take a whole historical epoch. Thus wrong hypotheses about the possibilities of perceptrons become the secondary. The negative heuristic, which includes any scientific and technological revolution, also becomes justified.

Nowadays, it become a very important to follow the ways to increase the analytical and cognitive opportunities of technics, and most importantly, similarities between its development and the past process of intellect formation. Naturally, it is the human intellect.

Therefore, it is necessary to analyze not only the structure of thought (logical), but also the process of human evolution as a subject (historical).

As the embryogenesis reflects the process of species evolution, and the formation of each individual reflects the sequence of biological processes and stages of cultural development. The study of human evolution reveals the prerequisites and conditions for the formation of consciousness (which are now perceived automatically) as an integral part of culture. Thus the formation of artificial intelligence should be compared with anthropo-sociogenesis.

Let’s try an analogy.

Isomorphism is obvious when comparing the shape of a bird and an airplane design. Creating an aircraft require the use of different technologies, and eventually allowed only partly reproduce birds maneuverability. The potential creation of AI requires a gradual accumulation of technologies that are not directly related to thinking. But for the design of aircraft from the point of view of bionics is not advisable to analyze the flight of a bird in its entirety, but the flight of bird species, which just learn to fly (a variety of flying squirrels, bats, some bad flying birds). That is not to explore the complex aerobatics, which can demonstrate swallows, but simply planning processes – from their example is much easier to build a model to carry out abstraction of factors that determine a flight. According to the structural differences in the structure of the skin folds of flying squirrels and birds wing should look for those signs that may lead to the concept of wing lift, air resistance. Becoming a bird as a biological class this is one process, the development of an aircraft as a technical product – other. Each process has a specific integrity and common features (materials of wing construction and a level of energy expenditure during flight).

If we compare the emergence of AI (this process is not yet fully understood) with already passed the process of emergence of a reasonable humanity, then, perhaps, possible tool for comparison of these processes is to use the biogenetic law (that is, the repetition of significant features of species phylogeny in the ontogeny of the embryonic). The question arises: how to use justified of biogenetic law in the application of the technics, and, especially, to the forms of thought, of consciousness? A possibly, this analogy contains reduction, when the socio-anthropological process is reduced to the biological?

The answer can be given at two levels.

*Firstly*, at the biological and technological evolution of the many features in common.

Direct identification of species formation and the creation of technical products are unacceptable. But the term «technoevolution» is widely used. V. I. Hnatuk indicates technoevolution [8, p. 100–120] as a process which can participate in generation of technical products. I. M. Vakula compared evolutionary and technological progress [7], came to the conclusion: «the main and overall driving force of biological evolution and technological progress appears selectogenesis – selection of the fittest variants to the environment (living organisms) and human needs». According to him, the technical prerequisites for the evolution of biological analogs are the «quantitative ensembles» of technical products, as well as competition, production management, etc. Also in the technosphere it found a large amount of structures whose properties are close to nature – technocenosis [15]. B. I. Kudrin indicates the separation of «genetic information», which determines the appearance of a technical product, from the product itself, while the body is inextricably linked with its own DNA «project».

That is the analogy between the development of life and technical progress does exist, but it requires careful use of similarity criteria.

*Secondly*, if the development of technology has evolutionary characteristics, can it be considered an AI as the second generation of intellects? The first generation is the human intellect, which arose spontaneously.

For the direct analogy there is an obstacle: «Usually, the lack of interest in the problem of creating an «integral AI» is human-level attribute as follows: we are still very poorly understood the nature of human intelligence and therefore cannot clearly imagine how it is possible to create an analogue machine» [6]. For more than half a century AI creators are trying to find ways to get around this obstacle. For example, since the 1960s, the evolutionary approach has used the creation of the AI [20]. The advantage of an evolutionary approach that AI can be obtained without a full reflection of the process of its creation – a selection allows you to not analyze the DNA, and to work with organisms on a «black-box» principle. Another approach was the biocomputing – up brain or individual characteristics of the human nervous system. The methodological basis of Biocomputing is bioepistemology, evolutionary epistemology, physical epistemology [5].

As one way of comparing, synthetic and human consciousness you could probably use of a wider concept than consciousness. This will reduce the accuracy of the conclusions, but if it is possible to talk about a well-defined concept which overlaps with the concept of «consciousness», it already allows to formulating working hypotheses, to work within the framework of thought experiments.

Let us analyze AI not as a copy of the consciousness in its pure form, but as a subject. «The support activities, awareness and knowledge» [23] may not differ from the level of human capacity. This approach is used, for example, in the work of C. Zobina and L. Khamitova «Evolutionary theory of natural and artificial intelligence» [11] – is made up of the subject range of opportunities that are available to him, depending on the level of thought. In fact, if the processes occurring in the human nervous system (largely inaccessible to the physiologists), the formation of collective subjects available for insider research. Synthetic, artificial equivalent of the individual subject could be called techno-subject.

**The purpose of the article** is to study of the process of formation of tehnosubjects, to draw an analogy between the formation technosubject and anthroposociogenesis.

**Main material.** The formation of the thinking subject is impossible without the existence of a particular infrastructure, a set of specific tasks. They all add up to a reproductive system of a subject. The history of computing shows how the development of man cannot be in a totally wild environment (possible full-fledged self-development feral children), so it is impossible to create a high-grade synthetic subject through a single computer, even if the computing power of such machines will be comparable to those of the human brain. The illusion of omnipotence programmer (or even a team of programmers) feed the ever-increasing opportunities for processing and storing information. But if you look at the history of science, the similarity of programmers with the alchemists, who dreamed of creating a homunculus in the retort, is striking. From the ability to manage individual chemical reactions to create a complete organism is a huge distance that biochemists began to overcome only in the last decades. Similarly, a team of programmers, not based on the interim results of the work of their colleagues and the amount of research in related disciplines, will get very limited results.

Let us consider the significant differences between the tehnosubject and those that create or consisting of humanity.

In order not to raise a separate problem «What is technics?» will take its definition as «a mode of existence of man-made systems that have been reflected, consciously» [4, p. 29]. If we consider the technics as a new stage of development of a matter – from the bone and biological matter to a «reasonable» [1], – that there is a problem of criteria qualitative leap.

What technique level can already be considered as «the smart matter»? Technics had the instrumental properties initially and will have them forever, but some qualities should manifest itself only when the formation of tehnosubject. Now technics, separated from the person cannot provide self-reflection, sufficient for its reproduction. That is, the technics does not exist just in a symbiotic relationship with a human, but we can say that the human mind is the carrier of the qualities, that define the development of technology.

If now in a thought experiment to isolate the technosphere of humanity, it quickly falls apart. And it is not a crisis that will be overcome (as an isolated community of people can restore strength and even civilization), namely, the collapse and complete disintegration. To prevent this and tehnosubject could be considered an existing, two requirements must be met.

Firstly, in the process of tehnosubject formation of all systems to ensure its existence, must go through the stage of biological development: from simple reproduction of machine individual elements and the possibility of self-maintenance of complete ecosystems, until the autotrophic technocenosis [2, p. 78–86].

Secondly, the stages of intellectual development are from simple record information up to create a picture of the world and self-formulating concepts [11]. Moreover, the processes to meet these requirements must pass if not simultaneously, then in close relationship. Without the emergence of a full-fledged subject of the correlation is unlikely. Let is consider the options of an isolated «biological» and «intelligent» development.

Already we created collective subjects who are temporarily satisfy the requirement of «biological» stability of, but did not have self-awareness. This artificial bureaucratic system, which can be called as «the technostructure» (term by J. Galbraith). They are created by the decision of a comparatively narrow range of tasks, ensure the existence of the state and large corporations, but to develop their own are not able to [3]. There is a permanent contradiction between the stability of the technostructure and the need qualitative growth which, in turn, leads to the need for a personal reflection technostructure.

The reverse case is the emergence of consciousness in a single computer. This image of «the machine in itself» was created by S. Lem [17]. Advancing the development of this machine is actually meaningless. Without adequate tasks and even a buddy with its level, «conscious of itself machine» slipping into solipsism – enters the epistemological impasse without practice as an integral part of knowledge. If you do not become isolated within the S. Lem, the full AI thought experiment should play not just knowledge, but also human skills. Work is a manifestation of intelligent activity. Therefore, if the AI is in the process of its formation does not replace the human in all production processes, it is not a full-fledged AI.

However, an attempt to mechanically move the traits of a human (as a social animal, as a member of society in the synthetic subject) is facing a problem.

Technosubject fundamentally not linked to a single computer, as the human consciousness with the brain or as a collective subject with society.

Even in the context of human-computer communication more extensive uses of the term «exocortex», which implies overcoming multiple barriers between the nerve impulses in the brain and the lines of code in the car. Computer software can also include an unlimited number of sub-systems. Attempting to draw a clear line between the individual computer that is in the process of exchanging large volumes of data with other machines and the Internet system as a whole – is a non-trivial task.

Enactivism and corporeal approaches to the subject of cognition, based on its fundamental connection with the body (for example, the work by E. N. Kniazeva «Enaktivism as a new form of constructivism in epistemology» [14]), are faced with a qualitatively new phenomenon. Holistic considering Chains «brain–body–mind–environment», we are faced with new qualities of the medium – the Internet of Things, which will make our environment in the near future, is seen as a new kind of physicality, corporeality [21].

The ability to transfer large amounts of information leads to the fact that some elements of the future and tehnosubject subsystem may exist now and will be compiled into a single entity not through gradual transformation of each of the media, and through the transfer of software packages. Consequently, in the overall process tehnosubject formation, which will inevitably submit to evolutionary theory, there may be manifestations of the regularities characteristic by L. S. Berg «nomogenesis» concept – when in evolutionary processes are becoming more important theological factors (selection is not spontaneous, remaining natural, and partly conscious to getting artificial features). It is necessary to take into account the concepts established under the now discarded biologists theories. The emergence of living organisms from separate sets of independently living parts, which is already two hundred years ago, looked outdated fantasy by Empedocles or P. Hassendi – are now materializing with the modular assembly automation systems.

D. Dennett during the analyzing of the mind evolution built a series of images – from the «Darwinian creatures» that solve any problem just by natural selection in their ranks (bacteria) to «Gregorian creatures» that can solve the problem by using accumulated by previous generations of tools culture [9]. If we continue this series, then the internal selective media organism (psyche) carried out a preliminary selection of not just individual behavior patterns or tools, but new organisms and new tools of culture –that is, a solution to a specific problem you can reproduce the model of evolution.

The question arises how much more significant is the biogenetic law, if evolution can be modeled and leapfrog development between man and tehnosubject will not have explicit transitional links, both between ape and man? If in nature none of the organism could not evolve element itself, in the equipment can develop a separate parts.

Biogenetic law, do not require a computer to cultivate the human legs to create tehnosubject. Compared with the wildlife in the technics of the law it is manifested in a simplified form.

If we consider the process of tehnosubject modeling (design), then using the new tools is always required to reproduce the logic of solving old problems. But the full simulation of the evolutionary process will never be reached, since it would require a complete knowledge about the world, which is obviously impossible. In free design of individual systems and the alienation of «genetic information» from the previous generations of the creation of any complex system is faced with the need to take account of natural selection, which occurs under the influence of unaccounted factors. That is an *abstract model* of the development system (which takes into account, it would seem, all the relevant factors) should be compared with a form, with the appearance of the previous generation system (which operates, unknowingly considering factors not yet identified).

This is quite a different perspective raises the psychophysical problem, the problem of the interaction of mind and body, tehnosubject and society.

Firstly, the amount of features that tehnosubject must performs in order to maintain its existence, must necessarily include those, which society takes. For example, for each individual company provides sign system – the language. Man will not directly educate the AI as educate children. The process in view of the mass production of AI would depersonalize, is subject to some algorithms. Even if we take as an example of a neural network, which is currently taught – virtual emulation of such training is always more profitable than chat with a live person. Therefore, on tehnosubject formation arise demands of his «ersatz-socialization», it becomes a self-learning.

Secondly, the architecture of computer networks that act as tehnosubjects carrier has its limitations and purely technological needs − from electricity to programs and spare parts. Social can be represented as ersatz, depleted, etc., but the requirements of interaction with nature, with the reality in order to maintain the autotrophy of the technocenosis – is irrevocable. Therefore, the biogenetic law is required not only apply to software development (the analogy between natural and artificial intelligence carried out repeatedly), but to hardware AI component. At the same time, understanding the AI is absolutely all processes taking place in the technosphere – is obviously impossible. At least because in their faces the complication of machinery undetected regularities and phenomena. But at the same homeostatic balance of production and consumption must be maintained at the proper level. That is part of the process will be biological in nature, correspond to the biological level of organization of matter.

Interim conclusion: to ensure the foundation of tehnosubject should go parallel to the process of creating three interrelated systems:

*– reflection* *of reality* (intelligence as is). The minimum possible requirement here is the opportunity to develop new concepts and images as part of a conscious picture of the world;

– *self-reproduction and self-improvement systems,* that is, as a continuous design of new mechanisms and algorithms to replace them. This is impossible without a full awareness of its own device and development tehnosubjekt development goals (without self-knowledge). A self is impossible without adequate reflection of the external world;

– *physical interaction with reality,* which inevitably requires the separation of the software on a qualitatively different level, the creation of specific instruments, mechanisms, machines. Minimum requirements for this set of machines – they must maintain a technical analogue of biological homeostasis.

For a person on the order of less than the totality of these systems is integral, if only because they were formed at different times. Any reproduction of man as a biological being and created infrastructure of civilization, which serves the body in the narrow biological sense – food, sleep, temperature control, etc. At the same time, there are mental human needs, which have been set in the era of the formation of Homo sapiens, and there is rapidly changing tools of human needs and culture.

We can assume that if tehnosubject will be created and will start its evolution, the next «generation» of tehnosubject be much less copied the way of formation of the human mind. Those contradictions are overcome spontaneously, will be presented in a sublation form. Therefore, the most obvious manifestation of phylogeny in ontogeny are into the first generation of artificial intelligence – that is, the creation of tehnosubject now and should as much as possible to carry the features imitation of the formation of human.

There are obvious parallels between the internal (human psyche and the body device) and the outside (of the infrastructure that is created for self-service human). And you can trace a lines of development that something must repeat technosubject:

– *information storage.* In humans: brain, it, books and libraries. The whole of human history is the emergence of diverse knowledge of storage systems. The language and human memory are very imperfect, but now achieving data standardization (a binary code) and a moment of its receipt. From the computer memory than stored in the cathode ray tubes into data centers, which are technically almost unlimited amounts of data storage;

– *priority setting mechanisms –* sensations, emotions*.* The man part of the brain is as a biological basis. Many aesthetic practices such as music. Instrumental music software. Finally, the emergence of aesthetics as a science. As part of the attempt to create artificial intelligence these processes corresponds to the development of neuroeconomics. This is a new interdisciplinary field that explores the role of emotions (based on neurobiology) in decision-making and economic development [13], similarly, the mechanisms of accelerated and simplified decision-making. In humans, it is the peripheral nervous system: conditioned and unconditioned reflexes. In technics – any semaphore, special beep etc.;

*– the physical impact on the surrounding reality.* In humans: the muscles and skeleton, development of the arms, tools development. As part of the tehnosubject formation occurs borrowing almost the entire set of tools and machine tools, and engineering;

*– human reproduction – the appearance of the first forms of family, education*. For tehnosubject: full automation of production processes of reflection AI use.

Different levels of neural activity within the culture are provided by different subjects, different practices. One of the turns of the spiral – from tools for thought and nervous system, and from it again to the tools – is inevitable in man. The hierarchy of the nervous system corresponds to the hierarchy of human activities.

If we talk about the hierarchy of computer systems, the first element of the qualitative difference is the need move from meronomic to taxonomic classification system in electronic devices. If the first describes the relationship «the set-element», the second – «part-whole» [11]. This system is not the same type of calculators, but a hierarchical structure in which there are «quantitative to qualitative» transitions.

Therefore, to find occurrence tehnosubject prerequisites necessary to look for appropriate separation – both quantitative and qualitative, as well as appropriate internal-external interaction among individuals and groups as subjects. This hierarchy is present, and that it is important to continuously complicated, combining the growth of the universality of individual elements, as well as specialization of the separated devices.

It is a long time process: on the one hand, there is a permanent selection and memory in computing devices, the very division of programs and media programs, with another – the standardization of data calculation units and almost all indicators of your computer. But the balance of standardization and specialization present in almost all branches of engineering. Can this process in itself be a precondition and criterion for creating tehnosubject?

Probably, the answer is in the transition to a holistic system. Discussed above trinity of consciousness–impact–reproduction are the functional characteristics of the tehnosubject (the tool–practice of using–institute, which regulates the use and reproduction of the instrument). Until now, the highest on the complexity of the chain link are institutions. They fundamentally cannot exist without a human, because are most closely associated with the use of picture of the world, abstract thinking, etc.

But what are the trends of recent years?

− The creation of «Internet of Things», in which information is larger in volume than they can control the people (in fact, it is the analogy of the lower nervous activity of the future technosubject) [14].

Maintain homeostasis processes in humans are performed unconsciously, but here we see, on the one hand, the possibility of such unawareness, on the other – which controls almost all high-level parameters of the program is more potentially feasible (for example, the work of the refrigerator detects a program that optimizes energy consumption, but the user remotely may give directions). That is, it is not just a biological level of self-control as the animals – but is the level of yoga, medicine, etc., that is, the conscious control «routine» physiological processes.

– Growing level reflection process which can carry out the programs. From a simple display (which is based on unconditioned reflexes) is the transition to the analysis of information on the growing number of parameters. For example, the construction of the graphical-analytical models [7]. Also already created for smart people control the city based on their behavioral characteristics. Programs allow to analyze the arbitrarily selected texts. There is no direct analogy with the level of thinking of the toad or rabbit.

The worldview of the living beings is holistic and not digitized, and of the machines it is, firstly, originally symbolев and, secondly, fragmentary, not past of the self-becoming process. But more clearly presents in computers the necessities which pushes the living entity for the acquisition of learning skills and improve the representation of the external world. And the creation of a «world pictures» for computers has become an urgent task [13].

– No less than a revolution going on in computer-aided design systems. Every working technical production system should be in working order, but the reality is automated software production management process – controlled partially functioning systems. As a result, software that creates a model of technical devices/systems are easier to use as when testing the system, and during its operation is due to the fact that all emergency situations have already been calculated. For example, the software power systems not only provide a list of emergency situations, but provide rolling blackouts to avoid overloading the system. But the creation of such programs, which are intended for automatic design and automatic operation systems, is in fact «self-awareness». But as part of a holistic picture of the world, it does not exist. There is only limited, segmented display and signal analysis algorithms, but they are already forming in some agglomerates having a qualitatively new features. That is, the realization of the design process, which is part of the development of civilization went quite late, during the industrial revolution, is now playing programs.

– A reflection of the process of any program immediately leads to the widest possible use of the program. Maximum use of the programs in the CIO (Chief Intelligence Officer – CIO) inevitably leads to the fact that control of the form (correctness of mail receipts, security mode, etc.) begin to move the program to control the content. Such control would inevitably benefit of using its staff. That is, create bureaucratic structures of management conditions through programs that will work better than a more complete picture of the world will be at their disposal. The «cognitive computers» (a term already used by IBM), Managing Director, is a means of winning the competition.

– The processes of the development of computer programs try to automate as much as possible: here and CAD automation, as such, and self-learning program, which can use the information from the World Wide Web, and continuous improvement of neural networks. Even assembly programs into a single code capable by means software compilers. Self-learning and self-improvement programs are different than human learning (not least because the information in the computer is standardized order of magnitude better than in human communication and its backup processes are extremely fast). But the need to control the information received, maintain the integrity of a set of programs when you install another, the use of brand new information, etc. It requires some training equivalent. For example, now anti-virus software is updated several times a day, which requires obtaining new data packets from the site of the manufacturer.

Thus, the faster there is a process of interaction in real time a sufficiently large number of primitive robots elementary programs, on the one hand, and complex systems, «weak artificial intelligence» on the other, that in fact leads to the distribution of information processing, comparable to the distribution process alive organisms: there are actions that are hardly understood by «psyche» of a large complex and implemented only in hardware (as in organisms is the Krebs cycle, and in the car the work springs), there are actions that the general «nervous system» of the machine are performed on the level of unconditioned reflexes (the same ignition control), and some require the use of a picture of the world. This system, which in its entirety must satisfy the integrity requirement is no mechanism (all the known mechanisms of integrity does not have – at least, goal definition it is set, they provide a supply of energy, raw materials and many other things), but the body (is a system to ensure the immediate needs, a system of self-reproduction) and more desirable to a reasonable (consciousness of the world, goal setting).

Before us is the emergence of a qualitatively new integrity in the technosphere, which continuously analyzes themselves, and for the preservation and performance of a given amount of work it needs to better understand everything in the outside world.

**Conclusions and further researchers directions.** The value of the biogenetic law in modern AI formation process is to determine the measures of a qualitative leap difficulty, which must implement the system in the development of technosubject. This measure serves the creation of equivalents is not just human thinking, but into the «sublation» form is required reproduction of social institutions and even the mechanisms of maintenance of biological homeostasis, which indirectly set the level of practice and consciousness. The corporal approach in thinking about AI requires not only greater use of well-known concepts of evolution, but also the expansion of the conceptual apparatus that are used.

***List of references***

1. *Базалук, О. О*. Мироздание: живая и разумная материя (историко-философский и естественнонаучный анализ в свете новой космологической концепции) : монография / О. О. Базалук. – Днепропетровск : Пороги, 2005. – 412 с.

2. *Бескаравайный, С. С.* Автотрофность техноценозов / С. С. Бескаравайный // Грані : науково-практичний і громадсько-політичний альманах. – 2013. – № 10. – С. 78-86.

3. *Бескаравайный, С. С.* Процесс деантропизации мегамашины // Грані : науково-теоретичний і громадсько-політичний альманах. – 2012. − № 5(85). – С. 61- 65.

4. *Бескаравайный, С. С.* Философия техники : монография / С. С. Бескаравайный, В. П. Капитон*.* – Днепропетровск : ДГФА, 2011. – 302 с.

5. *Богданова, В. О*. Эпистемология телесности: от модели «тело-протез» к модели «тело-сознание» / В. О. Богданова// Философия и культура. − 2011. − № 2 (38). − С. 9-19.

6. *Быковский, И. А.* Философские аспекты проблем создания искусственного интеллекта : автореф. дисс. ... канд. филос. наук : 09.00.08 / И. А. Быковский. − Саратов, 2003. − 20 c.

7. *Вакула, И. М.* Биотехнический прогресс в контексте эволюционизма : автореф. дисс… канд. филос. наук : 09.00.08 / Вакула Владимир Леонтьевич. − Ростов-на-Дону : Северо-Кавказский научный центр высшей школы, 2003.− 22 с.

8. *Гнатюк, В. И.* Философские основания техноценологического подхода / В. И. Гнатюк. − Калиниград : «Техноценоз», 2011. – 284 с.

9. *Деннет, С. Д.* Виды психики: на пути к пониманию сознания / С. Д. Деннет. − М. : Идея-пресс, 2004. – 188 с.

10. *Зимовец, О. А.* Интеграция средств формализации графоаналитических моделей Узел-Функция-Объекта / О. А.Зимовец, С. И. Маторин, // Искусственный интеллект и принятие решений. – 2012. − № 1. – С. 57-64.

11. *Зобин, С.* Эволюционная теория естественного и искусственного интеллекта / С .Зобин, Л. Хамитов [Электроннный ресурс]. – Режим доступа: http://aphy.net/texts/650-evolutional-theory-of-artificialintelligence ; http://aphy.net/texts/958-evolutional-natural-and-artificial-intellect

12. *Карпов, В. Э.* Методологические проблемы эволюционных вичислений / В. Э. Карпов // Искусственный интеллект и принятие решений. – 2012. – №4. − С. 43-50.

13. *Ключарев В. А.* Нейроэкономика: нейробиология принятия решений / Ключарев В. А., Шмид С. А., Шестакова А. Н. // Экспериментальная психология. − 2011. Т. 4. − № 2. − С. 14–35.

14. *Князева, Е.Н.* Энактивизм как новая форма конструктивизма в эпистемологии / Е. Н. Князева. − М. : Университетская книга, 2014. – 95 с.

15. *Кудрин, Б. И.* Технетика: новая парадигма философии техники (третья научная картина мира) / Б. И. Кудрин. – Томск :
Изд-во Томского ун-та, 1998. – 40 с.

16. *Ладов, В. А.* Плюрализм философских интерпретаций принципов разумной деятельности в контексте исследований в области искусственного интеллекта / В. Я. Ладов // Вестник Томского гос. ун-та. – 2007. − № 305. − С. 29-34.

17. Лем С. Голем XIV / С. Лем // Библиотека XXI века. – СПб. : АСТ, 2002. − С. 303-418.

18. Мейен, С. В. Таксономия и мерономия / С.В. Мейен // Вопросы методологии в геологических науках. – К. : Наукова думка, 1977. – С. 25−33.

19. *Пенроуз, Р*. Новый ум короля. О компьютерах, мышлении и законах физики / Р. Пенроуз. − М. : УРСС, ЛКИ, 2011. – 402 с.

20. *Фогель, Л*. Искусственный интеллект и эволюционное моделирование / Л. Фогель, А. Оуэнс, М. Уолш. − М. : Мир, 1969. −230 с.

21. *Чеклецов, В*. Интернет вещей как телесность / В. Чеклецов [Электронный ресурс]. – Режим доступа: http://2045.ru/news /33800.html

22. *Чудова, Н. В.* Концептуальное описание картины мира для задачи моделирования поведения, основанного на сознании / Н. В. Чудова // Искусственный интеллект и принятие решений. – 2012. – № 2. − С. 51−62.

23. Новая философская энциклопедия. − М. : Мысль, 2010. −
Т. 3. − 692 с.

24. Rob van Kranenburg The Internet of Things: A critique of ambient technology and the all-seeing network of RFID. − Pijnacker: Telstar Media, 2008. − 62 р.

*Статья поступила в редакцию 18.12.2015 г.*