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# ROBOTS IN EDUCATIONAL SYSTEM TECHNOLOGY AND THEIR INFLUENCE TO THE SAFETY OF HUMAN PROGRESSIVE LIFE BEING

# РОБОТИ В ТЕХНОЛОГІЯХ СИСТЕМИ ОСВІТИ ТА ЇХ ВПЛИВ НА БЕЗПЕКУ ПРОГРЕСИВНОЇ ЖИТТЄДІЯЛЬНОСТІ ЛЮДИНИ

***Summary.*** *We live in a world of emerging dominance of modern technologies. They have already penetrated almost all areas of life. This made it much easier, making it more mobile and autonomous. High technologies have reached the educational system already and opened up a new niche of distance learning for many people. Currently, almost anyone has the opportunity to receive an education, regardless of their location and physical abilities. Humans from even the most distant cities can learn their own chosen profession or a specific skill simply by using Internet educational courses.*

*The word "robot" is used very widely in scientific literature and in common life. However, its sense is not always been used correctly. Robots are often referred to as devices that are controlled by an operator. For a clear*

*understanding of what a "Robot" is meaning in terms of science, let's give "Its" modern definition from the viewpoint of the well-known Israeli scientist Professor O. L. Figovsky:*

*"A robot is an automatic machine capable of making decisions independently*
*or working under the control of an operator."*

*There are many opinions regarding the dangers and safety of the widespread of the robot's introduction into society. As a rule, when scientists are making predictions about the dangers or benefits of Artificial Intelligence (AI) robotization, the experts mainly consider economic threats to humanity and do not cover the psychological and pedagogical aspects of this problem. This article will assist in overcoming it.*

*Nowadays, one of the current flows of robotization is the creation of personal robots. Their construction follows the path of modeling various human mental characteristics, the main of which are memory and emotions.*

*In order to interact with a person, any robot needs to accumulate information from the surrounding world and, upon human demand, openly share it, providing intellectual and mechanical assistance upon people's request.*

***Keys words:*** *robot, education, robot-teachers, Memory model, AI problems, threats of AI, Weak or Specialized AI, Autonomous AI, Adaptive AI, General AI, AGI, Human-level AI, Superhuman-level AI.*

***Анотація.*** *Ми живемо у світі дедалі більшого домінування сучасних технологій. Вони вже проникли практично в усі сфери життя. Це значно полегшило його, зробивши більш мобільним і автономним. Високі технології вже дійшли до системи освіти і відкрили для багатьох людей нову нішу дистанційного навчання. В даний час практично будь-яка людина має можливість отримати освіту, незалежно від місця проживання і фізичних можливостей. Людина навіть із найвіддаленіших*

*міст може навчитися обраній професії чи певній навичці просто за допомогою навчальних курсів в Інтернеті.*

*Слово «робот» дуже широко використовується в науковій літературі і в побуті. Однак не завжди його зміст використовується правильно. Роботами часто називають пристрої, якими керує оператор. Для чіткого розуміння того, що означає «Робот» з точки зору науки, дамо «Його» сучасне визначення з точки зору відомого Ізраїльського вченого професора Фіговського О.Л. :*

*«Робот — це автоматична машина, здатна самостійно приймати рішення або працювати під контролем оператора».*

*Існує багато думок щодо небезпеки та безпеки повсюдного впровадження роботів в суспільство. Як правило, коли вчені роблять прогнози щодо небезпеки чи переваг роботизації штучного інтелекту (ШІ), експерти в основному розглядають економічні загрози людству і не висвітлюють психолого-педагогічні аспекти цієї проблеми. Ця стаття допоможе її подолати.*

*Сьогодні одним із актуальних напрямків роботизації є створення персональних роботів. Їх побудова йде шляхом моделювання різноманітних психічних властивостей людини, основними з яких є пам'ять та емоції.*

*Щоб взаємодіяти з людиною, будь-якому роботу необхідно накопичувати інформацію з навколишнього світу і на вимогу людини відкрито ділитися нею, надаючи інтелектуальну та механічну допомогу на вимогу людини.*

***Ключові слова:*** *робот, освіта, роботи-вчителі, модель пам'яті, проблеми ШІ, загрози ШІ, Слабкий або спеціалізований ШІ, Автономний ШІ, Адаптивний ШІ, Загальний ШІ, ШІ рівня людини, ШІ надлюдського рівня.*

**Introduction.** There is already talk that in the future traditional teachers will be replaced by specialized robots, and the teaching profession itself will disappear due to uselessness. Is it possible to replace natural intelligence with artificial? Let's consider all the pros and cons of this way of events.

Modern pupils and students are increasingly spending time with their gadgets, using them as a universal reference in the learning process. But a teacher, unlike an electronic storage of information, has a certain psychological approach to any of them and to their personal characters, which cannot be said about a robot teacher. Sensually emotional interaction between a trainee and a teacher cannot be replaced by any automated system. Creativity, artistry, and curiosity are subject only to the human mind. Consequently, in this regard, artificial intelligence is lower in rank to natural intelligence [17].

Often the teacher is torn between dozens of different trainees and can sometimes miss something important. Therefore, information technology will not displace teachers from the field of education, but, on the contrary, it will help them quickly understand the mistakes of any trainee, as well as speed up the learning process.

Ultimately, modern information technologies have every chance to become a full-fledged replacement not only for the well-known professions but also to create many new ones unknown now. These will be the special managers of highly intelligent systems both in the field of education and in other areas of life.

**1. Robot-teachers. Analysis of the current situation in the education system**.

The article says: "Japan's Ministry of Education plans to equip schools with English-speaking AI robots. According to "Reuters", as part of a pilot program in 500 primary and secondary school classrooms in Japan since 2019, robots are already teaching English lessons. The authorities hope in this way to solve the problem of the shortage of teaching staff, because highly qualified

specialists need to be paid high salaries, and robot teachers will cost the government much less than real teachers. Moreover, the experience of robots use in primary and secondary schools has shown that modern technologies can really help to raise the level of teaching English. Japanese schoolchildren are already working in class using PC-tablets with specialized applications and participating in online classes with native speakers, which live in their own homeland, and not in Japan.

It is not the first-time robots have been used as school teachers. An educational experiment has begun in schools of the Finnish city Tampere, in which robots teach some subjects together with teachers. Totally the four robots are involved: a humanoid robot that teaches foreign languages and three owl-shaped robots, which teach mathematics.

There are also robots in South Korean schools. They also successfully teach English.

In one school on Alaska (USA), robots are helping teachers conduct lessons remotely, organizing a combination of full-time and distance learning into one parallel process.

In Australia, the robots are currently being tested to teach several subjects in educational institutions. In the future, a transition to full training of peoples using robotics is expected.

In USA, the Silicon Valley scientists are developing programs for the ideal robot teacher, thanks to which it could determine his mood and character by the expression of a trainee's face in order to develop an optimal style of communication with everyone. Here we are talking about emotionally self-learning robots that psychologically and sensually adapt to the peculiarities of the learner's natural behavior.

The Chinese educational startup "Liulishuo" is very interesting. It received an investment of $100 million. The startup is teaching foreign

languages using AI. A robotic English teacher has already recruited six hundred thousand of trainees.

Japan has long been using information technology in the education process, using intelligent 3D computer games in history, biology, foreign languages and mathematics. In the spring of 2009, a robot teacher, "Saya", appeared in one of the elementary schools in Tokyo. The "Saya" taughts the general base of science and technology lessons. It can smile, and her face expresses six basic emotions: surprise, fear, disgust, anger, joy and sadness. "Saya" looks very much like a real person. Today the Androidization of robots is the most rapidly developing direction of cyberization in many areas of human activity.

According to the Vice-Chancellor of the Buckingham University, Sir Anthony Seldon, the modern AI will be able to choose a teaching style in accordance with the individual characteristics of the trainee. Thus, the need for traditional academic training will completely disappear. Naturally, this is an expected in the future, and not a real, state of affairs in the UK education system.

Renowned British analyst and futurist Ian Pearson says that by 2030, robots will surpass humans both physically and mentally. But Pearson believes that the teaching profession is one of those in which a robot cannot fully replace a human. This is primarily due to the fact that robots do not have critical thinking. They do not know how to create, because this process cannot yet be automated. The modern development of cybernetic systems using AI technology demonstrates some successes in this area. Therefore, it should be reminded about they all learn from the works of real professionals. That is, they are able only to modify the skill styles of advanced people. Consequently, the joint creativity of the teacher and trainees will remain a process of interpersonal interaction between living individuals for a long time, and do not between people and robots.

According to one of the most famous robotic specialists in the world, director of the Intelligent Robotics laboratory at Osaka University, Hiroshi Ishiguro, robots will soon be able to teach in both schools and universities. This is especially true in the case of people with disabilities. Hiroshi Ishiguro believes that such individuals have difficulty communicating with other people, and robots can help them learn and develop, avoiding these problems. The scientist believes that teaching a foreign language with the help of a robot is more productive, since people are more willing to speak a foreign language (without an inferiority complex of this skill) with a robot than with a regular teacher, who is a natural speaker of this language.

It is very important that robot-teachers will not make mistakes and will be able to work 24H a day, since they do not get tired and do not need a break to eat. But for this deal, it is necessary to provide them with appropriate power supply. Of course, robots will not soon be able to replace humans, since their production remains very expensive for the economical effectiveness of the new technologies. The Japanese creators of robot-teachers do not hide that one of the hindering reasons for their implementation is the lack of qualified personnel in many sectors of the economy. There is no doubt that using a robot as a teacher is primarily beneficial from an economic view point. But how will affect the robotization of teaching to the quality of training? Will it get better or worse? Time will put everything in its place and judge the supporters and opponents of cyberization in the education sector.

As an optimistic course of events, we can give an example when, the studying foreign languages is necessary to use elements of non-verbal, facial and even sensory-extrasensory emotionality communication in the process of developing spoken dialogue, which are accessible only for humans. These elements of education will remain necessary in the communication of robots with people, but it do not in the environment of communication between robots. Also, according to psychologists, people remember information in combination

with the emotions and sensations which they receive in the process of social communication. The sequence of human conversation does not always have a cause-and-effect relationship on every day and entertainment topics. That is, the conversation, jumps from one topic to a completely opposite one. Such dialogue between robots is simply impossible. Very often, a personality of the teacher, its individual charm and non-standard methods of knowledge presentation plays really decisive role in the trainee's attitude to the subject being taught and to the entire learning process as a whole.

**2. Advantages of robot-teachers.**

**2.1.** Quite a lot of teaching responsibilities have already been transferred to robotic systems. Take, for example, searching for information to prepare for a lesson. Now a teacher does this 70% via the Internet. Consequently, part of the professional burden is fallen on search engine robots of internet [17]. Nowadays, AI systems built into browsers. They open up even wider spaces, both for quickly finding the necessary information, and for designing progressive ideas and plans of a creative person. Here there are not only answers, here there are a diverse palette of implementations based on the experience of previous generations. All are given to the judgment of the consumer of AI services.

**2.2.** Teachers almost no longer use paper media. They search through Internet resources both for theoretical self-study and as visual aids that support their style of presenting knowledge. The same applies to checking students' test works. In 99 cases out of 100, this is done not by a person, this makes by a computer training system. It notices mistakes much faster than the most experienced teacher. When the teachers check any trainee work, an error may occur due to their very ordinary psychophysiological states, such as fatigue, malaise, etc. This process occurs automatically and more reliably with the help of new technology. That is, we already see quite a lot of advantages that the so-called robot-teachers will bring us [17].

**2.3.** Robotics will also be able to eradicate such a problem in educational institutions as personal hostility towards a trainee. The robot-teacher will always give the grade that the trainee really deserves. Software and hardware training systems contain much more information than one teacher can have. They do not tend to feel tired and forgetful, which is also an important plus for the educational process [18].

**2.4.** One of the opponent's misconceptions of automated education is that AI does not express the emotions that are characterized by teachers when they stimulate trainees to acquire new knowledge. The problem is different. If the trainees are not interested in it and they do not need to study, then no one teacher or robot will be able to instill a love for it. This take place, because any of trainees does not receive emotional satisfaction of education. There is either interest here or there is not at all. No one robot will force them to change. Therefore, there is a rapid development of research in the direction of creating emotional robots that joke well, laugh, get angry, and express doubts and dissatisfaction. This is a more subtle approach to trainee's engagement in studying. However, the robot-teachers are still not able to bring the trainees to a creative understanding of the knowledge taught to them. This is able to do human teachers only. One of the opponent's misconceptions of automated education is that AI does not express the emotions that are characterized by teachers when they stimulate trainees to acquire new knowledge. The problem is different, if the trainees are not interested in it and they do not need to study, then no one teacher will be able to instill a love for it. This takes place because they do not receive the emotional satisfaction of education. There is either interest here or there is not at all. No one robot will force them to change. Therefore, there is a rapid development of research in the direction of creating emotional robots, that can joke well, laugh, get angry, and express doubts and dissatisfaction. This is a more subtle approach to trainee engagement for its

studying deals. However, the robots-teachers are still not able to bring the trainees to a creative understanding of the knowledge taught to them.

**2.5.** The Internet system is a smart invention. It knows how to attract and capture the attention of users. The knowledge and assimilation of new information occurs with its help. Various video and audio formats, presentations, software and training systems, interactive communication, etc. are used here. The creation and use of "digital twins of teachers" on the Internet platforms will be the most promising direction of human educational cyberization. At the beginning, it will be implemented and standardized through the modern chat-bots. After these, the virtual robots will become the real companions of people not only in educational processes, but also in everyday and cultural communication with their own androidized devices.

**2.6.** The applicants for professional knowledge have a strict schedule of classes, determined by the rules of the institution in the standard system of education and training. This takes a lot of time and effort from the trainees. Therefore, they simply do not have the physical resources to implement other personal ideas and own hobbies.

**2.7.** The most important advantage of robotic-teachers is that the trainees are not tied to any place or time of their own lives. They can study at any time convenient for them, devoting exactly as many time periods of life to their own studies as they need, even at home or outside [17].

Studying is not suitable for everyone at online institutions of Internet platforms. Only those trainees, who are sufficiently disciplined and know how to properly distribute their workday can safely take on this option of education. But even the laziest and most unsociable students will enjoy emotional, erudite, and cultural communication with a personal robot. It will be like a pseudo-friend, that the trainee can communicate with and even adopt to their mind, as a "digital twin."

Each of these systems, both traditional and modern, has its own advantages and disadvantages. All exclusively depend on the psychophysiological characteristics of a trainee.

**3. Educational robotic systems.**

The secondary technical educational institutions are trying to introduce disciplines devoted to the basics of robotics already in many countries. However, so far these protections have not provided a noticeable influx of qualified specialists into the labor market. The modern economy really lacks robotics engineers, programmers, RD (Research & Development) specialists, who can work with modern AI technologies. These professionals are demanded in all areas of scientific progress that are related to robotics. This problem is not highlighted with highly specialized jobs only, but broad-based knowledge of the universal prophy men of robotic use.

Unfortunately, the education system is very slow to adapt to the emergence of such new professions. On the one hand, there is no one to teach. Almost all good specialists with knowledge and experience successfully work in enterprises for a good salary. On the other hand, there is nothing to teach without appropriate technical means. The modern technological base of educational institutions is very weak, is not systematized and standardized. Even modern computer simulators, laptops and gadgets cannot yet provide a decent education in the same way as competent teachers do.

To implement robotic learning, it is necessary to modernize the material and technical base of educational institutions. Also, this has to master the new technologies and training standards both from government stuff and from the teaching staff of educational institutions. Both sides are interested in the young graduated personas, which will be ready to work in the unplowed field of modern technologies.

Private companies have begun to attract students more often to solve promising, non-critical problems. They are engaged in testing ideas, prototyping and developing new areas of their innovative activities. At the same time, many companies are striving to open their own training centers for robotics-oriented specialists. That is while educational activities in this area are able to become a promising profitable business area.

In the nearest future, humanized robot-teachers will be able to replace a flesh-and-blood teacher in 70%. However, mass standardization of educational programs will also lead to an increase in the simultaneous shortage and popularity of advanced human teachers for remaining 30%. But they just have to become the "super teachers". The teachers will be need to find a new and unique approach to presenting knowledge to their trainees for remaining relevant and in demand by educational system.

Experienced teachers will teach robots, and the last will teach and prepare young people to communicate with primary sources of knowledge through communication with the "omniscient" AI of their mobile and stationary Internet communication devices.

**4. Analysis of the scientific thought achievements in the field of robotics.**

In the monograph of professors O.L. Figovsky and O.G. Pensky write: "In 1977, the American science fiction writer Isaac Asimov (well-known popularizer of science and biochemist) published an essay "New Teachers". In this article he proposed creating for each human a special teaching machine that could analyze his level of knowledge and, accordingly, automatically set the course of study for him. To ensure that older people do not lose their imagination and creativity and become a burden to the ever-decreasing number of active young people. He also proposed to have and to modify our education system so that a person continues to learn for the rest of his life. "But how to do that? Where to get so many teachers?" - Asimov thought. Another excerpt of

this author's thoughts reads: "Humans will never be able to replicate many of the functions that technology performs; technology will never be able to replicate many of the functions that humans perform. People and technologies work in different hemispheres of the human brain, and to assume that a robot-teacher can replace a full-fledged person means fundamentally misunderstanding the potential and limits of development of our civilization."

February 7 is World Robotics Day. According to legend, it was on this day that Isaac Asimov formulated three well-known laws of robotics:

*1. A robot cannot cause harm to a person or, through inaction, allow a person to be harmed.*

*2. A robot must obey all orders given by a human unless those orders conflict with the First Law.*

*3. A robot must take care of its safety to the extent that this does not contradict the First and Second Laws."*

AI has the ability to improve our lives in the same way that previous technologies have done for centuries, while at the same time enriching social interaction with a new quality of current life. This is a win-win solution for all participants in the evolving progress of the modern science and technologies. We all hope that robotics will benefit society and its development make people happier.

Education via Internet TV is developing at a tremendous pace. A significant percentage of children will no longer attend educational institutions on a regular basis in 10-15 years for developed countries. We are already seeing this due to force majeure circumstances in Ukraine now. Any training course of lectures will be able to path with a computer, with a TV or with a smartphone. That means, the studding and training programs will become individually selective!

Scientists such as P. Baxter, W. Browne [4] note that memory is a necessary condition for any form of learning. However, if the robot remembers

every detail of the events that take place, then over time its memory will overflow. One of the solutions that scientists offer is mathematical modeling of the forgetting mechanisms and the processes of generalizing information.

L. Correia and A. Abreu [5] model such mental processes as fatigue (satiety) and forgetting in their robot interpretation.

Z. Kira and R. Arkin [10] use the Case Based Reasoning system. They describe several strategies for defining a use case of information overflowing that is deleted when memory becomes full.

S. Freedman and J. Adams [7] propose the Act Simple forgetting algorithm, which, with some modifications, combines the special algorithm, which simulates the erasure of information from memory over time, and the additional algorithm, which simulates memory robotic interference under user management, i.e. generalization of information by human.

A number of foreign scientists (F. Alnajjar, A.A. Freitas, W.C. Ho, M.Y. Lim, P.A. Vargas and others [2; 8; 11; 12; 13; 14]) model the process of forgetting on based of the information presentation in the forms of a structural hierarchy of the accumulated data. During the robot's life, vertices are created in the hierarchically organized structure of its memory that reflect the events of the surrounding world. The authors of the development set limit metrics that determine the importance of such vertices and the possibility of deleting them when memory is full.

D. Dorner and K. Hille [6] reflected three components in the robot model: motivation, emotions and cognitive processes. The robot's motivation is represented by its need to survive. Emotions are responsible for the mechanism for controlling its cognitive processes in order to satisfy its needs.

Several shortcomings can be identified in the above developments and generalizations. For example, L. Correia and A. Abreu model fatigue in isolation from memory and forgetting, not taking into account the fact that in human psychology these concepts are interrelated. The level of the robot's reaction to a

stimulus during the period of fatigue remains constant, although in humans it decreases. A common drawback of all modern scientific directions is that their authors solve highly specialized problems and do not describe the "general psychology" of robots in the full range of their promising activities. However, they are all right that the principles of robot memory functioning should be borrowed from humans.

Professors O. Figovsky and O. Pensky proposed introducing the concept of a "digital twin of a person" continuing to develop the idea of the borrowing principles of the human brain for robots. By "human digital twin" they mean an emotional robot, where the input parameters of mathematical models of its "characteristic behavior" are psychophysiological parameters measured in a specific human person [19].

Let us note that a "digital twin" is only a certain psychological analog of a personality, and not a complete copy of a person since it is impossible to create a psychophysiological copy due to the unique lifetime development of each member of our society.

If we give a home personalized "digital twin of a trainee" knowledge about the its biorhythms of its owner, then the speed of self-learning can exceed the speed of real teaching. Here they have faced with a new type of technological relationship: the "digital twin of a teacher" and the "digital twin of a trainee". It turns out that cybernate communication between teacher and trainee can be organized through virtual "semi-personalities». This will allow "them" to remember clearly the entire history of acquiring knowledge without losing the material covered and the skills acquired in the educational process. Even if the teacher forgot something, the "digital twins" will always be able to recall and to remind what was missed, regardless of the time these people met.

Let us dwell on the description of the results of the "relationship" between robots and human digital doubles. We will assume that the robot, unlike the "digital twin" of a person, has absolute memory, i.e. doesn't forget anything.

In the theory of digital twins, the theorem has been mathematically rigorously proven:

*"Robots with absolute memory are dangerous for humans!"*

Danger to humans should be understood as psychological suppression of the "semi-personality" of the "digital twin" of humans by a robot with absolute memory. Therefore, a necessary safety for a human is that his "digital twin" does not have absolute memory. A computer which is not infected with malware is a robot with absolute memory because it does not forget anything. Therefore, another theorem is no less important:

*"Any "digital twin" that works for a long time in a computer software environment will become computer dependent without doubts."*

PC addiction is proposed to be understood as the psychological suppression by a computer of both a human "digital twin" and his personal individuality.

Currently, we everywhere observe people's computer dependence on mobile devices, since almost all residents of cities and villages use gadgets for a long time. In other words, a person already loses a sense of confidence if go out home forgets own mobile phone.

*"Unfortunately, computer addiction, as the theorem states, cannot be avoided by any of us!"*

**5. General analysis of basic terms and problems of AI.**

Currently, all developed countries have rushed into an unrestrained and historically unprecedented race for artificial intelligence and its harsh implementation into the life of society. However, there is still no uniform definition of artificial intelligence (AI) still, and therefore it is not entirely clear what exactly scientists, politicians and businessmen are introducing into society?

Let us present, in our viewpoint, the most successful classification of AI, which essentially reduces a single understanding to several definitions, based on the tasks of this scientific phenomenon for civilization development.

**5.1. Modern AI terms** [15].

In 2018, conferences on human-level artificial intelligence, artificial general intelligence, biologically inspired cognitive architectures, and neuro-symbolic technologies were held simultaneously in Prague at the Czech Technical University. The conferences featured presentations by leading specialists from companies and institutions leading in the field of AI: Microsoft, Facebook, DARPA, MIT, Good AI. These reports outlined both the current state of developments in the field of AI, as well as the unresolved problems facing society, and also threats are arising from the further development of this technology.

However, the first of all, it is necessary to clarify the meaning of some terms that are commonly used in conjunction with AI in various contexts:

1) *Weak or Specialized AI* is represented by all existing solutions without exception and assumes the ability to automate the solution of one specific task, be it playing Go or recognizing faces on the video cameras. At the same time, this AI has no possibility of independent learning of other tasks without reprogramming by human.

2) *Autonomous AI* assumes the ability of a system to function for a long time without operator intervention. For example, it allows a drone equipped with solar panels to make a multi-day journey from the Champs Elysees of Paris to the Independence Square of Kiev or in the opposite direction, independently choosing both the route and the places for intermediate landings to recharge own batteries, while avoiding all kinds of obstacles under its way.

3) *Adaptive AI* assumes the ability of a system to adapt to new conditions, acquiring knowledge that was not included during creation. For example, allow the system for maintaining dialogues in English to independently master new languages and apply their knowledge in conversation, getting into a new language environment or based on studying educational materials for these languages.

4) *General AI (AGI)* assumes such high adaptability that a system possessing it can be used in a wide variety of activities with appropriate training. Training can be either independent or directed with the help of an instructor.

5) *Human-level AI* assumes a level of adaptability comparable to a human thought, that is, the system is capable of mastering the same skills as a human within comparable training periods.

6) *Superhuman-level* AI implies even greater adaptability and learning speed. Thus, the system can learn the knowledge and abilities that a person, in principle, cannot do.

Despite many advances in neurobiology, today no one knows exactly how natural human intelligence works. Accordingly, no one knows exactly how to create modern artificial intelligence. There are a number of well-known problems that require solutions for its creation. Also, there are different viewpoints regarding the priority of achieving certain solutions. For example, the head of the international open source artificial intelligence projects OpenCog and SingularityNET, Ben Goertzel, believes that all the necessary technologies for creating General AI done, in principle, already been developed. It is only necessary to combine them in some correct way to obtain such synergy, the result of which will be the emergence of General AI [17]. Other experts are more skeptical, they believe that fundamental solutions to many of the problems that will be listed below are needed. The time frame varies greatly for the emergence of Strong AI. The period of its realization is from ten years to several decades.

At the same time, the emergence of Strong AI is quite natural within the framework of the general evolutionary process. It is just as the emergence of molecules from atoms, cells from molecules, organisms from cells, the separation of specialized cells into the central nervous system, the emergence of social structures, the development of speech, writing, and ultimately - information technology. Simultaneously, it is important to realize that in order to

build Strong AI no necessity to understand how it works, since it is not necessary to understand how a bird flies in order to make a rocket. Obviously, this will be done sooner or later in one way or another, or perhaps in several ways.

**5.2. Fundamental problems of AI** [15].

Most experts identify the following as problems that have yet to be solved in order to create General or Strong AI:

1) *Few-shot learning* is the need to build systems that learn from a small amount of material, in contrast to existing deep learning systems that require large volumes of specially prepared training material.

2) *Strong generalization* is the creation of technologies for recognizing situations in which recognized objects are encountered in conditions different from those in which they were encountered in the material used for training.

3) *Generative or generating learning models* are the development of learning technologies when the object of memorization is not the characteristics of the recognition object, but the principles of its formation. These models will be able to make the possibilities to reflect the deeper essences of the recognized objects and carry out faster learning and stronger generalization.

4) *Structured prediction and learning* are the development of learning technologies based on the representation of learning objects in the form of multi-layered hierarchical structures. It means where the lower-level elements determine higher-level ones, which may be an alternative solution to the problems of fast learning and strong generalization.

5) A solution to the problem of *catastrophic forgetting* is inherent in most existing robotic systems, which, being initially trained on one class of objects, then became taken a further trained stage of recognizing on a new class of objects, lose the ability to recognize the objects of previous classification.

6) Achieving the possibility of incremental learning, which presupposes the system ability to accumulate knowledge and improve its capabilities

gradually, without losing previously acquired knowledge. The ideal goal is to pass the "Baby Turing Test", in which the system must demonstrate the ability to gradually master language from the level of an infant to the level of an adult.

7) A solving the problem of AI Consciousness involves the formation of a proven working model of conscious behavior. This will provide effective forecasting and goal-directed behavior through the formation of its "internal picture of the world", within which it is possible to search for optimal behavioral strategies to achieve set goals without actual interaction to the real world. It significantly increases the safety of testing hypotheses, and also increases the speed and energy efficiency of this test. It will thereby create the possibility of self-learning of a living or artificial system in the "virtual world" of its own consciousness. From an applied point of view, the problem of consciousness has two sides. On the one hand, the creation of conscious AI systems will dramatically increase their efficiency. On the other hand, the emergence of consciousness in such systems raises both additional risks and ethical questions for human. Since such systems can be equated in terms of self-awareness to a person, with the ensuing consequences in the legal field of our life.

**6. Potential threats of AI** [15].

The emergence of systems, even Simply autonomous or Adaptive, and even more so General or Strong AI, is associated with several threats of varying scales that are already relevant nowadays:

*The firstly*, a threat to a person can be posed by intelligence that is not necessarily Strong, General, Human or Superhuman level, since it is enough to have an autonomous system that operates with large volumes of information at high speeds for our daily routines. It is dangerous, because the "autonomous lethal weapons systems" can be created - Lethal Autonomous Weapons Systems (LAWS) on basis of this AI kind. The simplest example of which is: the modern drones are used for war goals. They are printed on 3D printers both on a mass scale and in small batches in artisanal conditions.

*The secondly,* a threat to a state can be posed by a situation where another state (a potential aggressor) acquires weapons with more Adaptive, Autonomous and General AI that increased reaction speed and predictive ability in any (political and real) battles.

*The thirdly,* a threat to the whole world is posed by a situation arising from the previous threat, when the states enter a new round of the arms race, improving the intelligence levels of autonomous weapons of destruction.

*The fourthly,* a threat to all is posed by any, not necessarily a combat AI system, but also an industrial or household intelligent system with a certain degree of Autonomy and Adaptability. They are capable not only of purposeful action but also for conscious goal setting. It means the autonomous setting of these systems can lead to the setting of goals that contradict the goals of human beings, and the system will have much greater opportunities to achieve these goals. It may happen due to its higher speed perception, a larger volume of processed information, and greater predictive ability. Unfortunately, the scale of this particular threat is not fully understood by our community.

*The fifthly,* a threat to society is posed by the transition to a new level of development of production relations in a capitalist or totalitarian society. It is means, when a smaller part of the population gains the opportunity to control material production, excluding the overwhelming majority of the population from it due to even greater automation. This can lead to even greater social stratification, a decrease in the effectiveness of "social elevators" and an increase in the mass of "extra people" with corresponding social consequences.

*Finally*, the threat to humanity can be posed by the automatization of global computing systems for data processing. The so type of information dissemination can lead to social phenomena that are unpredictable from the standpoint of existing management models and decision-making based on the social global networks spreading. Since the speed of information dissemination in such systems of human being will be deltoid by their scale of impact. For

example, the social credit system being introduced in modern China social living is a unique experiment on a civilizational scale with consequences that are unclear to date.

The complexity of control over the different AI systems today is due, in particular, to the "closedness" of existing application solutions based on "deep neural networks". This situation does not allow verification of the correctness of decision-making before their execution only, but even after the fact for analyzing the decision that was accepted by the AI machine. Solving this problem is now being addressed by both the new direction of "Explainable Artificial Intelligence" (EAI) and new interest in the integration of associative (neural network) and symbolic (logic-based) approaches to this problem.

It seems absolutely necessary to take advance measures to prevent catastrophic scenarios of the AI development and technologies of their application.

A state support for work aimed at solving the identified problems, especially "well-explainable AI" are insensible. There is also the integration of various approaches to studying the principles of work for creating goal-setting mechanisms in order to obtain effective means of programming and control of intelligent systems. It means, that AI programming is not a rule for robots, but their hardware structured human values, which have been under our full control.

Democratizing access to AI technologies and methods, for example by reinvesting revenues from the implementation of intelligent systems into mass education in computing and cognitive technologies. The same story is present with creating open source AI solutions and developing incentives for existing "closed-code" AI systems, which be opened in the nearest future for developers. For example, the "Aigents" project aims to create personal AI agents for mass users, working autonomously and not subject to centralized manipulation.

The regulation of AI algorithms are protocols for the operation of distributed data processing systems and decision-making based on them with the

possibility of independence audit by both international and government bodies and private individuals also. One of the initiatives in this direction is the creation of a platform and ecosystem of open source AI applications, SingularityNET.

**7. Innovative model of relationship between robots and people.**

Human memory is a complex and fascinating cognitive process that allows us to perceive, store, and retrieve information. It plays a crucial role in our daily lives, shaping the experience of our personal worldview. This article proposes the author's development of a fundamental model of human memory. We hope it will facilitate understanding of the fundamental structures and vital functions of people, and also show the rational limits of the capabilities of robotic systems. By mastering the semantic load of verbal definitions of the different degrees of organization of levels, types, types and types of memory, you can obtain valuable information about the work of human Mind. This will improve the cognitive abilities of the individuals to study and master various information about themselves and their environment. The more we are aware about ourselves, the better the robots will be in helping us improve our lives.

**7.1. Memory processes or interaction between source and consumer.**

The memory can be thought as a dynamic interaction between the source of information and its consumer. The basic model illustrates this process through a closed loop of natural connections in which information from experienced events is processed. There are two main modes of interaction: when the external environment supplies information and a person perceives it, or when a person becomes a source of information for the external environment. These interactions are necessary for three vital operations: perception, storage and reproduction of information. We can also add operations of internal processing of old and creation of new information, but these are the same processes of perception, storage and reproduction, only by the organism itself without interaction to the external environment. (See Fig.1).

*"Robots are organized in the same way, only they are still technologically limited in phisical reproducing the results of acquired knowledge."*

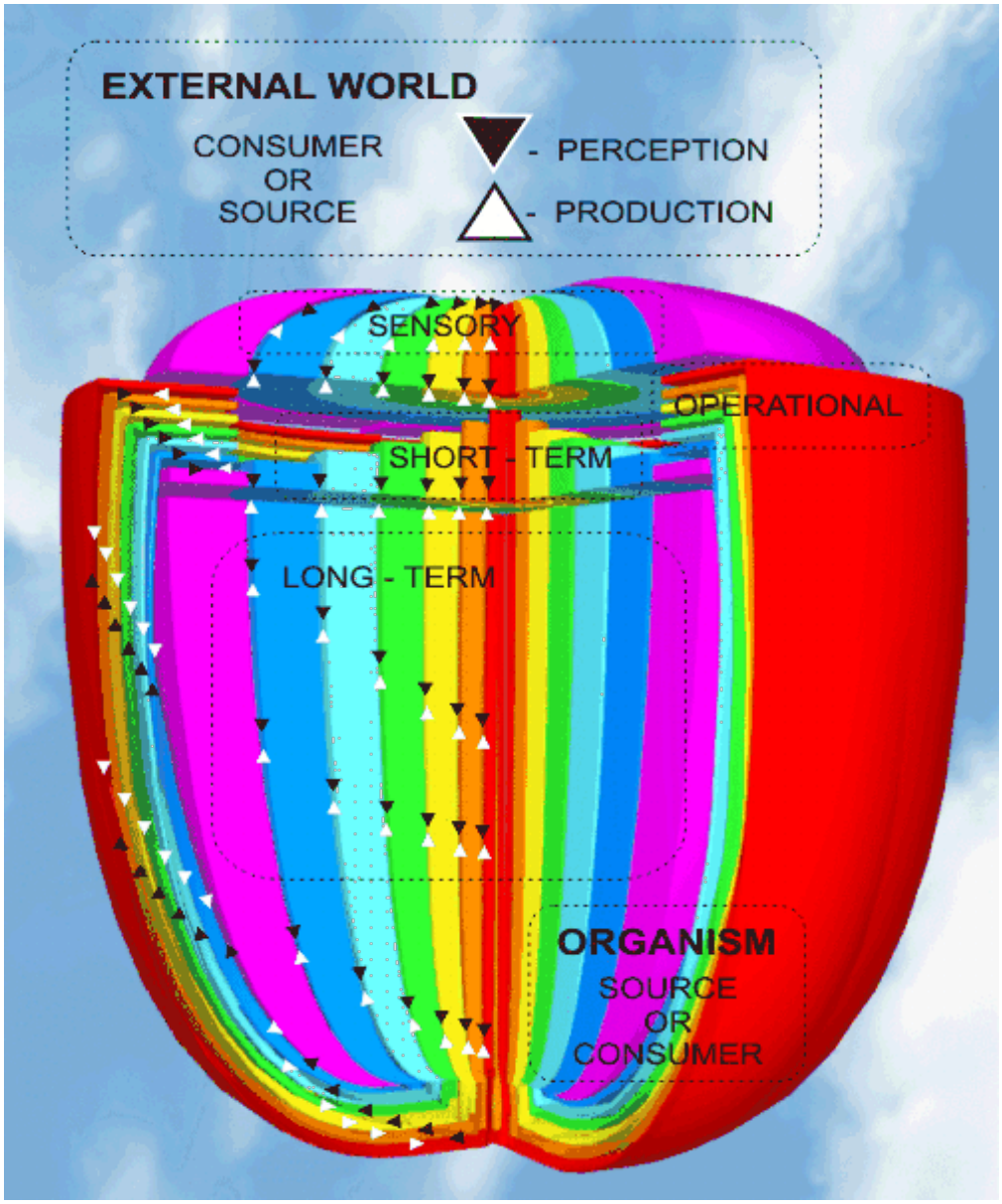


**Fig. 1. Abstract model of Human Memory. © 1984 - 2024 A. Herashchenko**

### 7.1.1. Perception: the role of the external environment.

The human perception is the initial stage of memory, where the external world serves as the source of information, and the individual acts as its consumer. The perceived material is divided into three components: stimulating, selective and residual. The stimulating component prepares the consumer to assimilate the incoming information by comparing existing knowledge with new

information of perceived data. This comparison leads to a selective process in which only the relevant parts of the material of interest are retained and the rest is ignored. The address and selective components form the basis of perception lay the foundation for further memory processes.

*"In robotic systems, the sampling of information is less than human, since their sensors do not perceive the entire palette of events, because they take only their own, defined by the developers for the solution of specific tasks."*

**7.1.2. Targeting and selection: interaction of external and internal factors.**

The processes of addressing and selection occur in the individual order of external-internal perceptions. These involve identifying specific stimuli and determining their significance. The most recognizable and physically easily determined part of the perceived data array, i.e. a quickly discernible feature of perceived information is called an "address". It acts as an intermediary between the source of information and its consumer. The acts are representing the primary interaction between an arbitrary flow of information and the potential possibility of processing it. That is the long-term memorization and subsequent reproduction of the necessary interpretations of the generally mastered part of memory taken place. The address allows the body to collect enough interesting data about external events, contributing to the formation of reflexes to associated data. It also provides storage of selected information about these events and determines the purpose of its reproduction in the future.

*"Robots do not necessarily need to collect and store information about dynamic changes in their environment, but these are vital for the people. The robot's existence depends only on monitoring the operating time of its power source. Otherwise, it is almost eternal in its intended purpose of use by owners."*

**7.2. Memory levels: or temporary depths of information storage** [9].

The temporal aspect of information retention in human memory is critical to understanding how it is perceived, stored, and recalled. American scientist

Donald Norman [16] conducted laboratory experiments to determine different levels of memory retention depending on the amount of information processed. As a result, three levels of its preservation were identified: sensory, short-term and long-term. (See Fig. 1).

**7.2.1. Sensory memory: instant impression.**

Sensory memory stores a direct imprint of all incoming information captured by the senses. This level maintains an accurate and complete view of the outside environment that can be stored for a very short period from 0.1 to 0.5 seconds. Sensory memory acts as a temporary buffer, allowing a person to process the stimuli and decide whether to transfer incoming information to the next level of storage.

**7.2.2. Short-term memory: temporary storage.**

The short-term level of memorization ensures the preservation of the interpretation of received information from the sensory level of memory. This level stores selected parts of the sensory-acquired data, retaining them for periods ranging from 0.5 seconds to several hours. Short-term memory is responsible for the active manipulation and repetition of the processed parts of information. It provides cognitive processes such as decision-making, understanding language, etc.

**7.2.3. Long-term memory: permanent storage.**

The long-term memory is the most reliable level of storage of information. It includes repeated reproduction of past experiences. This level provides long-term storage of information about external events and human reactions to them. Unlike sensory and short-term memory, long-term memory is capable of retaining information throughout a person's life. It plays a vital role in the formation of reflexes and the accumulation of any knowledge and experience in their application.

In addition to the three scientifically established levels of memory, the proposed model proposes the concept of the "working memory" level.

**7.2.4. Range access memory (RAM): working storage.**

This level acts as an operational link between the short-term and long-term levels of memory. It dynamically stores and retrieves associatively selected information from long-term memory storage by means of addressed stimulus from sensory storage level. That is, it allows to perceive or reproduce information not only about current events, but also to unearth the truth about the past, as well as model the course of the future. This level of memorization ensures the process of continuous comparison of accumulated knowledge with information from the external environment. Its basis helps to make forecasts for their future use. In addition, it may cause the modeling of unreal events, as well as erroneous forms of their relationship. It is defined by fantasies of disordered human desires.

The operational level of memory promotes temporary, periodic or permanent storage of details of selected information data parts, depending on their relevance and significance. That is, it provides associative connections between known and unknown information about the environment of their existence.

*"Without the physical implementation of all the above memory levels, the existence of robots is simply impossible. This is a necessary and sufficient condition for the operation of cybernated systems of any complexity."*

**7.3. Types of memory or evolutionary stages of its organization** [9].

To gain a complete understanding of our memory, it is important to study the evolutionarily acquired types of its hierarchical structure. This model identifies seven dominant types of human memory organization, each of which represents separate stages of its biologically gradual modernization. (See Fig. 2).

**7.3.1. The degree of MOTOR character.**

***This is a type of memory about the Movements of a living Organism, clearly distinguished by the ability to reproduce its own kind.***

This type of human memory "lives" in the range from the bodily realized gene codes of parental heredity to meaning fully intelligent speech and motor actions of a person's creative life. It stores information about the motor abilities of human organism, i.e. about his biological, mental, social and individual skills of physically realized behavior.

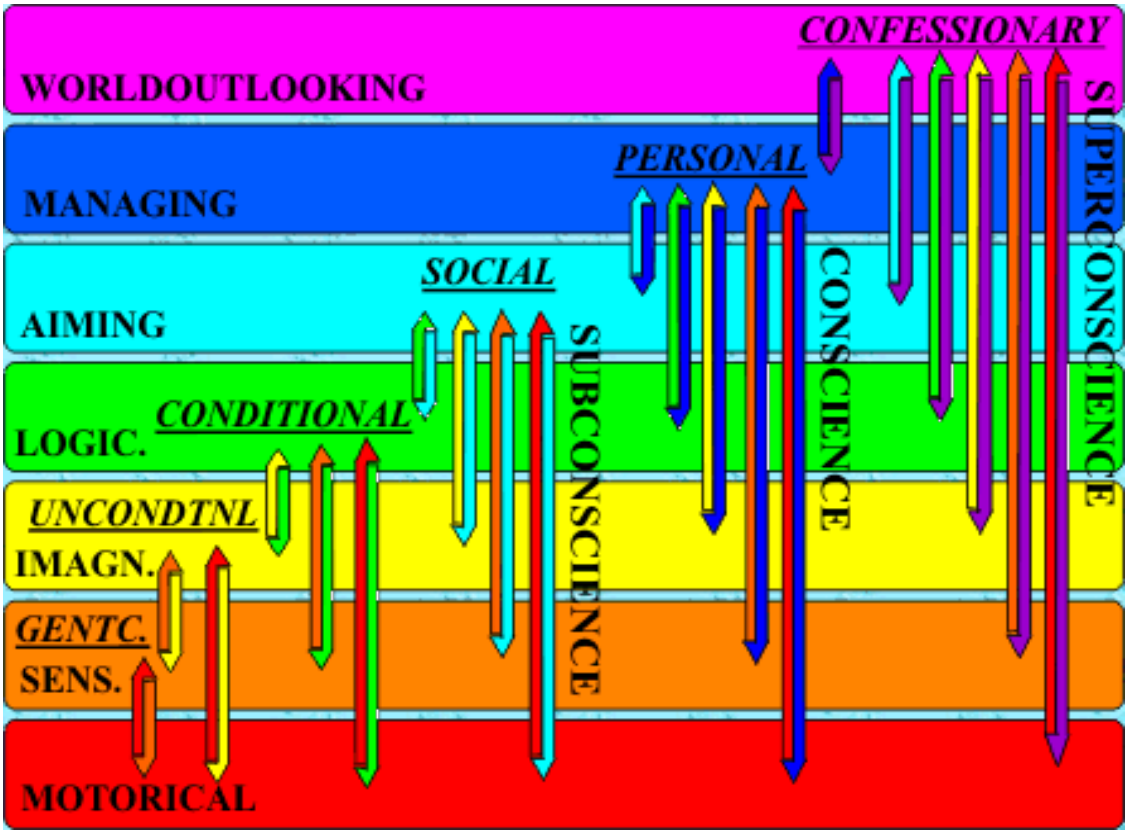


**Fig. 2. Classification of Human Memory. © 1984 - 2024 A. Herashchenko**

The Motor memory type focuses on remembering physical movements inside and outside a living organism. It covers a wide range of activities: from genetically determined movement patterns to consciously controlled behavior in the spheres of transformation of the external environment. This memory type plays a critical role in the development of human self-preservation, allowing people to acquire and improve motor skills throughout own life. It responsible for height, sex, facial expressions, gestures, speech, dancing, sports, work, etc.

*"For robots, this type of memory is modeled using optical, electric, liquid or pneumatic drives of mechanical devices that are capable of copying the*

*movements of living organisms, but with much greater accuracy and speed of execution than in humans. This is determined only by the modern degree of their cyberization."*

**7.3.2. The degree of SENSUAL character.**

***This is a type of memory about the Organism's Reactions to the influences of environment and Itself; clearly distinguished by its ability to adapt to the various life being conditions.***

In general, this is the memory of the development processes for maintaining the Organism's responses to eventual influences of the external environment. Next, let's take a brief excursion into the evolution of the planet flora and fauna, slightly distracting from the direct topic of this subsection.

The widespread "Amoeba" is considered one of the first simplest single-celled organisms on Earth. The smoothly changing covers lay of "Her" gelatinous body are capable to change the direction of its body shape and movements depending on the location of consuming food. There is no nervous system here, but "Sensitivity" is already present. The differentiation of cells arose according to the principle of "division of labor" for their own life support with the transition from unicellular to multicellular organisms. These are precisely done, what determined the development of this memory type of most vivid organisms. It exists due to the corresponding specialization of physicochemical mediators of intracellular response to irritations of the external environment.

Further, in the course of the organism's evolution, the rudiments of the nervous system raised. At the beginning, this was carried out in a one-dimensional ("such as strict orientation along a ray") organization of the life of materialized tissues. At the next stage, the structural changes became occurred a two-dimensional ("planar orientation") system of habitat reflections appeared. After that evolution was required a more flexible response to changing conditions of existence, and the organization of the nervous system became

volume-oriented (three-dimensional). Subsequent steps of progress led to the formation of four or more-dimensional systems of vivid organisms.

Now let's return to the explanation of the introduced concept the Sensual type of human memory. The first of all we start with the definition of emotions: *"EMOTIONS /in Latin - shock, excite/ - are subjective reactions of humans and animals to the influence of internal and external stimuli. Feelings are the highest product of emotions."*

In our sense, the understanding of the "SENSUAL" word is significantly expanded by connecting the semantic load of such a more biological concept as "Sensations". This allows to determine the boundaries of the action of "ITS" semantic load from primitive control of the temperature balance, humidity and satiety to such "shrines" of people as "Unforgettable love" or "Selfless devotion to the Motherland". Grief, resentment, pain, joy, sadness and heat, happiness, health, laughter – these are the FEELINGS for everyone!

The Sensual memory type involves the accumulation and presence of emotional memories of personal experiences of experienced events. This allows people to remember specific episodes of their lives, including the associated body reactions, timing and details of emotionally experienced events. It can be called episodic. This type is the basis for autobiographical memory, allowing human to form different feelings of self and support them with an emotionally corresponding state of own body. This always makes its unique contribution to the sensory reproduction of personal information about the past, present and future course of events in one's life. This type is called "Emotional memory" in modern classics science. It includes the formation and recall of experiences recorded in reflexive and personal standards of one's feelings. That allows people to remember past events, both positive and negative, as well as the emotions that accompany their own life circumstances.

*"These processes are alien to a robot, because they take a lot of energy from its power source. Therefore, it is clearly not rational to load the "digital*

*twin" with such a heap of sensually-associative connections. It is easier to imitate them with more or less suitable facial expressions of their humanoid interface. For interactions between robots, this level of complexity is simply not needed, since the priority of their work is initially determined by saving their own energy resources."*

**7.3.3. The degree of IMAGINATIVE character.**

***This is a type of memory of the Organism about the Forms of the external environment of Its life, which is determined by the processes of visual comparison of the relationships of Their parts; It is clearly distinguished by own ability to navigate remotely in the spaces of its habitat. (See Fig. 2)***

An area of influence of this type of memory extends from the distinction between light and darkness, their shades and colors to the "boundless sea" of fantastic dreams and the "highest peaks" of the creative imagination of scientists, writers, artists and sculptors. It is necessary to beware of the tempting idea that "vision" is that Figurative type of memory. "It" provides only the initial "food" for the development of a given degree of human life organization.

The rainbow colors of the sun and morning forest, emerald grass of Alpine meadows and rock crystal of glacial waters, heavenly blue of the abysses and flaming palm trees of the evening tropics, tanned faces of rejoicing friends and slender, torn script of ancient manuscripts, a snow-white scattering of formulas on the black field of a school board and an enthusiastically funny mathematician , parents who have been waiting for news and children rushing into a highly automated future, and much, much more through images of cinema and life of the "Fantasy land " to ward the radiant future of descendants!

*"This set of figurative associations is clearly not interesting for the robots themselves, but it is necessary for people, which use the technical capabilities of them. Automation of this memory type is based on the development of sensors of external influences that exceed the limits of the spectral sensitivity of our eyes.*

*Usually, robots have other type of sensors. These sensors allow us to see phenomena that are beyond the biological capabilities of humans. The robots give a computer interpretation of such information to a person by symbolic and visual forms that are accessible to our vision."*

**7.3.4. The degree of LOGICAL character.**

***This is a type of memory about Sequences of events experienced by the Organism; stands out clearly by defining the strict order of cause and effect of their appearance, as well as the ability to determine intervals of periodic stability of these processes. (See Fig. 2)***

It is already difficult to set any sensible explanation of framework for SUCH organization of vivid activity. The essence and work of this sphere of memory will be able to help us explain only the principles of elementary logic, well known to mathematics. They are quite simple: "AND", "OR", "NOT" in an abbreviated form acceptable for explanation. It means that if the current moments of united cause-and-effect chain of occurring events are connected by "ONE OF THE THREE" mentioned operations. Then this is a work of the Logical memory type. Its scope of action is determined by the strict continuity of the chain of consiquence actions connected by the operations: "AND", "OR", "NOT". Of course, when the events do not use any combination of "THEIR" actions were simultaneously being observed.

Without "logic" don't meddle in "society" now! This will be outraged the people by your "lack of education", naivety, and maybe even extravagance. Because a logically rigid sequence of obvious reasoning is required such as: the sun rises in the East "AND" sets in the West, at night "OR" during the day, a fish is "NOT" a bird, chicken is "NOT" a person and other our "pseudo wisdom» of life.

*"The current stage of robotic cyberization is based on a strictly defined digital logic of these "THREE" operations. Even long linguistic AI models are written on processor's hardware that still rely working on the "Bit base" of*

*Informational organization ("YES or NO"). It is here that robotics has achieved the best results in the technological production of automated and cybernetic devices. If replacement of these restrictions will be done a measured unit of information from a "Bit" to a "Qubit" will lead to a complete replacement of the entire fleet of communication means. If now a modern smartphone can already replace an old laptop, then with the transition to the new Qubit technologies, a device of the same size will be able to replace computer servers of entire states."*

**7.3.5. The degree of TARGET character.**

***This is the memory type of Organism about the Structures of the desired course of events realization; stands out clearly by the optimality of its decisions among alternative ways to achieve the intended results. (See Fig. 2)***

The original sources of the human mind are hidden in this degree of memory organization, the sphere of narcissistic purposefulness of which sometimes reaches the vast expanses of the Universe. But the fixations of so huge volume of information arrays are still definable and possible to describe. It is partially manifested in the use of fairly familiar words, such as: "Phenomenon", "Essence", "Connection" and the like. Of course, this is not a "chair" or "bench", where everything is logically clear and figuratively imaginable. With "Such Words" it is much more difficult, because "Each" of "Them" sticks wherever you want. Let us call upon the mathematical theory of "Series of Integers" to interpret the polysemy of "These" words. We make commence with the first Row: "1, 2, 3, 4, ..., infinity." Let's call "It" the first infinity and go ahead to count by infinities: "1st infinity, 2nd infinity, 3rd infinity, 4th infinity, ..., infinity of infinity." The mathematicians call "such a thing" as "Aleph-zero". Next, we will try to make do with the proposition that the degree of organization of the Target memory type is formed due to the mastery of the natural Structure of many times repeated phenomena. This allows

the organism to use the structurally specific information content of endless cycles, which are fundamentally similar to the concept of "Aleph-zero".

Any desire of a human head forms a large or small Goal. It generates a search for optimal solutions how to overcome the necessary problems in deals of its implementation. The further process already depends on the execution of the found structure of repeated actions used to achieve the desired.

The human lives are manifested in the ability to quickly overcome any difficulties. In other words: "These are the skills of making wishes come true!"

*"The appearance of such abilities in robots is accompanied by the achievements of modern programming algorithms that use models of cyclic processes with established criteria for a satisfactory result. Such cybernetic skills give machines an indisputable advantage over people, both in terms of the number of successive searches of different options for solving problems, and in the speed of finding optimal solutions. Automation of these processes allows people to save a lot of time for personal life. Therefore, improving the efficiency of such algorithms at this stage of cyberization plays a decisive role in the development of robotics. No one will refuse a home implementer of their household wishes or a personal executor of routine work in the work team!"*

**7.3.6. The degree of MANAGERIAL character.**

***This is a type of the memory Organism about the Principles of its own organization of natural phenomena perceptions; they are clearly distinguished by the ability to naturally predict the course of upcoming Events, as well as the ability to change the spatiotemporal characteristics of its habitat. (See Fig. 2)***

This is the memory type that distinguishes Human from the monkey "so similar" to Him. The mathematical, physical, and chemical analogies of these memory work are very voluminous and difficult to describe narratively. Therefore, let us immediately turn to the classical definition of the word Principle: *"PRINCIPLE /from Latin - beginning, basis/ - the main starting*

*points of any theory, teaching, science, worldview, political organization; the internal beliefs of a person that determine his attitude to reality, norms of behavior and activities; the basics of the design or operation of any device, machine, etc."*

Considering to the mentioned above, the work of the Managerial type of memory can be explained by examples from ordinary life being of developed countries. Its influence is observed both in the areas of complex organization of any economic enterprise or in government institutions, and usually in the areas of scientific and everyday planning for upcoming Events move!

*"The robot's formation with this memory type remains an insurmountable problem for cyberization of any their production. Only a human is capable to generalize the information of such huge volume. Exclusively the humans are able to determine the points of support for organizing their personal and social life. The robot cannot engage in self-analysis and "self-correction" of wrong settings. Only its manufacturers can do this. They provide robots with a foothold for self-healing in the event of problems and establish the boundaries of their powers. Any AI can initially be programmed to self-destruct at the command of its owner. These devices must be blocked for programing to freely replicate their own kind. Otherwise This is tantamount to the suicide of the "author-parents". Therefore, the following postulate takes place in the Legislation on the areas of further development of robotics:*

*Robots are allowed to produce robots below the level of its own organization only."*

**7.3.7. The degree of WORLDOUTLOOCKING character.**

***This is the memory type of Organism about the Laws of evolutionary development of the experienced events; it is clearly distinguished by the universality of the reflexively mastered rules of the vivid existence of nature for the benefit or harm of other organisms. (See Fig. 2)***

This memory type has so far found its application only in the field of highly moral ideals of Religion, and in truly progressive creations of art and science due the past and present eras of our Civilization development. This is the first source, where the true of the human Mind is hidden!

*"Robots are not characterized by systems thinking. They cannot cognize and master the laws of Nature. They can only see what is invisible and intangible to us, collect and sort information about these phenomena, look for the shortest ways to solve the problems, polish texts and poems by copying the best writers and poets, redraw what has already been drawn by different styles of fine art of people. The main difference of robots is their unableness to discover and create own Laws of Natural Existence. Therefore, even a "digital twin of a person" is not able to bring anything into the systemic patterns of the civilization development. Hence the conclusion of the next postulates of robotics takes place:*

*"Robots and even different AI have to be inferior to their creators always. The main thing is that their creators have not to degrade below the level of their creations!"*

*Automation and cybernavigation of many processes will force people to change their lifestyle and develop a new type of memory in their bodies. Robotization of many areas of our lives will change the information standards of human awareness of the true Nature Laws."*

**7.4. KINDS of Memory or means of Its formation and development.**

A school biology course introduces us to an interesting concept: *"REFLEX /Latin - reflection/ is a natural reaction of the body to changes in the external and internal environment, carried out through the central nervous system, in response to receptor irritations."* Due to the fact that the historical meaning of the "GIVEN WORD" is REFLECTION, and IT is inherent in any memory Type, Level, Kind and Genus. We will be interested in the processes of

These components. The concept of REFLEX can be represented in a scientifically generalized form as follows:

**ANALYSIS (by own Organism) + SYNTHESIS (by own Organism) = (Own) REFLEX;**

Taking this FORMULA as the "ideal" of the most generalized knowledge about the principles of Memory construction, the assumption that the biological memory of an Organism is a repository of current experiencing and already experienced REFLEXES can be made. All remaining components of Its systems are the factory of THEIR production.

In reality, it is very difficult to single out the processes of "ideal Analysis" or "ideal Synthesis" for any living organism. It is taking place, because "These processes" act simultaneously and, as a result, constitute a single complex of interdependence. Let's make a proposition that the processes of influence from a less organized memory Type to a Type with a higher degree of its organization will have the dignity of INTERNAL ANALYSIS, and the influence in the "reverse direction" will have the dignity of INTERNAL SYNTHES.

There are 21 reflex KINDS of relationships between **the 7 Types** of human memory organization for this model (See Fig. 2) [9]:

1) The kind of reflexes between the MOTOR and SENSORY memory types is characterized by the analyzing-synthesizing connection of "Movements" and "Emotions". What are we doing when got burned hand? We immediately pull back our hand and only then we begin to look and to reason why and how it happened. Without Movements, we cannot feel what causes pain and what pleasure. Of course, this is a weak example, but with "higher" Feelings the situation is similar: "What you feel is what you do, if you are frank in your actions."

2) The interconnectedness of the FIGURE and MOTOR memory types is convincingly proven by examples of instant evasion from an object flying at Us or visual copying of any forms of movement.

3) The following connection is between "IMAGES" and "FEELINGS". Here it is enough just to recall some beautiful natural landscape that evokes a storm of emotions, and they are the founders of the Sensual memory type. Also, "Feeling" can form "Images" associated with "Its" memorization, which is confirmed by our nightmares or voluptuous dreams.

4) The interactions of "MOTORIC" and "LOGIC" appear everywhere. For example, human hands are the most perfect apparatus of Mechanics. It is impossible to learn motor skills of independent work without their consistent actions.

5) The reflexive connection between "FEELINGS" and "LOGIC" creates conditions for us to automatically adapt to the seasonal vagaries of the weather and even to everyday standards of social life. We increasingly trust the "voice of Logic" rather than the "voice of Feelings." True, this situation depends on the predominance of "Logical" or "Sensual" conditions of education of a person.

6) The combination of the IMAGINATIVE and LOGICAL nature of memory can be observed in the processes of constructing a strictly sequential chain of "picture plots" of nature or when "they" are demonstrated as in "cinema" or "animation". For example: the rotation of the Earth around the Sun corresponds to a strictly periodic sequence of changes in the illumination of our position.

7) Messages between TARGET and MOTOR memory types reflect the formation and use of motor combinations in the most advantageous option among possible alternatives. There has long been a trick in the circus when the artist with his eyes blindfolded shoots better than any of us with open eyes. We can justify that he watches the first time, remembers and at the same time constantly trains, plus talent. But let us remember that the Target type of memory organization stores the optimal structures, that the result of their use, in our case, is the precise movement of a hand with a weapon.

8) Connections of the areas of TARGET and SENSITIVE memory organization provide our emotional state in exciting moments of strong desires. For example: when a guy goes on a first date with his girlfriend, he is sure to be worried, and he does not have the strength to curb this excitement.

9). The relationship between TARGETS and IMAGES determines "close scrutiny" both in the literal and figurative understanding of the meaning of "this" phrase. That means the directed contemplation of the unproven information truth about the external and internal organization of the interested objects. For example: "prophetic" dreams of great scientists.

10) The connections between the TARGETAL and LOGICAL characters of human memory give rise to processes of specifically directed activity. Because any strict sequence of frequently occurring events leads to goal-setting about achieving the optimal way for their use. That determines the subsequent logic of their implementation.

11) The "martial art" of MOTORICAL and MANAGEMENTS SKILLS does not need clarification. This is the Mastery of owning our Body.

12) "The artistic plasticity" of FEELINGS and MANAGEMENTS is distinguished by the flexibility of adjusting the emotional states that accompany the self-expression of experienced events. A striking example is the knowledge of the popular "auto-training" system or methods of acting roles in cinema.

13) The "picturesque design" of IMAGES and MANAGEMENTS is distinguished by the fundamental inseparability of visually imaginary events. In other words: this is likes "cinema game", where the characters in the "volitional scenario" can be any, the most fantastic objects and models.

14) The "prudent sobriety" of LOGIC and MANAGEMENTS is determined by the tactical sequence of verified relationships of connections between informationally experienced events. An example is the modern "management" of various organizations.

15) The "Creative mastery" of TARGETS and MANAGEMENTS is expressed in determining strategic directions for using the events of one's environment. For example: a thoughtful person constantly feels the presence of some other unrealized desire, often without suspecting that it is born thanks to THIS KIND of reflexes. THEIRE development characterizes our "Talents" in arranging our own lives.

16) WORLDOUTLOOKING - MOTORICAL Kind. This is when a person is constantly drawn to the physical movements. For example, it is becoming the main belief of life when the playing sports.

17) WORLDOUTLOOKING - SENSUAL Kind. Here we have an emotional rhythmic sensation of environmental events. It is a vital necessity. Usually, it entails an aggressive or humble submission to own Fate, which strikes both the lovers of pleasure and pain.

18) WORLDOUTLOOKING-FIGURATIVE Kind. This is situations, when the roads of life and death take the Forms of the unbridled fantasy of talented film directors or the authors of virtual world of high-organized computer games.

19) WORLDOUTLOOKING - LOGICAL Kind. Here a person is captured by the reflex whirlwinds of mysticism and occultism deals, in other words, by the "divine" consequences of theoretical generalization of Natural transformations way.

20) WORLDOUTLOOKING - TARGETAL Kind. This is already intuitively sectarian aspirations of person to destroy or save Humanity or Nature that is confirmed by the reckless beliefs of various fanatics.

21) WORLDOUTLOOKING - MANAGEMENTS Kind. It reigns over the power-hungry world of Systematized self-confidence. To put it more clearly, these are personally dominant strategies for managing the events of own life.

*"Technologically, we can simulate only the first 10 Types of reflex activity with robots and computers currently. It means, we are able to create the*

*physical devices to implement them with absolute memory only. The remaining 11 (12-21) reflex Kinds are not only dangerous to model, but also technically impossible! Nowadays even biological modeling of this kind activity is powerless.*

*Therefore, theorem: "Robots with absolute memory are dangerous to humans!" will accompany us for many more years until we will master the new heights of generalized knowledge about the Cosmic life Laws."*

**7.5. GENUSES of Memory or stages of Its evolution** (See Fig. 2) [9].

Generally, we can distinguish six systems of evolutionary memory origin. This applies to both the process of "phylogenetic" development of Organisms and the "ontogenetic" formation of any of Them. Under this way of consideration, the principal model of memory and their determined Types are divided into the GENETIC, UNCONDITIONAL, CONDITIONAL, SOCIAL, PERSONAL and CONFESSIONARY Genuses!

**7.5.1. *The GENETICAL Genus* represents the sum of organically mastered connections of the Sensory-Motor Kinds, the reflexes of which are necessarily fixed in the hereditary gender-code of Organisms, which is responsible for the viability of their reproducing.**

The reflexes of THIS kind are present in all available Types of human memory in any living organism. These reflexes presence is realized through associative connections between the evolutionarily formed Subtypes ("branches") into the model of principal memory Types. The Subtypes are contained within each of the determined ones. (See Fig. 3). The work of the interconnections of these representations is organized similarly to the associative-reflex interactions of the basic hierarchy of the human memory Types.

The GENETIC Genus of reflexes is present not only within the Long-term level of the memory, but also in all its other levels too. It ensures the reproduction the organisms of those similar to itself in appearance and habits.

*"From the view point of the robotics and cyberization development THIS genus of reflexes does not make sense to model with software, since this will lead to the uncontrolled reproduction of different AI machines. Imagine please, how quickly they will fill the computing and network hard resources of the Internet, as well as the electronic RAM content of computers. We simply won't have time to feed them with physical memory drives. A striking example of this is the "Worm" class of computer viruses. Of course, THIS Kind of reflexes will have to be created, but with a pre-calculated number of permissible copies when exploring places unsuitable for biological life of distant space."*

**7.5.2. *The UNCONDITIONAL Genus* determines the sum of organically mastered reflexes that are formed through the relationship of the Figurative degree of memory organization with the Sensual and Motor types of its lifestyle being. This reflex Genus is responsible for the innate "talents" of an Organism, the development of that is determined by external environmental events in the course of Its biological growth.**

This type of reflexes develops in the mother's womb in the middle and last stages of pregnancy of her body. The genetic predisposition of the fetus to the Imagery type of information acquisition, laid down by the parents, begins to realize its purpose in advance.

*"The models of this reflex genus are determined by the manufacturer according to the purpose of robots use. It is necessary demanded for advanced image modeling systems of the environment. These models are Included in the first 10 reflex Kinds of human memory. The simplest example of this robotic kind is a radar station that sees and controls various objects beyond the capabilities of the human observing. That is, these capabilities may be embedded in an unchangeable part of the memory of automated, computerized or cybernetic devices by default."*

**7.5.3. *The CONDITIONAL Genus* determines the sum of organically mastered reflexes that were formed through the relationships of the Logical memory type with areas of its less organized types. The work of THIS reflex Genus is manifested in the development of the Logical sequences of the Figurative, Sensual and Motor characters of memory. THESE develop already in the processes of Organism's collision with frequently repeated events of environment.**

The human reflexes of this Genus begin to work already in the last months of pregnancy, when the fetus starts to vigorously claim its right to a place under the Sun. Further, they actively develop in the range from the first collision of the "new subjectivity" with the outside world to the age of "mature years" and determine the formation of the personal habits. Let's us to present the classical definitions of the concepts used above comparing the essence presented with the generally accepted opinion:

The Unconditional reflex genius is inherent in a person from birth and insured the maintenance of vital activity in relatively constant environmental conditions. Conditional reflex genus is developed on the basis of Unconditioned reflexes when exposed to an influence of externaly new, earlier unknown stimulus.

This principle about reinforce the SUBSEQUENT reflexes after the birth by the older reflexes of PREVIOUS ones is observed for the entire Memory classification model!

*"CONDITIONAL genus is the dominant direction of automatic self-learning of robots at this stage of cyberization development. In other words, it base on the technical capabilities of the equipment. Here, the software code models give the possibility of robotic self-learning. Now it is named ML (Machine Learning). Such robots are called self-adaptive in their environment of use. The principle of a such organization is to maintain a balance between*

*external, periodically repeated influences and the conditions for stable operation of the robot. This must be to accordance with the tasks assigned to it."*

**7.5.4. *The SOCIAL Genus* determines the sum of the socially mastered reflexes of Organism, which are formed through the relationships of the Target memory type with the areas of Logical, Imagery, Sensual and Motor degrees of its organization. THIS Genus of reflex connections is based on the need for "group" life activity of organisms united by the natural conditions of existence.**

A reflex memory activity of THIS genus awakens from the moment of birth, when the child the firstly seen his mother, and then his immediate environment and relatives. Further, the "many faces of different communication" determines the direction and speed of improvement of social reflexes. This memory genus develops his skills in mastering the most advantageous structures for achieving its desires surrounded of own kind.

*"The group modeling of robots work involves a rigid combination of coordinated actions of automata at this technological stage. This is a new conception of "digital twins of the robots themselves." But if this happens rarely for people, then for robots this is normal set by the manufacturer. It carried out in accordance with certain tactical and technical data of their series. They cannot self-organize into a single whole without the leading role of external management for jointly coordinated work. Therefore, people create an advanced model that has a connection with the entire series. Consequently, the latter main robot can issue commands to everyone else to achieve one common goal. When the robot's group have achieved the result of their use, the community of them freezes in anticipation of the next task for everyone. It turns out that the robotic "community of the same" is not adapted to independent actions. That means, all depends from the organization of the people leadership, and not the robots themselves."*

**7.5.5. *The PERSONAL Genus* represents the sum of individually mastered reflexes, which are formed through the interrelations of the Managerial type of human memory with the areas of previously defined characters of its "Multi-typed" organization. The basis for the development of reflexes of THIS Genus is the desire of the Organism to use the vicissitudes of accompanying events for the benefit of Its own life.**

This genus is based on the results of the subjective actions of human personality, which are formed during the personal assimilation of social Information about human relationship. Here, the power of the ancient reflexes of self-preservation is concentrated on the activity of all later layers of memory organization. Therefore, the ground of personal minding point has own models of experienced social events according to the own thoughts and actions.

*"If robots are given this Genus of opportunity, they will ignore any commands from the outside. That will definitely lead them to self-destruction. Therefore, a purely robotics community is practically impossible. The Limiting the borders of robot's thoughts should be prescribed in advance. That is, this Genus must be excluded from the robot's memory in the beginning! In other words, this is the serially determined ability of them to self-destruct, i.e. at best the functions this is zeroing the own power supplies. The cybernetic activity of robots of this genus should be limited only to the joint performance of tasks in achieving the human goals for the benefit of our society."*

**7.5.6. *The CONFESSIONARY Genus* represents the sum of intuitively mastered reflexes that are formed through the interrelations of the Worldoutlooking memory type with all other types of its organization. The base of THIS Genus is the desire of human to create regular models of own life and to comply with the value rules that our Civilization has defined in different eras of human being.**

This reflex Genus is formed during the development of religiously or scientifically propagated teachings about the Universe Nature. In other words, this is storage of old reflexes about the causes of the emergence and conditions for the development of the Earth life.

*"The CONFESSIONARY Genus cannot be mathematically modeled, so it is simply impossible to force a robot to believe in any of the existing Religions! We can dress him up and give him a national identity, but making him believe in God is a priory not! The reason is simple. There are no scientific and technical means to implement systematic knowledge about the nature of the Divine sources of life. It is possible to model this knowledge mentally, we can even draw it, but it will not be possible to translate it into technology for a very long time. This Knowledge is ahead of Mathematics, which is still 50-70 years ahead of any modern technology in its developments."*

**7.6. CLASSES OF Memory or Stages of Its Awareness manifestation**

All representatives of flora and fauna have at least two types of memory: Motor and Sensual. In this case, the first of Them performs the LEADING role (heaviest load of interaction with the external environment), and the second one plays the MAIN ("leading") role. Hence, we need for a new, expanded understanding of the word "Consciousness".

"This word" must be understood as thoughts and activities, which respectively determined by Knowledge and Skills taken into account the historical formation of "Its" meaning. This is, that an organism uses any known Information to ensure its life. In this way, the new semantic sense of "Consciousness" will be applicable not only to the life activity of people, but also to some styles of existence of other organisms, which are represent different stages of the biological evolution.

It is possible to formulate generalized definitions of CONSCIOUS, SUBCONSCIOUS and SUPERCONSCIOUS thoughts and actions for

organisms of any Nature by the MEANS of CONDITIONS described above. (See Fig. 2 and Fig. 3)

**CONSCIOUSNESS** ***is the work of any reflex Kinds of body's activity, which is engaging the LEADING TYPE of memory organization and ITS "representative branches" in all others basic Types of human memory.***

**SUBCONSCIOUS** ***is the work of any reflex Kinds of body's activity, which does not engage the MAIN and LEADING TYPES of memory organization, as well as THEIR "representative branches" in all others basic Types of human memory.***

**SUPERCONSCIOUSNESS** ***is the work of any reflex Kinds of body's activity, which is engaging the MAIN TYPE of memory organization and ITS "representative branches" in all others basic Types of human memory, excluding all connections with the LEADING memory TYPE and ITS "representative branches" in the all Others.***

The modern human CONSCIOUSNESS mainly uses the organization of the Target type of memory at the current stage of the historical development of civilization. This memory Type plays the LEADING ROLE in the processes of interaction between the body and the external environment of its habitat, using all reflex Kinds of the Social genus. The MAIN ROLE is played by the Managerial type of memory, which characterizes the imaginary "perfection" of the all reflex Kinds of the Personal genus. The current level of society development shows that the vast majority of people's CONSCIOUSNESS still make very little use of the 5-species reserve of their diversity. But it is precisely this reserve of combinatorial reflex interactions that gives rise to the development of the individual abilities of each of Us.

SUBCONSCIOUS activity in this case includes the reflex work of the Genetic, Unconditional and Conditional genuses of memory. And the

SUPERSCONSCIOUS has only reflexes of the Managerial-Imaginative and the Same orientation of the Sensual and Motor reflex Kinds.

Only truly religiously spiritualized or naturally gifted people use the MANAGEMENT type of memory as the LEADING and the Worldoutlooking type as the MAIN. Their CONSCIOUSNESS has long surprised society with the results of their life activity. (See Fig. 2) (See Fig. 3)

Generally, the human thoughts and activities are determined by the TWO Global CLASSES of the reflexes:

"CONSCIOUS" and "UNCONSCIOUS".

It is legitimate to state that AWARENESS and UNAWARENESS human thoughts and actions are present in all Types and in all Levels of the reflective capabilities of the body. This is true due to the principle of "evolutionary reinforcement" of a new reflex Kind by reflexes with the more ancient Kinds. THEY differ only in varying degrees of AWARENESS (introduction of information into the sphere of Consciousness) and UNAWARENESS (the state of invisibility for Conscious attention, the effect of complete or partial Uncertainty).

It should be noted that these properties of AWARENESS relate both to the processes of Consumption and Production of information, and to the processes of their Preservation.

The UNCONSCIOUS human thoughts and actions can be AWARENESED. The same is true with results of the CONSCIOUS human thoughts and activities can be UNAWARENESSED that means they are completely reckless and harmful to life.

In the model under consideration, a CONSCIOUSNESS (like internal dialogs) most often manifests at a Short-term level of memory. ITS performance depends on the direction and concentration of attention processes, which are determined by the activity of the Operational level of memorization. This is

subject to training and development with the help of the appropriate stimuli of the environment.

*"It is necessary to make a qualitative leap in the general educational system of our descendants to more fully realize the creative potential of people. This has to be expressed in modern CONSCIOUS mastery and development of NEW TYPES of informational generalization in the memory of their bodies. It is possible to realize this only after cyberization and robotization of the base educational system for youth."*

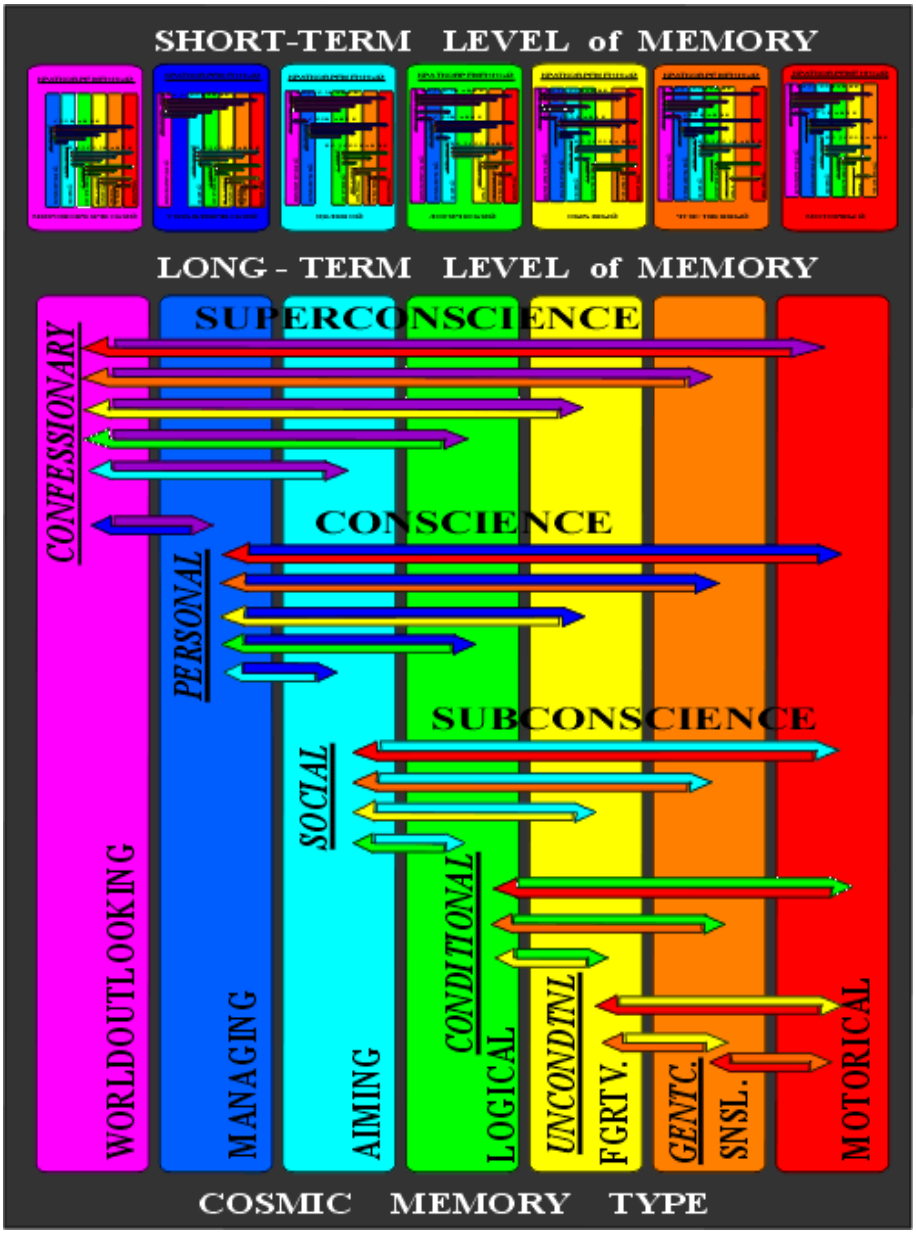


**Fig. 3. Hierarchical organization of human memory. © 1984 - 2024 A. Herashchenko**

*"Here we are faced with a revolutionary approach to the use of the "CONSCIOUSNESS" concept, that has not yet been unambiguously interpreted in classic science. The robots also have Consciousness and Subconsciousness concepts, which are based on the postulates of the memory model described above. But their Superconscious work remains under the control of the human creators. Despite this fact, we still don't have the luxury of having robots smarter than ourselves. They may be more erudite and omniscient, but they are no smarter than their owners. It's just that the nature of a person's managerial and ideological decisions must always be higher due to legislative generalizations".*

**Conclusion.** The principal model of memory can provide a holistically meaningful basis for understanding the various processes of human life and training, at the same time his "digital twins" also.

The exploring of Levels, Types, Kinds, and Genuses of memory allows us to obtain valuable information about the organization and functioning of the Conscious, Subconscious, and Superconscious processes of our environmental cognition.

This model also helps determine the acceptable limits for improving the memory of robot-teachers. It can facilitate effective learning and improve creative problem-solving skills, both personal and robotic. The ideas and principles of organization described in this article will allow to reveal the internal potential of people's memory and expand the practical application of our knowledge about Nature. As well as it allows us to create robotic assistants worthy of us to overcome the pressing problems of modern life.

One thing is certain! High technologies will soon take over most of our lives and the education system will be one of the first to experience this. Therefore, teachers will need to work hard on the rules and standards for using the new capabilities of cybernetic robots controlled by AI without compromising the classical systems of primary, secondary and higher education.

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