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The Philosophy of Robotics, or "Unfinished Piece for a Mechanical Person"

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***Abstract*—In this paper, the author analyzes the historical background of robotics as an independent branch of scientific and technical knowledge and discusses the philosophical aspects of its presence in the life of a man. The author tries to show the ambiguity of the use of "mechanical people" by modern societies. The author made a number of assumptions about the futurological perspectives of the development of robotics. Both the negative side of humanizing the machine and its humane use in the form of android robots in medicine and emergency situations are considered.**

Keywords—"live machine"; robotics; robot-android; Hiroshi Ishiguro; cybernetics; "feedback"; Geminoid

I. INTRODUCTION

The etymology of the concept "robot" is associated with the design of such concepts as "living automaton" and "automaton". The word itself is an invention of the famous Czech writer Karel Čapek, in 1921 he presented to the public a play entitled "R. U.R." (Rossumovi univerzální roboti), from which the term "robot" originated, from Czech language "robota" literally translates as "hard labor", i.e. "hard work". The fundamental difference between robots in the XX-XXI centuries from any type of automata preceding them lies in the existence of "feedback" between man and machine. In order to understand the essence of this distinction, I will make a small excursion into the history of the creation of automata, mechanical people and animals, and specifically focus on the definition of "feedback" in cybernetics. It should also be noted that interest in robotics is by no means idle, it represents one of the foremost areas of science and technology in our time, it is an interdisciplinary direction that integrates knowledge of theoretical physics, mechanics and mechatronics, mathematics, cybernetics and medicine, which allows using in this area specialists from different fields of science [1]. The rapid development of robotics in the world opens up new opportunities in many areas of science and life of modern society, it plays an important role in the economy, as well as in ensuring the defense capability of states [2]. However, the philosophical understanding of this phenomenon obviously lags behind the pace of its rapid actualization (implementation).

II. TYPES OF ROBOTS: HISTORY AND MODERN ROBOTS

The history of robotics goes into deep antiquity. Statues of gods with moving parts of the body (arms, head) appeared in ancient Egypt, Babylon, China, in the 3rd century B.C. the Roman poet Claudius mentioned the automaton made by Archimedes, which had the shape of a glass ball with the image of the firmament, which reproduced the movement of all the celestial bodies known at that time. We have reached the books of Heron of Alexandria (I century A.D.), where similar and many other automata of antiquity are described, as water, steam, gravity (weights) were used as an energy source. In the Middle Ages, various kinds of automata based on the use of watch movements were very popular. In the 13th century, Albert the Great created an automaton, which later became known as a "talking head" capable of reproducing a human voice. In 1495, Leonardo da Vinci developed a detailed design of a mechanical person capable of moving his arms and turning his head. And in 1500, he built a mechanical lion, which at the entrance of the king of France to Milan advanced, tore his chest with claws and showed the coat of arms of France. Work on the creation of androids reached the greatest development in the XVIII century simultaneously with the heyday of watchmaking. In 1738, the French mechanic and inventor Jacques de Vaucanson (1709-1789) created the first working humanoid device that played the flute. "Flutist" was the height of a man. He also created a mechanical duck, covered with real feathers, which could walk, move its wings, quack, drink water, peck at the grain and, grinding it with a small internal mill, send the need to the floor. The duck consisted of more than 400 moving parts and was clearly recognized as the crown of the master's creation.

Of course, these were just mechanical toys, but they were also multi-program machines with operatively interchangeable programs.

In Russia, there is a legend about the "iron man" created by the court masters of Ivan the Terrible, according to her, a humanoid mechanical servant at the Russian Tsar's court served him a cup of wine and a caftan, swept the floor, bowed to the guests and even "beat the bear", it sounds fantastic, but it should be borne in mind that this legend is based on the letters of the Dutch merchant Johan Wem — a man of extremely pragmatic and not inclined to fantasies,

known for his inventions and the Russian genius of mechanics I.P. Kulibin (1735-1818). In the Middle East, Ali ibn Khalaf al-Maradi, who lived in the 11th century, described not less than 30 complex automatons in his "Book of Secrets". In the XVI-XVII centuries there is also a new scientific direction at the junction of physiology and mechanics — the mechanics (from the Greek "iatros" — "doctor"), an outstanding representative of this direction was Giovanni Alfonso Borelli (1608-1679), a doctor and mechanic, in his paper "On the movement of animals" considered the work of muscles heart, blood circulation of other organs of animals and humans based on mechanical analogies. Yatromekhanika laid the foundations of modern scientific fields — biomechanics and bionics. Russian mathematician and mechanic P.L. Chebyshev (1821-1894) laid the foundation for a new stage in the study of machines and mechanisms. He linked the issues of structure and synthesis of mechanisms into single teaching on the construction of mechanisms based on mathematical methods. The industrial revolution of the second half of the 18th century brought industrial automation to life. The English mechanic Charles Babbage (1792-1871) developed a calculating "Analytical machine", the structural features of which for a whole century predetermined the direction of development of computing technology [3].

It was at the end of the nineteenth — the first half of the twentieth centuries that the first attempts were made to comprehend the introduction of automata into the system of human social relations, mainly in the field of literary creativity, i.e. science fiction, the stories of which are largely frightening: Mary Shelley's novel "Frankenstein" (1818), the play of Rossum Universal Robots by Karel Čapek already mentioned by me (1921), and a number of other original works (stories by A. Azimov, A. Green , Alexei Tolstoy, and others.) — all these novels about the riot of technical inventions, mainly "live machines", against people. The writers of cinema, which was emerging in the 20th century, did not lag behind on this issue either. The general direction of these works is obvious: the mechanical person tries to subordinate to his will his own Creator, possessing powerful intelligence, such a humanized mechanism is completely devoid of "soul", the intellectual doll is deprived of feelings of compassion, pain, fear and other limiting behavior of a living person "caesura" of consciousness. This conflict of the Creator with his creation was brilliantly reproduced in the film version based on the story of A.Green under the title "Mr. Decorator" (1988. Dir. O. Teptsov). The topic of robotics occupies a special place in the work of science fiction writer, American scientist and popularizer of science, Isaac Asimov (1920-1992). In one of his stories, united by the common cycle "I, Robot", in 1942 he tried for the first time to formulate the basic principles of the behavior of robots, based on the categories of goodness and humanity. The principles were called the three laws of robotics: the first law is A robot may not injure a human being or, through inaction, allow a human being to come to harm; the second law is A robot must obey the orders given it by human beings except where such orders would conflict with the First Law; The third law is A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

I will not touch upon the problem of introducing robots into the industry, since this is not the topic of my research; I note only that one of the first industrial manipulators was developed only in 1948 for servicing nuclear power plants, which became largely feasible due to the introduction of cybernetic approaches in robotics [4]. It can also be said that computing technology, figuratively, "Turing machine" and cybernetics, which declared themselves together with the publication of N. Wiener's book "Cybernetics, or control and communication in animal and machine" (1948), became a turning point in the development of modern robotics and its specific direction — the humanized machine — the intellectual robot with a high degree of feedback from its creator. Of course, not only Wiener is the founder of cybernetic approaches in modern science, but the breadth of his views on control problems surpasses other authors, it can be said, it is from him that a serious philosophical understanding of robotics begins. He focused on the importance of feedback in the management process and made a mental experiment — to imagine a rational being whose time flows in the opposite direction in relation to our time, for such a creature no connection with us would be possible. He noted that at all stages of the development of technology from the time of Daedalus and Heron of Alexandria people were interested in the possibility of creating machines that imitate a living organism. When in one of the interviews he was asked: "Do you agree with the forecast that we sometimes hear that it is going to create machines that will be more creative than people?" He answered: "I dare say that if a person is not inventive than a machine, then it is already too bad. It is not murder, but suicide" [5]. One of the most important ideas of Wiener's book was the justification and disclosure of isomorphism in the control of machines, living organisms, and human societies. Few people know that the Russian physiologist and eminent psychiatrist V.M. Bekhterev also substantiated 23 universal laws both in the sphere of psyche, society and in the sphere of physics (physiology). The isomorphism of complex dissipative (open) systems today is what the cybernetics, the general theory of systems L.fon Bertalanffy, and also synergetics still converge. Further progress in the development of modern robotics was largely due to the formation of the theoretical foundations of computer technology, which is associated with the activities of the American mathematician, also one of the founders of cybernetics, John von Neumann (1903-1957). That he belongs to the idea of writing a program to solve any problem in the computer memory. Thanks to the principle of stored programs, computers have become universal [6].

The emergence of modern robots can be attributed to 1959. This year, the first industrial program-controlled manipulators were created in the USA. In the early 1970s computer-controlled robots appear. In subsequent years, after the creation of the first robots around the world, the rapid development of robotics began in the industrial market. Proof of this is the formation in 1972 of the Japanese Industrial Robotics Association (JIRA), in 1974 — the

United States Institute of Robotics (RIA), and others. Scientific and technical achievements of robotics allowed in the 1960-1980s. to create a number of complex scientific and special robotic complexes for the study of outer space: Luna-type stations, Lunokhod apparatuses (USSR); stations such as "Mariner", "Surveyor", "Viking" (USA), as well as for the development of underwater depths: machine TV, Mosquito, Dolphin (Japan); KURV, RCV (USA); "Manta", "OCA" (USSR); "ROV", "RM" (France) and others. It should be emphasized that technical progress in the development of robots was aimed primarily at improving control systems. In the context of this article, the "third generation of robots" is of particular interest to me — these are intelligent robots with intelligent control.

An intelligent robot is a specific-purpose robot, in the main functional systems of which artificial intelligence methods are used [7]. The emergence of intelligence in robots is associated with the development of computers. In 1967, in the USA (Stanford University) a laboratory model of a robot equipped with technical vision was created for research and development of an eye-hand system capable of recognizing environmental objects and operating them in accordance with the task. In 1968, in the USSR, Institute of Oceanology of the USSR Academy of Sciences, together with the Leningrad Polytechnic Institute and other universities, created a tele-controlled underwater computer "Manta" from an electronic computer with a sensitive gripping device, and in 1971 its next version with technical vision and target designation system television screen. Concluding this review, I would like to especially note that in 1972-1975, in Kyiv, Institute of Cybernetics, under the leadership of N. M. Amosov and V. M. Glushkov, a mock-up of an autonomous integrated transport robot (TAIR). The robot demonstrated purposeful movement in its natural environment. A feature that distinguishes TAIR from many other systems created in the USSR and abroad is the absence of a computer in its structure in the form to which we are accustomed. The basis of the control system is a hardware-implemented neural network [8].

III. HUMAN ROBOTS, OR HOW A MAN WANTS TO BECOMES "GOD"

From the second half of the nineteenth century, philosophy became predominantly existential. Existentialism does not mean humanity, on the contrary, it is often a cruel philosophical experiment, where the philosopher himself acts as the main subject, as was the case in Denmark with S. Kierkegaard, or in Russia with FM. Dostoevsky. The choice of a person's life, according to Kierkegaard, has three possibilities: aesthetic, ethical and religious. "Superhuman path" later proposed by F. Nietzsche (1844-1900). In the twentieth century, Julian Huxley (1887-1975), rethinking Nietzsche's ideas in an evolutionary vein, will write in the book "New Bottles for a New Wine" (1957): "... a person will remain human, but will surpass himself of nature". Evolution in this way instead of stochastic will become directional — "transhumanist" [9]. It was at the end of the fifties — the beginning of the sixties, that is, at the time of Huxley's statements, there is a global "boom" of public interest in robotics. It is significant that in the Soviet film library in 1967 the film "His Names of Robert" directed by Ilya Saulovich Olshvanger (1923-1979) appears. At first glance, this is nothing more than a slightly naive comedy about a dispute between lyricists and physicists about the use of artificial intelligence in the form of an android robot. The focus is on a robot copy of its creator — the brilliantly played "double role" by O. Strizhenov — the owner and his technical "slave". The logic of robotics behavior and the host conflict with its technically executed copy turned out to be, as it seems to me, prophetic. I note that the film won the Golden Ball award and a diploma at the International Film Festival of Fantastic Films in Milan (1969). Today, interest in android robots is characteristic not only of representatives of the emerging transhumanism subculture, but also of scientists of various directions in science and medicine, focused on the targeted use of robots [10]. I will give a few examples of such use, as well as briefly analyze their motivational component. If you push off from the existential idea of M. Heidegger (1889-1976), that the technical inventions of mankind reveal the "secret" of the technical structure of the world, the ontological basis of nature itself, then in the age of nano-bio-info-cogito-technologies with many alternative possibilities a "mirror", a double robot, will seem by no means accidental [11]. The main motive, apparently, self-knowledge, as well as the desire to feel like God, the Creator of his image and likeness, in which some of them, for example, Japanese robotics Ishiguro, are openly recognized.

H. Ishiguro was born in 1964, and in the 1990s he took up robotics. In 2003, he headed the laboratory of robotics at Osaka University. One of his most famous creations is his "counterpart" — an interactive robot that almost completely replicates human behavior and looks like Professor Ishiguro himself. The Android, created in the image and likeness of Professor Ishiguro, appeared in 2006 and was named Geminoid HI-1. This robot is so perfect that it can replace professors in teaching at Osaka University — students do not immediately notice the substitution. Ishiguro looks at the use of android robots quite broadly, he is confident that in a megapolis robots will be able to replace a person in all kinds of activities, and at some point this replacement will be realized all over the world total, as happened with the use of mobile phones. After arriving in Russia with lectures (May, 2015, Skoltech), he noted that it would be two or three hundred years before the robot could become mayor of the city, but, as a result, robots would also prevail in the authorities. In Russia, according to the Japanese professor, there is an oversupply of officials, who for the most part do nothing, but take money at the same time. This, according to Ishiguro, must be stopped, and only robots can handle such problems [12].

No less interesting is the recent test in Russia of Alex's robot by the Perm startup Promobot in Russia in this context, when on April 16, 2019; he acted as the news presenter on "Russia 24" channel. The basis of the appearance of the android took the face of company founder Alexei Yuzhakov, the similarity turned out to be frightening, Hollywood experts worked on his appearance. 35 actuators were

responsible for the facial expressions of "Alex", which rather accurately imitated about 20 human emotions; it is noteworthy that all the parts from which the android is assembled are produced domestically. A Perm startup has been developing Alex since 2017, and work on it has not yet been completed. The developers are confident that Alex can become a consultant, for example, in banks, airports or shops, i.e. where high stress resistance is required [13].

Another example is the Japanese from the laboratories in Tokyo and Osaka created the anthropomorphic robot Alter. Despite the fact that the smart machine looks unfinished and is not an exact duplicate of a person, it has an amazing feature that destroys the ideal image of more perfect looking androids: Alter movements are devoid of torn mechanical hinges, they are incredibly smooth, fascinating and indistinguishable from human. In the body of the robot 42 pneumatic actuators, its seemingly chaotic movements are controlled by neural network algorithms based on sensor readings that replace the robot's human sensory response and respond to noise, humidity, approaching people, changes in ambient temperature, etc. No less curious is the intellectual humanoid robot created in 2010, which is a copy of Bina Rotblatt, the wife of a successful entrepreneur and transgender Martin Rotblatt (USA), the "brain" of the anthropomorphic mechanism is loaded with the memories, views and feelings of the real Bina, who herself trained the smart machine talk and move in her style and also imitate facial expressions. Android can keep up a conversation, including on complex philosophical topics, and even joke [14]. It took Bina more than 100 hours to load her personality. At the same time, BINA48 is able to learn — his vocabulary and knowledge are updated with each new conversation. The hopes of transhumanists about keeping a person's personality after death in his technical copy are connected with this robot [15].

Summing up, I would note that the arguments for this kind of humanization of robots primarily lie in the plane of greater comfort in communicating with the machine when it looks "human". Debatable arguments are pros, coming from transhumanist searches for immortalism (immortality). Of course, the use of robots — androids for solving target tasks is beneficial and useful: helping people with disabilities, exoskeleton and bioprostheses, working in inhumanly difficult conditions — space, ocean, pandemic conditions, etc. [16]. The arguments "against" the humanization of robots lie in the very plane that the Olshvanger film highlighted. A robot cannot perform all human tasks; it will require "superhuman" efforts from it; a man for the robot is the same "God"; the result of non-fulfillment is scrapping machines. Another aspect of "against" is the "heartlessness" of any beautifully executed machine — the absence of emotions, not emotions. For joy, a person can cry, and laugh with grief. In Pushkin's fairy tale "On the dead princess and seven heroes", the queen, having waited for her beloved husband from a military campaign, "from admiration" (i.e., from the joy of a long-awaited meeting) "died". This is precisely the perception of the world, which is not characteristic of any humanized machine, as it is impossible for Robert the robot from Olshvanger's movie to remember how "the hay smells after the rain" and the beautiful in its appearance doll from "The Mr. Decorator" just to love.

There is also, it seems to me, the opposite effect in the relationship of a person with his technical counterpart: the copy imitates emotions, it is insensible, but the creator of this copy is not immune from worries about it. The question is whether we will seriously say "Good morning!" To our robot, or whether the humanized robot will forever remain for us only a good helper, but an inanimate machine. In this regard, one example from the creation of robots that imitate the behavior of animals is indicative. The Robot Dog Sparko appeared in 1940 — it could bark, sit down and ask for food, its developer is Don Lee Hadley (Don Lee Hadley, USA), and the prototype was Scottish developer terrier. He created three The Robot Dog Sparko. Robots were able to follow the light source. One of the robot dogs was lost before the show.

It ran out into the pavilion's left-open doors, chased the car, reacted to the light of its headlights and "perished" in this unusual car accident. Another dog was lost in 1957. The fate of the third remains unknown [17]. The answer to the question of empathy work only at first glance is unambiguous. We unwittingly'm sorry Sparko, which cannot be repaired, we involuntarily feel sorry for Robert the robot, which at the end of the film Olswanger dismantled for parts. As a child in childhood animates his toys, and parents can not take away his filthy old hare or donkey, replacing them with new beautiful toys, and part of the soul (psyche) robotics, even without material (technical) carriers in the machine itself will remain in Android, causing involuntary empathy or sympathy, if not the Creator, then on the part of users.

I cannot fail to note that today there is a different view on the use of robots-androids, which, as if, "removes" the problem of human communication with the robot. The well-known research project leader in robotics at NASA, Ill Rez Nurbakhsh, published the book The Future with Robots in 2013, in which he states that "over the past fifteen years, the following has happened in robotics: the technologies that are being developed for robots ... are very different from technologies that robots have been made in human fashion.

Now we can talk with our phone, and he can not only answer us, he can decide how to act: to remind you of an important meeting, to reduce the temperature in our house, etc". Such technologies, according to robotics, are gradually changing world [18]. One could agree with such a position if it were not contradicted by the situation with robotics in the Land of the Rising Sun — Japan.

IV. JAPAN: COUNTRY OF ROBOTS

It is believed that the Japanese "economic miracle" in the second half of the twentieth century is largely due to the achievements of robotics, which still maintains high growth rates. According to a report by the Mitsubishi Research Institute (2017), by 2030, robots will have released 7.4 million jobs in the Japanese labor market, but overall, it will be reduced only by 2.4 million jobs, since another 5 million will be created in the robotics sphere. The development of robots in Japan is often carried out by world-famous

companies — Sony, Honda, Toyota, Mitsubishi Electric, Panasonic, Kawasaki, Yamaha, and many others. Some projects are funded by the state, especially if they are pursuing socially significant goals, such as medical care. One of the promising areas of robotics in Japan today is associated with a high life expectancy of the population and those "challenges" in the social sphere, which are associated with the redistribution of the labor market, when a large ratio of older people falls on one working person, as well as an increase in the number of single and frail in old age people especially in big cities [19]. So among the android robots, you can select the whole direction associated with the hospital case, the models were presented in 2009 and 2011. One of them is Robot for Interactive Body Assistance, its main task is to gently lift and carry patients who cannot walk on their own, help them get out of bed in a wheelchair and vice versa, there is another model of the robot that can lift a person from the floor, for which she was awarded the ability to bend down. Android robots provide the patient with maximum comfort, and their device provides a lot of sensors that guarantee the safety of the patient, the robot itself and all others. The "most therapeutic robot" of the Paro pup was introduced into the Guinness Book of Records — initially, it was intended for single elderly people and Alzheimer's patients. The first such seal was shown to the public in 2001. No less impressive in terms of its objectives, the robot Jukusui-Kun presented in 2011 in the form of a bear against snoring and helps with sleep apnea (breathing). In Japan, where earthquakes and tsunamis are frequent, humanoid robots are being developed that can help in saving people in emergency situations. One of the interesting developments is a pair of humanoids HRP-2 Kai and Jaxon who demonstrated walking on a thin board like a monkey: bending their backs and leaning on their hands. These models are incomplete and are under development [20].

V. CONCLUSION

It can be concluded from the examples given that the process of studying the capabilities of the human body with their transfer into the technical bodies of robots has not been completed. It seems that humanity is still at the very beginning of solving the technical foundations of its own living construction. The android robot is not only a "toy", not only a source of self-knowledge and self-realization of robotics, but it is a living need of modern urbanized humanity for providing self-help. Japan clearly demonstrates to the world the possibilities of the humane use of humanized machines. A piece for a mechanical person can be played in the style of Frankenstein, or maybe in the style of Paro seal pup.

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