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Intelligent Robots, Cyborgs, Genetically Enhanced Individuals, Chimeras: the Future and the Challenges of Law

Irina A. Filipova

National Research Lobachevsky State University of Nizhni Novgorod, Nizhniy Novgorod, Russia
Samarkand State University named after Sharof Rashidov, Samarkand, Uzbekistan

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digital technologies,
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human,
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neurotechnologies,
risk,
robot

Abstract

Objective: to identify theoretical and legal problems associated with the steadily increasing spread of digital and biotechnologies' development products; to assess the risks associated with this process that can change the position of a human in the society of the future; to develop and substantiate proposals to minimize risks and eliminate the identified problems through legal regulation.

Methods: the research is based on the methods of generalization of scientific and technical information and theoretical analysis used while studying the source materials; axiological and systematic approaches; the formal legal method and, in addition, methods of legal forecasting, primarily extrapolation, which made it possible to highlight the prospects for reforming law due to technological expansion.

Results: include a description of the dynamics of digital and bio-technologies' development; a description of the changing social landscape with the emerging new types of entities that can affect the actual status of a human; a classification of risks threatening people due to the digital and biotechnologies development; a list of tasks whose solution based on law will help to eliminate, postpone or, at least, significantly reduce the severity of problems by increasing the time limit allotted to humanity to comprehend a number of conceptual points. The author presents arguments substantiating the need to develop special legal regulation in relation to new types of entities, the appearance of which becomes an inevitable result of the mentioned technologies' development.

Scientific novelty: consists, first, in a comprehensive study of the development of interconnected groups of digital and biotechnologies, taking into account their increasing convergence; and, second, in the formulation of legal problems that need to be resolved due to the potential emergence of new types of entities with cognitive functions and capable of having a targeted intellectual impact on the environment and legal entities.

Practical significance: it is present in the answers given to the formulated legal questions, which contain suggestions and recommendations on the necessary adjustment of legal regulation and focus the attention of legal scholars on the problems arising from the pace and vectors of science-consuming technologies' development.

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Contents

Introduction

The development of artificial intelligence is currently being discussed by legal professionals, including from the viewpoint of the possible recognition of the legal subject status for artificial intellectual systems. The latter are a fairly new phenomenon compared to humanity, because Homo sapiens appeared on the planet about 200 thousand years ago. The growing attention to the possible legal personality of artificial intelligence is explained by the high pace of artificial intelligence technologies development and the rapidly expanding dissemination of the results of this development in practice.

As is known, a person can demonstrate cognitive abilities or functions, i. e. the higher functions of the human brain that connect people with the world around them, allowing them to get an idea of it and interact with it. These functions include thinking, speech, learning, spatial orientation, imagination, and memory. Human intelligence manifests itself through cognitive abilities, but artificial intelligence systems also show them. The presence of such abilities provokes a discussion about the recognition of legal personality for artificial intelligence systems, especially if they reach the level of human intelligence.

In addition to improving artificial intelligence and other digital technologies, for example, robotics components, scientific laboratories conduct research aimed at developing biotechnologies. Together with the achievements of digital technologies, it enables connecting people with artificial intelligence systems or purposefully transforming the genetic characteristics of the human body.

The progressive development of digital and biotechnologies will potentially lead to the emergence of new types of entities with cognitive abilities, not inferior or even exceeding the level of those of a modern human. This cannot but cause problems, including problems of a legal nature.

1. Development and practical application of digital and biotechnologies

1.1. Development of digital and biotechnologies

In the context of information society, the key factor in socio-economic development is the transition to the use of so-called high technologies that require the use of scientific knowledge in the creation and production of technically complex products. High-tech sectors of the economy using such technologies have the greatest potential for economic

growth, which attracts public and private investment in this area. The global technology race, in which global technological dominance is at stake, pushes states to create programs aimed at accelerated technology development, and businesses to promptly introduce new technological products.

High technologies include a number of digital technologies based on the digital information and data processing using computers. The term "end-to-end technologies" is often applied to these technologies, which emphasizes their property to complement each other, increasing the useful characteristics of the resulting products. Among the main digital technologies are artificial intelligence systems, wireless communications, virtual and augmented reality, the Internet of Things, etc. Robotics is also mentioned in the list of digital technologies, since the design of robots today is based on "digits"; due to the digital component, the "material part" of robotics is rapidly improving.

In addition to digital technologies per se, biotechnologies can also be attributed to high technologies. They are developing at the junction of biology and technology and testifying to bio-digital convergence. Some biotechnologies are called nature-like because they allow reproducing systems and processes of animate nature in the form of technical systems and technological processes. The biotechnologies discussed below, in theory, can also be called digital, since their development is a consequence of the progress of artificial intelligence technologies, as a result of which computing capacities have appeared, allowing the use of many datasets while reducing the need for manual laboratory research.

While earlier, in the first two decades of the 21st century, researchers mentioned NBIC convergence – the unification and synergetic enhancement of the achievements of nano-, bio-, information and cognitive technologies (Roco & Bainbridge, 2003), now we can stated that digital and biotechnologies have largely absorbed the rest, and now accompany and ensure the transition of society to the next technological order.

1.1.1. Progress of digital technologies

The level of development of digital technologies is significantly increasing every year. This is clearly visible on the example of artificial intelligence technologies as the most important subgroup of digital technologies having a huge impact on all others. Currently, generative artificial intelligence is being actively improved; such artificial intelligence systems can create texts, images, audio and video, and other media data based on generative models. The speed of development of such artificial intelligence can be traced by the product of one of the world leaders in this field – the OpenAI company; the product is ChatGPT. It was only in 2017 that a new neural network architecture, Transformer, was invented, which allowed combining the capabilities of previously existing architectures, for example convolutional and recompetitive neural networks. In 2018, the first ChatGPT model – a neural network trained on a large volume of texts – was created.

A year later, in 2019, the next ChatGPT-2 model appeared, which was a tenfold increase in the previous neural network with a corresponding increase in capabilities. In 2020, the creation of ChatGPT-3 was announced, showing a new level of text processing, and in 2022, ChatGPT-3.5 appeared, which can "draw" through interaction with DALL-E neural network. In 2023, ChatGPT-4 was launched, demonstrating advanced "work" with texts, audio files and images. In May 2024, ChatGPT-4o appeared, capable, among other things, of responding with a human-like voice and simulating emotions. In September 2024, we saw OpenAI o1, showing the ability to "reason" like a human, and the appearance of ChatGPT-5[1] announced in 2025 is linked to the possibility to connect to artificial intelligent agents and to personalization of tasks.

Today, the production of hyperrealistic deepfakes (images, video and audio files created by artificial intelligence, but indistinguishable from those actually filmed or recorded by people) no longer requires a lot of time and other resources. In the legislative bodies of some states, it provoked discussion of bills providing for the labeling of such content in order to avoid misleading people. This is just one example showing the pace of artificial intelligence technologies development. Its vector is aimed at creating a strong artificial intelligence. An intelligent system carrying strong artificial intelligence will have thinking abilities comparable to those of humans, including having artificial "consciousness". One of the key conditions for the acquisition of consciousness by artificial intelligence systems is the ability to carry out multimodal behavior by integrating information from various sensory modalities (text, image, video, sound, etc.) and by "linking" this information to the surrounding reality, constructing full-fledged coherent "images", as humans do. According to the estimates of developers, for example, the founder of SingularityNET B. Goertzel, a computer is expected to reach the computing power of the human brain no later than 2030, and in about 10-15 years one computer can be compared with the computing power of all mankind. A well-known IT researcher and a Nobel Prize winner G. Hinton believes that there are between five and twenty years left before the advent of strong artificial intelligence[2].

The second subgroup, which development level should be described, is robotic technologies. Robotics as a set of technologies includes digital and "material" components, which together ensure the development of automated technical systems and "materialize" the result, based on such fields of science as mechatronics, cybernetics, telemechanics, radio engineering, and materials science. Robotics is based on mechatronics, a complex field of science and technology that primarily includes mechanics and electronics. The progress of electronic components in the "body" of robots, which ensures the integration of digital sensors, processors, actuators and communication modules, allows the robot's "nervous

1 ChatGPT. https://clck.ru/3Eh7aC

2 Artificial intelligence: a ticking bomb or a new stage of evolution? (October 19, 2024). Securitylab.ru https://clck.ru/3Eh7cg

system" to perceive the environment better, choose the most effective solutions and perform complex tasks with extreme accuracy. The development of technical cybernetics increases the ability to control individual robots and their joint group work.

Previously, a robot had a metal shell, bulky and traumatic for humans, then plastics and composites began to be used in the construction of robot "bodies". Their improvement resulted in the robot shell increasingly consisting of soft elastic materials – silicone, vinyl, nylon. Inside robots, there are often hydrogels, which are extremely durable and at the same time capable of changing shape like human muscles; in addition, they ensure an enormous rate of chemical reactions. The use of artificial intelligence in materials science has made it possible to sort through hundreds of millions of elements combinations, accelerating the creation of lightweight and durable materials with new properties. The development of materials technologies, including nanotechnology, has led to the construction of nanobots – artificial systems capable of self-replication, disassembling any material into atoms and using them later as raw materials.

The combination of robotics with artificial intelligence technologies has made it possible to create robots supplemented with artificial intelligence, not only suitable for doing hard work, but also demonstrating cognitive properties, as a result of which the robot becomes a cyberphysical artificial intelligence system.

The next subgroup – virtual and augmented reality technologies – includes digital technologies that make it possible to immerse a person in a virtual world or add digital layers of information to the physical environment. Virtual reality technologies make it possible to plausibly simulate a person's physical environment using VR glasses, helmets, gloves, and other means. Augmented reality technologies "shift" artificial images into a real-world system and display objects that are usually invisible to humans, complementing the physical space with virtual details. The development of these technologies allows for combining the virtual and physical worlds, as well as for people interacting with digital content just like with each other. Thanks to another subgroup of technologies – Internet of Things – physical objects can communicate with each other, being connected to multi-level networks using the Internet and exchanging data without human intervention. Built-in sensors and software for data collection and exchange allow such physical objects to automatically perform certain tasks. Another subgroup of digital technologies contributes to the development of Internet of Things; these are wireless communication technologies that provide very fast, reliable and secure transmission of information using radio waves of various ranges, infrared, optical or laser radiation.

1.1.2. Promotion of biotechnologies

We should also focus on the vast field of biotechnology. The growth rate of the biotechnology market is impressive: the volume of their global market in 2023 amounted to 1.38 trillion US dollars, in 2024 it was estimated at 1.55 trillion dollars, and by 2034

it is expected to reach about 4.61 trillion dollars, increasing by an average of 11.5 % annually[3]. Currently, various areas of biotechnology are rapidly developing: genetic, cellular and tissue engineering, biopharmaceuticals, neurotechnology, etc.

Initially, the term "genetic engineering" referred to various methods of manipulating organisms in order to influence their heredity and reproduction. The term covered genetic modification, artificial selection, in vitro fertilization and cloning. In the second half of the 20th century, the term began to be applied specifically to DNA recombination methods, when, as a result of combining genetic material of at least two species, DNA segments representing new genetic combinations are formed[4]. With the help of genetic engineering methods, it became possible to modify the structure of genes, including creating hybrid genes, i.e. to obtain completely new organisms that had not previously been found in nature. As a result, crops with new properties appeared first (resistant to diseases, saturated with vitamins, with changed color, taste and shape); then gene technologies made it possible to create transparent frogs, featherless birds, luminous cats, etc.[5] Genetic engineering techniques are now used to overcome the limitations associated with organ transplantation, in particular for growing human organs in animals for subsequent transplantation to humans (Brown et al., 2023). Ethical issues are already being discussed, because "as the search for the creation of fully functional, transplantable human organs in large animals progresses", there appears a greater "prospect of creating animals with noticeably human-like brains" (Pluchino & Lombardi, 2024).

Cell engineering technologies differ from the previous subgroup. They allow combining cells of different species and cloning living organisms, and s well as changing them during embryonic development. Similar technologies are also rapidly developing: there are numerous examples of mammalian cloning (Liu et al., 2018). Successful experiments on implanting human cells into animals (Jiang & Alam, 2022) and on obtaining animal embryos with such cells (Tan et al., 2021) help in solving problems related to human diseases. In turn, tissue-engineering technologies, such as bioprinting, make it possible to create biological substitutes that restore, maintain or improve the functions of tissues of a living organism. The aim of tissue engineering is to construct and grow living tissues and organs outside the human or animal body for further transplantation or replacement of damaged tissues or organs. With the help of 3D bioprinting, equivalents of skin, bone and cartilage tissues, and internal organs are obtained.

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3 Biotechnology Market Size. Share and Trends 2024 to 2034. Precedence Research. https://clck.ru/3Eh7go

4 Genetic Engineering. Britannica. https://clck.ru/3Eh7hU

5 Japanese scientists have developed a unique species of transparent frogs. (October 1, 2007). RBK. https://clck.ru/3Eh7iC; Skripin, V. (May 3, 2013). Wonders of genetic engineering: glow-in-the-dark sheep. Hi-News. https://clck.ru/3Eh7it

Biotechnologies are used not only in working with living organisms (biological systems), but also to connect living organisms with artificial systems so that the former receive additional advantages through the latter. For example, neurotechnologies make it possible to correct or improve the brain functioning by affecting the nervous system and restoring the motor, sensory and cognitive functions of the human or animal body. Neurotechnologies contribute to the development of devices and procedures for monitoring, manipulating and simulating the nervous system functions. The devices measure and analyze chemical and electrical brain signals, can interact with the brain by changing activity, "translating" technical control commands into signals. The most intensively developing areas in neurotechnology today are:

– neuroimaging (serving as the basis for, in particular, magnetic resonance imaging and computed tomography);

– neurostimulation (as transcranial magnetic stimulation, micropolarization);

– neuroimplantation (when neural implants, such as neural chips, act as brain stimulators) and neuroprosthetics (allowing a person to regain lost limbs and the ability to move independently);

– neuromodulation (adding neurochemistry to neural implants).

Neurotechnologies give impetus to combining humans with an artificial intelligence system, clearing the way for the creation of hybrid human-machine intelligence, as demonstrated by tests conducted by Neuralink. A neurochip implanted into the human body and connected to the brain may restore once-lost body functions or add new ones. Neuralink is not the only developer of neural devices in the world leading to the cyborgization of mankind. Government agencies are also engaged in this, for example, the US Defense Advanced Research Projects Agency (DARPA), the European Brain Research Infrastructure (EBRAINS) and a growing number of private corporations (Filipova, 2024).

The sphere of neurotechnology is most closely related to the "digital" sphere in the sense that it not only uses the emerging computing capabilities, but connects living and artificial systems, forming hybrid ones with a dual nature. In other words, neurotechnologies can be attributed in parallel to bio- and digital technologies, maximally reflecting the convergence of both groups.

1.2. Results of practical application of digital and biotechnologies

1.2.1. Intelligent robots

The end product when combining artificial intelligence and robotics technologies is an intelligent robot. The symbiosis of these technologies contributes to bringing both of them to a new level (Gibney, 2024): robots show better and better cognitive abilities, gain greater efficiency, adapt to increasingly complex tasks and environments (Soori et al., 2023). An intelligent robot is a cyber-physical system of non-biological origin with artificial intelligence. At first, robots were created as man-made objects that may

replace a human when performing heavy or dangerous physical work. Modern intelligent robots can not only perform physical work, but also solve creative tasks. Developers strive to improve the following characteristics of intelligent robots:

– autonomy (the ability to act without external control);

– mobility (the ability to move among people);

– interactivity (the ability to interact with the environment using sensors and actuators);

– communication (facilitating communication with a person through computer interfaces, speech recognition and synthesis technologies)[6].

Robots, thanks to artificial intelligence and a strong flexible "body", can look outwardly similar to humans, interact better with them and with each other, as well as solve an expanding list of tasks.

Experts recognize the achieved level of generative artificial intelligence, represented today by Large Language Models, as a serious step towards strong artificial intelligence. The intellectual abilities of multimodal neural network models are improving with an increase in the number of parameters – perceived modalities, including those inaccessible to humans, such as ultrasound or infrared radiation. Model training users huge amounts of data, which a human is physically unable to process. As a result, an artificial intelligent system will be able to achieve impressive superiority over any person in similar activities. Moreover, sometimes artificial intelligent systems exhibit emergent (unexpected) properties, for example, the ability to predict the next words in a human-written text, which requires a deep understanding of the previous text using cognitive skills (Nolfi, 2024).

The development of generative artificial intelligence has influenced the approach to programming robots: "large behavioral models" (or "large content and behavior models") began to be created, following the example of large language models. They make it possible to increase the functionality of robots and make contacts between them and people more convenient (Khandelwal et al., 2024). For example, in 2024 Boston Dynamics and Toyota Research companies joined forces to create a partnership aimed at turning the Atlas robot into a humanoid robot with universal artificial intelligence[7]. They were not alone in this intention; the concept of the Optimus humanoid robot is embodied by Tesla. The company's demonstration videos show that such robots can both perform everyday human tasks (walking a dog, watering flowers, bringing food) and assemble new robots[8]. Another example is the release of Walker S1 humanoid robots by the Chinese UBTech company; they do work previously performed by humans at the world's

6 UNESCO. (2017, September 14). Report of COMEST on Robotics Ethics. SHS/YES/COMEST-10/17/2 REV. https://clck.ru/3Eh7rV

7 Ackerman, E. (2024, October 16). Boston Dynamics and Toyota Research Team Up on Robots. IEEE Spectrum. https://clck.ru/3Eh7sQ

8 AI & Robotics. Tesla. https://clck.ru/3Eh7sw

largest manufacturer of electric vehicles. Such a robot is able to work together with logistic unmanned vehicles and intelligent production systems, which makes it possible to automate entire production facilities[9]. Another example of a humanoid robot is Ameca, developed by the British company Engineered Arts and positioned as the most advanced robot in terms of human imitation; the emphasis is on reproducing human facial expressions and behavior[10]. So far, the humanoid robot looks simplistically like a human body, but due to the success of materials science, the creation of android robots is approaching, which will look less and less different from humans.

As a result, an anthropomorphic robot with strong artificial intelligence will be similar to a human in appearance, physically stronger, while not inferior intellectually, and even surpassing us in a number of parameters. It is worth noting that initially it will be a very expensive item, but the more of them are produced, the faster they will become cheaper. Such an ideal "substitute" for a person is in demand in various fields, for example, in labor sphere. However, there is an obstacle called the Uncanny Valley effect, the essence of which is the emotional reaction of people to the appearance of robots. A humanoid robot that only superficially resembles a human is perceived by people warily. To reduce anxiety it is enough to make the robot more similar to a human. However, "humanization" of the robot improves perception to a certain limit, and then anthropomorphic robots begin to cause sharp dislike and fear due to realistic imitation of humanity with observed minor inconsistencies (Mori et al. al., 2012). This problem will decrease, because, on the one hand, technology will reduce the number of differences visible to humans, and on the other – for new generations of people, the robot environment will become familiar.

The cognitive abilities of an intelligent robot do not depend on the degree of its anthropomorphism. Imitation of a human appearance will fit those people who consider such robots as interlocutors, companions, colleagues (to replace people in contacts), but it is optional.

1.2.2. Cyborgs

As the result of a combination of artificial intelligence and robotics technologies is an intelligent robot, the combination of artificial intelligence and neurotechnology, and, usually, robotics, enables cyborgization of humans. A cyborg (short for "cybernetic organism") can be broadly defined as a biological organism that includes non-biological components. Such components are implants, for example artificial organs, or external attached parts – prostheses designed to replenish lost body fragments. People and animals with bodies including non-biological components appeared long

9 Sinha, S. (2024, October 18). China: Walker S1 humanoid robot starts manual jobs at world's largest EV maker. Interesting Engineering. https://clck.ru/3Eh7vp

10 Ameca. The Future Face of Robotics. Engineered Arts. https://clck.ru/3Eh7wU

before the artificial intelligence, but the previously encountered connection of a living being with artificial objects has now reached a fundamentally new level. The "fusion" of a person with artificial intelligence systems (neuroprostheses or neuroimplants) is becoming more and more perfect, which suggests a growing trend towards cyborgization of the mankind.

Cyborgization elements such as a pacemaker, joint replacements or dental implants do not change human nature. The same is true for "simple" neuroprostheses or neuroimplants, for example, cochlear implants for people with hearing impairments. Modern neural devices are able to improve the quality of life of people with disabilities, making up for the lack of motor, sensory or cognitive functions, the absence of which may be congenital or a consequence of a disease or injury. This refers not only to neuroprostheses of limbs, but also to installing a neurochip under the scalp or directly into the skull to connect it to the brain, thereby creating a brain-computer neurointerface. There are already examples of successful installation of such brain neuroimplants. In 2024, using the example of a 30-year-old man paralyzed in an accident, in whose skull there was a neurochip connected to the brain with electrodes, Neuralink demonstrated the restoration of a paralyzed person's ability to work at a computer. Now he can control the digital cursor on the computer screen, mentally making a movement with his hand using a computer mouse or looking at the cursor and imagining the trajectory of its movement[11].

A Neuralink competitor, Precision, announced the introduction of its first commercial device, a brain neuroimplant, in 2025[12]. This confirms the forecasted increase in the use of neurotechnology products, and not only by people with health problems. Researchers mark a phenomenon: modern man, striving to life longer, is increasingly ready for a radical transformation of their own nature (Popova, 2015). It is likely that, given economic opportunities, organ replacement and enhancement of some cognitive functions that naturally decrease with age will become the choice of a growing number of people. Over time, advances in neurotechnology (and biotechnology in general) will advance human civilization to a state where more and more people will be able to continue living only by becoming cyborgs (Grinin & Grinin, 2016).

Neuroimplants can improve the cognitive functions of a person who has not had health problems, increasing the analytical abilities, enhancing natural intuition by improving memory and processing huge amounts of data previously inaccessible to humans. The interaction of humans and artificial intelligence "forms a new system of thinking, a new cognitive pattern, external to the human mind, but capable

11 Leffer L. 1st Neuralink user describes highs and lows of living with Elon Musk's brain chip, 9 June 2024. https://clck.ru/3Eh7yE

12 Capoot A. Here's what it's like inside the operating room when someone gets a brain implant, 25 May 2024. https://clck.ru/3Eh7yt

of enhancing its cognitive abilities" (Chiriatti et al., 2024). Thus, in the long run, a person who has installed a neuroimplant gets an intellectual advantage over other individuals.

The gradual cyborgization of humanity will be the answer to the problem that people have faced since the beginning of the 21st century: the rapid complication of the reality (physical and mental) in which a person lives, when it becomes increasingly difficult for the brain to master new types of activities and social roles, cope with the information load, interact with complex technical systems. Human adaptation to an environment increasingly shaped by digital technologies will become less and less possible only through the expanded use of technological advances. The successes of neurotechnologies enable putting into practice the fusion of man and machine through the substitution of technologies for the human body and mind's natural functions. The integration of the human body with various mechanisms in order to improve it leads to the emergence of technologically advanced people (Emelin, 2013). One of the obstacles that stood in the way until recently was the reaction of the nervous tissue at the site of injury, characterized by inflammation, which may lead to refusal of the implant (Gulino et al., 2019). To overcome the limitations, fundamentally new biocompatible materials are being developed and tested today (Sharon et al., 2023). According to experts in medicine, within one or one and a half decades, the problem of body traumatization due to a neuroimplant installation will be eliminated.

1.2.3. Genetically enhanced individuals

A genetically enhanced individual is a person with a genome modified by editing technologies. A genome is a collection of hereditary material enclosed in an organism's cell and containing the biological information necessary for its construction and maintenance of viability. Such an improvement can be carried out to treat a certain disease or to prevent the possibility of infection (as a gene therapy). Today, the CRISPR/Cas technique is increasingly used, which allows targeted changes in the DNA of living organisms. This technique is referred to as "molecular scissors", because it allows accurately "cutting" and "inserting" DNA sections. With this technique one may, for example, edit genes to treat hereditary diseases affecting various organ systems. Given that "over 80% of all rare diseases affecting up to 450 million people worldwide have a genetic origin, mainly arising from monogenic mutations", gene modification therapy is "slowly but surely moving towards clinical application" (Citra et al., 2024). Moreover, since gene therapy for adult patients requires enormous costs, and the cost of prenatal therapy is expected to be only a fraction of this amount due to the lower doses required, such therapy will also develop due to economic feasibility. Over the past decade, many clinical trials have been initiated that show "encouraging results", while preclinical studies are extending CRISPR therapy to an increasingly wide range

of diseases every year (Laurent et al., 2024; Morshedzadeh et al., 2024). Continuous improvement and accessibility of genetic sequencing today help to quickly identify immune pathologies, while "advances in gene therapy and bone marrow transplantation have made it possible to treat the diseases that would otherwise be fatal" (Perez, 2022).

An example of using gene technologies is an experiment by a Chinese researcher who edited the human embryo genome to artificially "switch off" the gene responsible for the work of body cells to which the human immunodeficiency virus (HIV) may attach. This procedure made children born from an HIV-infected person immune to the virus[13]. It should be mentioned that such experiments cost the researcher a sentence to three years of imprisonment for an illegal genetic experiment on children. Now these children are several years old, they live a normal life, and the geneticist who returned to work, with the permission of the Chinese authorities, opened three new laboratories to study methods of treating severe genetic diseases such as Duchenne muscular dystrophy and Alzheimer's disease.

In addition to treating or preventing diseases, genome editing can be used to improve metabolism and slow down age-related changes in the human body. The possibility of prolonging life and improving its quality is increasingly mentioned as one of the goals of applying biotechnology. Aging is determined by the end sections of chromosomes (telomeres) that are present in the body since birth. Telomeres gradually shorten, stopping cell renewal, but with the same lifestyle and similar external factors, some people age faster than others, i.e. aging also depends on a hereditary predisposition. This allows genetic engineering to partially correct the situation.

Genetic engineering can also be used to change a person's appearance, improve physical performance, for example, endurance, or to increase mental abilities, including memory (Veit, 2018). Such genetic changes can be inheritable or non-inheritable (Almeida & Diogo, 2019). A geneticist from Harvard University G. Church compiled a list of potential genetic modifications that would be possible due to the development of "gene hacking" technology, allowing DNA to be "rewritten" as a code without extracting stem cells (Goldstein et al., 2019)[14]. Besides protecting against diseases, it includes:

– reducing the need for sleep;
– building muscle mass;
– forming super-solid skeleton bones and joints;
– resistance to radiation;
– possibility of prolonged breath retention;
– improving learning abilities, etc.

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[13] 田中韻. 収監された中国研究者、「早すぎたが、100％成功」ゲノム編集ベビー. https://clck.ru/3Eh893

[14] Robitzski, D. (2019, December 6). This Harvard Prof Is Listing Genes That Could Make You Superhuman. Futurism. https://clck.ru/3Eh89u

As one can see, genetic engineering technologies can be used not only to treat or prevent dysfunctions, but also to improve the parameters of an organism that does not have harmful genetic mutations, and especially for inherently eugenic manipulations – "breeding" people with improved characteristics compared to natural ones. There will certainly be people who want to gain access to such opportunities and have financial and other resources for this[15], despite attempts by some countries to legally prohibit experiments with human embryos. In addition, it is not possible to "draw an exact demarcation line separating health restoration from body improvement"[16].

1.2.4. Chimeras

Man is the measure in the anthropocentric world that exists today. Digital and biotechnologies are actually "expanding" the society we are used to, which, alongside with people (including technologically and genetically enhanced ones), will increasingly integrate intelligent robots. In addition, the appearance of another group of entities is predicted, which can be conditionally united under the name of "chimeras". Biologists borrowed this term from the ancient Greek mythology; later researchers in the field of artificial intelligence and futurologists started using it, too. Chimeras include:

– "animated" artificial systems – biorobots, partially or completely consisting of organic matter;

– "animated" digital entities – Embodied Virtual Agents.

The chimeras of the first variety began as xenobots – "living robots" created with biotechnology and artificial intelligence and, by the way, capable of a specific method of reproduction – "kinetic replication", previously observed only at the molecular level and never in whole organisms (Kriegman et al., 2021). While early examples of biobots were hybrids of biological cells and inert chemicals supporting them (gels, 3D scaffolds), new biobots can be completely biological, self-constructing and mobile structures created from human cells – anthrobots (Gumuskaya et al., 2024). Thus, we can talk about the future appearance of intelligent biorobots, which, unlike cyborgs, will be not a connection of a human with a cyberphysical artificial intelligence system, but "animated" artificial systems created using advanced biotechnologies.

The second type of chimera is embodied virtual agents, which are already used for interactive assistance to users in virtual space and represent 3D copies of humans or computer characters (Lloyd et al., 2024). A high degree of their realism is achieved through digital modeling using artificial intelligence based on digital or digitized human

[15] Connor, S. (2015, September 18). Gene-editing embryos should be banned to prevent 'genetically-enhanced children', scientists warn. Independent. https://clck.ru/3Eh8Df

[16] Belyaletdinov, R. R. (2017). Risks of modern biotechnologies: philosophical aspects: Cand. Sci. (Philosophy) theses. Moscow: Institute of Philosophy of the Russian Academy of Sciences.

data (these data can be both synthetic and real). All of the above enables achieving a hyperrealistic imitation of the appearance, voice, and other unique psychophysiological or behavioral parameters of a person.

It should be noted that the technological progress pushes for a gradual increase in the proportion of time spent by a person in a virtual environment. With the improvement of artificial intelligence, as well as virtual and augmented reality technologies, virtual "digital personalities" will "grow" from digital imitations of non-existent people or from digital doubles of living or deceased people. The creation of a full-fledged metaverse in the future, representing a permanent virtual space where people can interact with each other and with digital objects through their avatars, will increase the influence of these characters on a person. As a result, artificial "digital personalities", including those with no real prototypes at all, but endowed with their own history and uniqueness, will become an integral part of people's daily lives.

2. Impact of the results of digital and biotechnologies application on society and law

2.1. Potential emergence of new participants in public relations

Participants in public relations are individuals or groups of individuals (persons) interacting about the distribution of tangible and intangible benefits. Relationships may refer to ownership of things, work, the functioning of state institutions, etc. Can new types of entities that appear as a result of the development and practical application of digital and biotechnologies be participants in public relations? In this case, new types of entities are understood as physical, digital and hybrid (cyberphysical) phenomena. Like humans, they must have cognitive abilities, but unlike humans with their physical body and biological nature, they at least either have no physical body, or have a non-biological nature, or their physical body and biological nature have been radically changed artificially.

"One of the most significant consequences of the information technology revolution that occurred at the end of the 20th century was the loss of boundaries between entities such as machines, people and information technology" (de Andrés-Sánchez et al., 2024). The development of digital technologies, as well as biotechnologies, which continued in the 21st century, leads to new types of entities that have "originated" recently, are emerging now or are predicted to appear in the near future. Below we consider each of the types of new entities identified earlier in this article as potential participants in public relations: intelligent robots, cyborgs, genetically enhanced individuals, and chimeras.

2.1.1. Intelligent robots

At the moment, robots, including those augmented with artificial intelligence, are things, i.e. if they are present in public relations, they are not their participants, but objects that people use in relationships. At the same time, increasing the intellectual component of the robot and improving its cyberphysical form lead to the fact that such robots will increasingly replace people in relationships. This applies, in particular, to the labor sphere, where an intelligent robot can take the place of an employee, which is already happening. The share of robots in production is growing every year. Some of them were originally designed as collaborative, i.e. adapted to work among people and together with people. For example, according to the South China Morning Post, about 70% of the work in China's highly automated factories is already done by robots and only the remaining 30% is done by humans. The goal set by the robot manufacturing companies (UBTech) is to reduce human labor by up to 10% by using humanoid robots, "so that the remaining workers focus on higher-level tasks"[17].

Participants in labor relations are employees and employers. The latter, if they run a business, are entrepreneurs interested in increasing profits. When implementing a scenario in which intelligent robots are able to perform any kind of work efficiently and at the same time cost the employer less than human workers, they will try to replace people with robots. So far, robots cannot replace humans everywhere, and it is often unprofitable due to the high price of the robot and the additional costs of its maintenance. Several interrelated factors may affect the change in the situation:

1) artificial intelligence and robotics technologies are being improved;

2) the intelligent robot industry is gaining momentum with the technology development;

3) due to the increase in production volumes, the final cost of an intelligent robot as a product becomes lower;

4) there is an increasing shortage of personnel in the workplace, as some people do not want to take jobs because of their low attractiveness, while others cannot, because they do not have the necessary qualifications and are unable to perform such work.

The fewer people willing or able to take jobs, the stronger the desire of employers to replace people with intelligent robots in order to "forget" about the problems of vacations, illness and maternity leaves, etc. Consequently, the presence of intelligent robots in the labor sphere will grow. According to the 2024 Economics Nobel Prize winner D. Acemoglu, technological changes in production and service sectors are increasingly shifting towards automation "with insufficient emphasis on creating new tasks in which labor can be

[17] Wu, X. (2024, October 17). Humanoid robot could recharge China's manufacturing labour shortage. South China Morning Post Publishers Ltd. https://clck.ru/3Eh8LL

productively used" (Acemoglu & Restrepo, 2020). The negative consequences of such a choice are a stagnating demand for labor and a decreased share of labor in national income.

Strengthening the link "artificial intelligence – neurotechnology" allows "developing" robots predisposed to social interaction (Sandini et al., 2024). Besides proliferating in services (trade, beauty industry, entertainment, etc.), such robots will most likely be used as agents representing people in various relationships. Such intelligent robots will be in demand in the household; moreover, an android robot with artificial intelligence comparable to human intelligence is quite attractive as a companion or partner in personal relationships[18]. The improvement of android robots will cause them to fulfill, among other things, gender roles in society (Karnouskos, 2022). The assumption is based on data reflecting the statistics of demand for intelligent robots designed for personal use, including intimate relationships (Döring et al., 2020; Hanson & Locatelli, 2022). This is confirmed by the growth rate of investments in the industry of making sex dolls with artificial intelligence; Chinese companies already sell tens of thousands of such robots per year. With an increase in the technology level, they will be able not only to replace sexual partners, but also to become life companions with their memory, feelings, character and emotions. According to the developers, in about 20 years, families with a robot as a partner will become quite common[19].

2.1.2. Cyborgs

Unlike intelligent robots, which are considered things, a cyborg is not a thing, but a human combined with an artificial intelligence system. Respectively, a cyborg, if present in public relations, is a subject, not an object from the legal viewpoint.

The tendency to increase the share of cyborgs will clearly manifest itself with technological progress. Some of these technologically enhanced people will appear involuntarily, due to medical solutions to restore body functions or prolong life. Others may appear arbitrarily, due to the desire of technologically tolerant individuals to "upgrade" and, supplementing the natural resource of their body, to acquire capabilities that exceed those of an ordinary person. Such an advantage of cyborgs will interest employers; hence, it will affect the labor sphere. Professional sports, which are "tied" to high results and have already "squeezed" most of the natural physical capabilities of a human to the limit, is another area extremely attractive for cyborgization. A person without health problems who agrees to the installation of neuroimplants can not only achieve better results, but also increase the effectiveness of training, while reducing its duration and frequency, i. e. freeing up time for other activities, not limited to sports.

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[18] Marriage with a robot – the future of humanity? (August 29, 2022). Leotronics. https://clck.ru/3Eh8So

[19] Cuthbertson, A. (May 25, 2018). Robots will have civil rights by 2045, claims creator of "I will destroy humans" android. The Independent. https://clck.ru/3Eh8Tg

In addition to technological progress, the factors indirectly contributing to cyborgization are:

– digitalization of the world, which gives an additional advantage to people who are able to directly contact electronic devices in terms of the speed of receiving and transmitting information, i.e. adapted to the new technological reality;

– the aging of the world's population due to an increase in life expectancy and a slowdown in natural population growth (over the past 50 years, the growth rate has decreased by about half) [20];

– an increase in the number of people with disabilities due to the aging of the population and the rapid spread of chronic diseases[21];

– increasing the technological tolerance of new generations of people who were born and raised in a technosocial environment and cannot imagine themselves without electronic gadgets.

The technological revolution has motivated people to transform into entities capable of continuously receiving information and transmitting it to the environment (Kadlecová, 2020). This fusion of humans and information is carried out through intelligent technological devices that can be both wearable and implantable (Olarte-Pascual et al., 2021). According to UNICEF, in the next 5-10 years, neural devices designed to monitor and modulate brain and nervous system functions "may become generally accepted for some children of the next generation"[22].

Speaking about cyborgs as people, it should be emphasized that they will increasingly manifest themselves as a separate social group with their own interests. For example, a cyborg's artificial intelligence system receives data from a variety of digital sensors. The information may relate to the surrounding space and is necessary for the correct operation of the neuroprosthesis/neuroimplant. The data received from the external environment relates to the movement of nearby objects, their configuration, and if people appear near the cyborg, the information received from the sensors will include biometric personal data of these people, their psychophysiological reactions. Ultimately, the cyborg's artificial intelligence system acquires access to data that allows predicting the subsequent behavior of other people, assessing their health status, recording what was seen and instantly transferring information via Wi-Fi to external electronic devices.

2.1.3. Genetically enhanced individuals

Genetically enhanced individuals are people, like cyborgs, differing from others. This difference is due not to combining them with an artificial intelligence system, but

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20 World Bank Group. World Development Indicators. https://clck.ru/3Eh8YL

21 World report on disability. (2011, January 1). Geneva: World Health Organization. https://clck.ru/3Eh8ZS

22 Pauwels, E., & Vosloo, S. (2024, September 27). Neurotechnology is here. It's time we get serious about what that means for children. World Economic Forum. https://clck.ru/3Eh8ZS

to a serious increase in the natural resource of the body due to artificially synthesized and embedded biological components. In the future, such individuals will be able to possess abilities that are not available to all other people. The field of genetic engineering is a priori the most controversial of those considered in this article, since it may be about "growing" people with predetermined characteristics (the task is to "outsmart" evolution). The likelihood of such a development caused noticeable alarm in society at the end of the last century, which led to the development and adoption of laws restricting "playing" with human biology. An example of such a law is the Russian Federal Law of July 5, 1996, No. 86-FZ "On state regulation in the field of genetic engineering"[23]. It is generally prohibitive and restricts the implementation of genetic engineering beyond research and development. At the same time, the Decree of the Russian President dated November 28, 2018, No. 680 "On the development of genetic technologies in the Russian Federation"[24] names as one of the main goals a comprehensive solution to the tasks of accelerated development of gene technologies, including genetic editing technologies, and this signals that such technologies are considered acceptable[25].

The continuation of "shadow" research by some scientists is likely to eventually lead to the emergence of individuals with characteristics and abilities that differ from ordinary people, opening Pandora's box. Such individuals, provided they possess inherently transmitted genetic improvements, will pass on their abilities by inheritance, which will accelerate the emergence of a special social group of genetically improved people, provoking contradictions between the interests of this group and others. For example, the recent pandemic "locked" hundreds of millions of people in their homes; the virus resistance of genetically enhanced individuals would exclude them from this global community of the "locked down". Given that gene technologies may not only protect against certain diseases, but also increase human endurance and give other advantages, the interest in genetically enhanced individuals is also shown by the professional sports industry.

2.1.4. Chimeras

Unlike cyborgs and genetically enhanced individuals, entities of a new type, which can be conditionally united under the name "chimeras", are not people, but represent digital or physical/cyberphysical objects. Biochimeras (biorobots) are not identical in nature

[23] On state regulation in the field of genetic engineering. No. 86-FZ of 05.07.1996. (ed. of No. 643-FZ of 29.12.2022). (2022). Garant. https://clck.ru/3Eh8d5

[24] Decree of the President of the Russian Federation No. 680 of 28.11.2018 (ed. of the Decree of the President of the Russian Federation No. 975 of 29.12.2022). (2022). Garant. https://clck.ru/3Eh8d5

[25] Shcherbakova, A. I. (2023). Legal support for the development and implementation of biotechnologies in the European Union and Russia: Cand. Sci. (Law) thesis. Moscow: MGIMO University.

to intelligent robots, although in theory they can be both hybrid systems (a combination of cyberphysical and artificially grown biological components) and systems created entirely from organic matter. An artistic example of biorobots are replicants from the "Blade Runner" movie. Biorobots are potentially the most successful "substitutes" for people in personal relationships due to their exceptional anthropomorphism. At the same time, the "breeding" of intelligent biorobots still seems, if feasible, then a very remote matter (if a cyberphysical system is responsible for the intelligence of a biorobot, such an entity should be considered an intelligent robot). Therefore, we will focus on the second subspecies of chimeras more likely in the near future – digital chimeras, or virtual personalities, capable of "hatching" from embodied virtual agents with the development of technology.

Virtual personalities will be in demand in the entertainment industry: making films, shows, fashion shows, advertising, and other creative projects. They will be great digital companions and even "educators". Such entities are attractive to employers as a substitute for employees whose work function is not related to physical labor, because embodied virtual agents can function around the clock; they do not need salaries; no permission is needed to use their image or voice. At the same time, their biography, personal qualities and images can be adjusted to the needs of the audience[26]. In the context of building a full-fledged metaverse, digital entities imitating famous people who once lived will become widespread. Already today, embodied virtual agents with elements of artificial intelligence can act as digital imitations of real or fictional personalities. They are trained on digital profiles of people, developing the characteristics of a prototype personality, or on synthesized data to obtain specified characteristics. With the development of artificial intelligence and virtual reality technologies, there is a growing probability of the emergence of strong artificial intelligence virtual systems with hyperrealistic avatars as full-fledged participants in public relations that will flow into cyberspace. The growing portion of personal and business communications in a virtual format will introduce such virtual personalities into the daily communication. On behalf of a real person, they will not only "make purchases, organize trips, make decisions or even analyze memories"[27], but also interact with authorized governing persons (Fontes et al., 2024).

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[26] Suragina, E., Mimoglyadova, E., Neznamov, A., Kraynov, A., Izraylit, S., Chirva, D., Matsepuro, D., Kuleshov, A., Vorobyov, A., Vorobyov, P., Romanov, I., Markov, N. (2024, April). Ethical recommendations in the field of creating and using digital imitations of living, deceased and non-existent people: presentation. https://clck.ru/3Eh8jz

[27] Berggruen Institute. (July 16, 2024). Digital Personality: Humans and AI. https://clck.ru/3Eh8m3

2.2. Associated risks of using digital and biotechnologies

The emergence of new types of entities (intelligent robots (1), cyborgs (2), genetically enhanced individuals (3) and chimeras (4)) increases the level of uncertainty. Hence, it increases the number and level of risks that can lead to adverse consequences for a person, a group or the whole humanity, i.e. one may detect individual, collective and existential risks critical in terms of possible losses. While individual and collective risks concern a limited number of people, the existential risks arising from the spread of new technologies threaten human civilization as a whole.

2.2.1. Individual risks

The main individual risks, growing with the spread of new types of entities, include:

– the risk of causing physical harm to a person as a result of hacking an artificial intelligence system (1, 2);

– the risk of stress for a person due to the need for direct contact (1, 2);

– the risk of loss of personal data confidentiality (1, 2, 4);

– the risk of using human biomaterials without consent (3).

The risk of causing physical harm to a person due to hacking of the artificial intelligence system by intruders increases with the "inclusion" of intelligent robots in society and their spreading in the labor, healthcare, and household spheres. Moreover, while such a robot appears in the household at a person's will, it appears at work regardless of the employee's desire, which can cause severe stress, thereby creating a psychosocial risk.

Proliferation of digital and cyberphysical entities capable of using digital sensors to "capture" information about the world around them, analyze it and transmit it to other electronic devices leads to the risk of losing personal data confidentiality. With technological development, sensors are becoming cheaper and smaller, some of them the size of nanoparticles. Sensors can be located both on external objects and on the human body or embedded in it. For example, the latter may become necessary to personalize medical procedures that will be much more effective and thanks to which many diseases can be detected and cured at an early stage. Due to the Internet of Things technology, the collection, analysis and transmission of huge amounts of data is possible offline. Even if a person refuses to install sensors on the body, they will still have to live in a "smart" environment – numerous sensors will be located in public places. Given that the capabilities of artificial intelligence systems for searching, processing, analyzing and generating data are many times superior to human ones, artificial intelligence can deanonymize data by accessing various open databases on the Internet.

Due to the development of gene technologies and the "build-up" of genetic improvement of people, there is an increased risk of taking biomaterials of a particular person against one's will, including during medical procedures.

2.2.2. Collective risks

Collective risks are usually associated with some sphere of life activity: labor, education, healthcare, leisure, etc. Among the main collective (group) risks, we shall, first of all, name:

– the risk of segregation of people unable to adapt to the new high-tech reality (2, 3);

– the risk of increasing the intensity of human labor (1, 2, 3, 4);

– the risk of displacement of people from certain fields of activity (1, 2, 3, 4).

In the field of labor, the collective risk due to the introduction of intelligent robots is the loss of work by entire professional groups, displaced by cyberphysical entities with cognitive abilities. In addition to the advantages over people in the amount of information processing and the speed of data analyzing, the new entities will significantly surpass people in endurance; they do not need so much rest in between work, they do not need long sleep to recuperate. Accordingly, when doing similar work, they will be more efficient than people, and this will reduce the employment opportunities of people in the society of the future. Thus, the loss of a person's current position is one of the main consequences of the emergence of new entities in the "era of artificial intelligence", which humanity is now entering.

While an intelligent robot cannot be recognized as an employee under current legislation, a technologically enhanced person (cyborg) has the same right as any other person to take a workplace, from the legal viewpoint. Having the advantages due to the "embedded" artificial intelligence system, cyborg workers will in many cases be more profitable for the employer. This may lead to the actual coercion of other employees to use neural gadgets (neural headphones, neural helmets, etc.) in the workplace.

The sphere of professional sports is at the junction of labor and entertainment. Top-level sports are attractive when sports results are continuously growing, arousing the interest of the audience. Since the natural limit of human physical capabilities is almost exhausted, a logical consequence is the development of sports with the participation of cyborg athletes, whose strength, endurance and coordination can significantly exceed human ones.

The formation of genetically enhanced people as a social group with their own interests will certainly affect the healthcare sector. In this regard, the risks are similar to those arising from cyborgization. The only difference is that the "artificial part" of man and humanity, based on the achievements of biotechnology, will increase. The risks to the labor sphere will again be associated with the displacement of a person without artificial "improvements" and the replacement of a "new kind of people" capable of performing work with greater efficiency due to increased endurance and other previously described advantages for the employer. Professional sports will also be affected by the changes. By now, performance-enhancing substances have become "ubiquitous in many sports, often undermining the spirit of competition" (Momaya et al., 2015). Accordingly, interest in gene doping – a therapy to improve athletic performance – will continue to grow (Ginevičienė et al., 2022).

Chimeras as digital entities with artificial intelligence will also increase the vulnerability of people in the labor sphere. First of all, this concerns the so-called creative industries, where virtual personalities are already filling the scene. The displacement of humans from the film industry, television, shows, fashion industry, advertising threatens a large part of actors and media workers[28] and will over time completely change the creative industries, inexorably reducing the proportion of people employed in them[29].

2.2.3. Existential risks

Below, we will focus on the risks that threaten humanity as a whole, among them:

– the risk of almost complete displacement of people without artificial "improvements" from the labor sphere (1, 2, 3, 4);

– the risk of replacing people with artificial intelligence systems in personal relationships (1, 4);

– the risk of losing human control over their consciousness and behavior (2);

– the risk of dividing humanity into two species (2,3);

– the risk of "losing" in competition to a new kind of people and "extinction" of people who refused to artificially change their nature (1, 2, 3).

The gradual displacement of a person from the labor sphere, their replacement with artificial intelligence and technologically or genetically enhanced people will inevitably lead to the restructuring of the entire socio-economic system, and this can be referred to existential risks. A serious transformation awaits the sphere of personal relationships. The risk is the loss of the inviolability of a human's position as a partner in a personal relationship and the appearance of a "competitor" in the form of an anthropomorphic robot. This will affect the family institution, and since the family is the basic unit of society, it will affect society as a whole, which is irreversibly "turning" towards a posthumanistic future.

Medicine, being rebuilt to meet the needs of technologically and genetically enhanced people, will stimulate further growth in their number and isolation as a social group, with a corresponding increase in the weight of the "voice" of this group in society. The tempting increase in body resources inherent in many representatives of this social group will push other people to increase their "artificial part", setting the direction for the transition of humanity to a new state. Unfortunately, the price for the opportunity to increase the body's natural resource through cyborgization will be "concomitant dependence on artificial intelligence and the potential loss of cognitive autonomy" (Chiriatti et al., 2024).

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28 Shaw, L. (August 19, 2024). Four Experts Explain How AI Will Change Hollywood. Bloomberg. https://clck.ru/3Eh8rV

29 Whiting, K. (February 28, 2024). This is how AI is impacting – and shaping – the creative industries, according to experts at Davos. World Economic Forum. https://clck.ru/3Eh8s7

Despite the absence of a physical body, digital chimeras, with the advent of strong artificial intelligence and the achievement of a point of technological singularity that finally deprives humanity of the option to "turn off the switch", will be able to gain independence. Taking into account the previously achieved power of influencing people through the media environment, virtual personalities, which by that time would become integral parts of the public administration system, would increase existential risks for humanity. Simplistically, this can be shown by the example of Skynet as a virtual artificial intelligence system in the "Terminator 3: Rise of the Machines" movie.

2.3. Legal issues related to the emergence of new types of entities

As one can see, potential new participants in public relations in the future are either people, but with abilities inaccessible to others, or systems of strong artificial intelligence, connected or unrelated to the physical shell. Human society, having passed along the path from a hunter-gatherer society (Society 1.0) through an agrarian (Society 2.0) and an industrial society (Society 3.0) to a modern information society (Society 4.0), will not stop there and will continue to evolve further. The next stage of development (Society 5.0) will demonstrate at least equally large-scale changes[30]. Given that the 5.0 Society will draw a line under the fourth industrial revolution, it is "no longer science fiction"[31], as the development of digital and biotechnology inevitably leads to it. Society 5.0 is a highly developed and technologically integrated society in which various technologies, primarily artificial intelligence, but also neurotechnologies, the Internet of Things, etc., are used to solve social problems and improve the overall quality of life (Das et al., 2024). Technology is blurring the boundaries between the real world and the digital space, and "technological convergence has fundamental consequences for people" (Helbing & Ienca, 2024). The main features of the Society 5.0 include:

– merging of cyberspace and physical space, when every element of society has a digital counterpart in the cyber environment;

– convergence of knowledge in both natural sciences and the humanities and social sciences, to solve social problems through science and technology;

– further development of human resources.

A whole range of issues arises, including conceptual ones, that cannot be solved without the help of law:

1. How can we ensure that there is no discrimination in Society 5.0 if people who do not have artificial improvements coexist with technologically and genetically enhanced individuals?

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30 Government of Japan. (December 18, 2015). Report on "The 5th Science and Technology Basic Plan". Council for Science, Technology and Innovation. Cabinet Office. https://clck.ru/3Eh8uk

31 Helbing, D., & Ienca, M. (2024, June). Society 5.0: Is the Internet of Bodies Coming Upon Us? Preprint. https://clck.ru/3Eh8vR

2. Under what conditions may people be technologically or genetically enhanced if they wish to do so, especially if they do not have medical indications?

3. How to prevent interference in the consciousness of a cyborgized person in order to manipulate their behavior?

4. How to ensure the safety of people near a cyborg under the possibility of a cyberattack on the artificial intelligence system it contains?

5. How shall we regulate the procedure for obtaining medical care if the results of genetic improvement have not reached the declared level and additional work is required (on general or extraordinary terms)?

6. Should we distinguish between a person's right to use genetic engineering technologies for positive genetics (improvement of normal functions (Vaughn, 2023)) with and without subsequent inheritance of altered genes?

7. Will the social support measures that people in need are entitled to differ? In particular, this refers to maintenance therapy at the expense of state funds.

8. How can we maintain a balance in the labor sphere between the production efficiency in the interests of business, which is the basis of the economic development of society, and man?

9. Will the employer have the right to prefer a cyborg as an employee, replacing with them a person who previously occupied the workplace, but failed to adapt to new technologies?

10. What should be the position of intelligent robots with strong artificial intelligence, if they can actually replace people in public relations, significantly saving people's finite resources?

The list of questions can be continued; the acuteness of each will increase as we move towards the Society 5.0, signaling the need to reconfigure the regulatory landscape. Symptomatic is the increase in the number of bills that fit into this topic and are submitted for consideration in parliaments around the world. The first laws have been adopted concerning the use of artificial intelligence technologies (the European Union Regulation establishing harmonized rules on artificial intelligence, or the Artificial Intelligence Act, dated June 13, 2024)[32] and neurotechnologies (Law No. 21383 of October 14, 2021 on amendments to the Chilean Constitution related to the recognition of neural rights)[33]. Based on the latter, the first court decision on the protection of neuroprivacy has been made in Chile. This is the decision of the Supreme Court of Chile No. 1.080–2020 of August 9, 2023, which protected the right to mental

[32] European Union. Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act). https://clck.ru/3Eh947

[33] Ley 21383. (October 25, 2021). Modifica la carta fundamental, para establecer el desarrollo científico y tecnológico al servicio de las personas. Biblioteca del Congreso Nacional de Chile. https://clck.ru/3Eh958

integrity of a person based on a constitutional protection lawsuit filed against Emotiv Inc. (USA). The company commercializes neural devices that collect, among other things, data on the electrical activity of the brain (Cornejo-Plaza et al., 2024).

Rapidly developing technologies are changing reality so quickly and profoundly that such lawmaking, although it has some advantages, raises new problems due to the lack of theoretical tools. Sometimes the rules established by law become outdated even before they come into force, simply because a new field appears, as happened with generative artificial intelligence. "To avoid repeating the same mistakes, the discussion of the future law on cyborgs should begin today", because "the law regulating the symbiosis of man and machine will become the main problem in the second half of the 21st century" (Księżak, 2024). This statement is valid not only for cyborgs, but also for the other types of entities mentioned above.

With the development of new technologies, two opposing approaches to managing this process began to take shape: supporters of the first advocate strict regulation in order to protect society from unforeseen dangers; supporters of the second advocate soft regulation that promotes innovation. Based on these approaches, the formation of law in the field of digital and biotechnology has begun. The time of intervention is of great importance per se, because if the course correction is performed at an early stage, it is easier to implement and less costly; however, the difficulty will be the lack of comprehensive information about the possible consequences of technology development and therefore a lack of understanding of the necessary changes. Later, the necessary changes will become more understandable, but will most likely require much more effort, which will lead to complex, lengthy and expensive course adjustments (Collingridge 1982).

Further, we collected, systematized and developed the proposals put forward by various researchers, both legal scholars and specialists in technology, who insist that norms taking into account the impact of technological (including artificial biotechnological) transformations on humans and society must be included into the legal matter. It seems that the time has already come to discuss these proposals. Posthumanism as a "populist diagnosis of a new era, a new way of critical research" (Lorimer, 2009) promotes "a focus on expanding previously human-specific categories (agency, sociality, legal personality) by including non-human forms of existence in them" (Yumartov, 2021).

2.3.1. Legal regime (potential legal status) of intelligent robots

Currently, robots with artificial intelligence are objects of law, but, unlike things, intelligent robots are able to act autonomously and their capabilities are increasing (Lima & Paiva, 2024), while they strongly depend on the availability of external data (Ponce del Castillo, 2024). "The stakes of technological progress are rising every day"[34], changing

[34] Pasquale, F. (2021). The New Laws of Robotics. https://clck.ru/3Eh9EQ

the balance between machines and people in everyday life, but people can "guide technologies by law"[35]. Given that the impact of robotics on the world around us has a steady tendency to grow, the creation of a special Lex robotica is inevitable over time, and it is likely to be based on the requirements of ethical acceptability and orientation to social needs (Palmerini et al., 2016). If an intelligent robot of the next generation (with strong artificial intelligence) remains an object of law in accordance with existing legislation, and is not endowed with the status of a subject of law, it will not be able to perform a number of functions instead of a human. If such a robot is recognized as a subject, taking into account its hypothetical intellectual superiority, this may lead to a loss of human-centricity of society. Thus, in the paradigm of anthropocentrism, robots cannot have legal personality, as this is contrary to the interests of people.

Possible options are to program robots to develop up to a certain limit or to accept the loss of human-centricity. The first option does not exclude the growth of risks, which IT specialists often associate not with a hypothetical uprising of strong artificial intelligence, but with the use of weak artificial intelligence as a tool by an attacker. Some authors propose to provide robots with limited or partial legal personality (quasi-personality), with a minimum set of rights and obligations, and only for certain purposes (Mocanu, 2021). According to proponents of this idea, endowing advanced artificial intelligence systems with "limited and narrow forms of legal personality ... seems to be the best way to promote the individual and public interests that the law must protect" (Bertolini & Episcopo, 2022). Among the statutory duties of such a robot is, first of all, non-hostility towards people. Hence, it must be guided by the "first law of robotics" in relations with people – not to harm a person by action and not to allow a person to be harmed by inaction. Other proposed obligations include: willingness to aggregate (unite with other robots for teamwork), ensuring situational awareness (discovery or concealment of relevant information), the obligation to fulfill one's role (leader in a group or subordinate to another robot or human), the obligation to undergo regular checks, etc. To implement the ability of an intelligent robot to act autonomously, in addition to the above obligations, it is suggested to stipulate the following rights of a robot:

– the right to receive, replenish, store and use information;
– the right to education and self-study;
– the right to exchange information with the external world;
– the right to respond to changes that occur in the environment;
– the right to "have an opinion" (the right to rational behavior);
– the right to make mistakes, since there are no methods for creating error-free software yet (Abrosimov, 2022).

Opponents of the possible legal personality of such artificial intelligence systems often refer to the lack of self-awareness in these systems as an insurmountable obstacle.

35 Ibid.

However, new research are emerging confirming the reality of demonstrating consciousness or gaining stable agency in the near future. It means that the prospect of "having artificial intelligent systems with their own interests is no longer a matter exclusively of science fiction or the distant future"[36].

2.3.2. Legal status of cyborgs

In an anthropocentric society, the biological body "always remains the supreme essence and frame of reference" (Fuchs et al., 2024), but this does not mean a ban on artificially increasing human capabilities. The specificity of cyborg's legal status will be determined by cognitive integration, which leads to complementing the human brain functions with artificial intelligence. By the way, according to sociological studies, cognitive improvement causes less rejection among the surveyed people than the desire for artificial physical improvement through body cyborgization (Zhang et al., 2024). The negative perception depends on age; it is less in younger generations (Reichel et al., 2024).

The intelligence hybridization and the emergence of new properties in the subject allows speaking of the features that require reflection in the legal status of technologically enhanced people: "As technological components become an integral part of the human body, the international community should reconsider the concept of cyborg ethics", as well as its ethical and regulatory implications (Ireni-Saban & Sherman, 2022). The impact on people who acquire cyborg properties in order to change their behavioral reactions is different from the impact on humans, and this should be taken into account in legislation (Viljanen, 2017).

The features of the legal status of cyborgs stem from the insecurity of their personal data, incomplete control over the neural devices built into their body, and the needs of the cyberphysical part of the body.

Cyborgs, on the one hand, have certain advantages; on the other hand, they are very vulnerable in terms of maintaining confidentiality of information, exercising the right to make medical decisions independently, etc. However, as for the threat of "mind reading", advances in neurotechnology allow gradually decoding information about functioning of the brain, not only supplemented by a neuroimplant. This indicates the urgent need to discuss neurorights as a new group of individual rights (Wajnerman & Lopez-Silva, 2022), regardless of cyborgization.

The specific rights which should be recognized in a cyborg include:

– the right to improve one's body using certified cyber components and medical devices;

– the right to keep their cyber and medical devices under any circumstances (with the exception of illegally integrated, non-certified ones or those posing a danger to others);

[36] Long, R., Sebo, J., Butlin, P., Finlinson, K., Fish, K., Harding, J., Pfau, J., Sims, T., Birch, J., & Chalmers, D. (2024, October 30). Taking AI Welfare Seriously: Report. https://goo.su/L7IeY

– the right to non-misuse by manufacturers and suppliers of cyber devices;

– the right to a share of ownership of components that are integrated or implanted into the cyborg's body;

– the priority right of governing the activities inside one's body;

– the right to make a decision on any type of medical intervention;

– the right to protection against discrimination due to cyborgization[37].

The recognition of these rights for cyborgs will require significant changes to the norms of constitutional, administrative, civil, family and labor law (Sokolova, 2022), as well as defining the "cyborg" concept in legislation. "Subject regulation in this area should be made in advance to a certain extent" (Kamalova, 2021) in order to eliminate the gap between technological modification of a human and their social identity, as well as to prevent the growth of digital and biotechnological inequality. In addition to specific rights, cyborgs should also have symmetrical responsibilities arising from the additional risk to people around them. These should be, at least, the obligations to register complex neural devices in the state register, not to use devices that pose a danger to others, and not to distribute confidential information about other people obtained during the operation of a neuroprosthesis/neuroimplant.

2.3.3. Legal status of genetically enhanced individuals

Such individuals, along with cyborgs, are human beings; therefore, they act as subjects of law under current legislation, but unlike other people, their body is artificially biologically modernized. On the one hand, these individuals, like all people, have the right to protection from discrimination; on the other hand, ensuring security for all should be the basis for legal restrictions in biomedical research and procedures (Czomartova et al., 2021). Such persons, being resistant to infectious diseases, can be their carriers without harm to their body, which is fraught with serious consequences for other people. Or they can increase their personal abilities through genetic improvement, "laying a bomb" for the next generations of their descendants, because, according to frontier research, "many diseases are closely related in the sense that reducing the risk of one increases the risk of the other". For example, the probability of some cancers is inversely proportional to neurodegenerative diseases, such as Alzheimer's and Parkinson's disease (Benton et al., 2021).

Today, the questions of human nature, the norm and its boundaries are raised "in a completely different sense than before: for the first time in human cognition of humanity, we moved from observation to intervention" (Przhilenskiy, 2024). This is why the prospective emergence of genetically enhanced individuals began to take on quite real outlines. This is why the formation of bio-law began, as a comprehensive area designed to protect not only humans, but also humanity as a whole, covering future generations. Rights of a human as a biological organism should be built on the currently being

[37] Memorandum on the rights of cyborgs. (August 8, 2018). https://clck.ru/3Eh9PH

formed “principles of bio-law ensuring the unity of legal and ethical-social regulators” (Umnova-Konyukhova & Aleshkova, 2022).

The specificity of the status of genetically enhanced individuals should rely on the public interest as the basis of a balance between the unhindered receipt of information about genetic improvements, which will contribute to the development of science and ensure the safety of other people, and the preservation of confidentiality as everyone’s right to personal data protection (Berg, 2024).

Genetic improvement can be the result of the will of the person, the decision of their parents, or the birth from similar individuals who transferred the acquired genetic improvements. Thus, it must be borne in mind that new individuals will appear who did not choose to become such or remain human without artificially produced changes; the status of genetically enhanced individuals will apply to them from birth. Such individuals should at least have the right to supportive therapy if they need it vitally.

The specific obligations of genetically enhanced individuals are likely to be ensuring that up-to-date data is provided to biobanks and refraining from actions that do not harm these individuals due to genetic changes, but endanger the lives and health of people around them.

2.3.4. Legal regime (potential legal status) of chimeras

The first subtype of chimeras is biorobots. Biorobots with artificial intelligence, although similar to genetically enhanced individuals in some biological characteristics, are not human. Hence, legal regulation regarding them is likely to be closer to intelligent robots. We should expect an even more intense dispute over the legal personality of intelligent robots in relation to biorobots that are not inferior to humans in terms of intelligence, if such biorobots appear. Such a robot will not only move and speak like a human; it will have “living” muscles and organs. The ability for biological evolution and the potential for reasonableness will inevitably entail ethical dilemmas that go beyond technology (Mestre et al., 2024) and need attention from the law.

The second subtype of chimeras is “digital personalities”, or virtual artificial intelligence systems that are autonomous (not “tied” to a specific living person), but having cognitive abilities equal to or greater than human ones. This is the only type of new entities that does not have a physical shell, which cannot but affect the forms of legal responsibility of these virtual personalities if they are recognized as legal entities. The absence of a physical embodiment does not exclude the possibility of recognizing such chimeras as subjects or, more precisely, quasi-subjects of law, since “the growing use of artificial intelligence promises huge advantages in speed and efficiency in all forms of decision-making” (Burgess, 2024). Respectively, if, in order to be an effective embodied virtual agent and replace people in various processes, such entities require a certain minimum of rights and obligations, like intelligent robots, – these rights and obligations will, with a high probability, recognized over time.

Conclusions

Summarizing the study, it is worth emphasizing that the task of law is to develop a balanced approach to regulating public relations that are being transformed under the influence of digital and biotechnologies. One can talk about the emergence of new types of entities as about a growing probability, partly even as an already emerging phenomenon. Some of them will be systems of strong artificial intelligence (intelligent robots, virtual personalities); others will be technologically and genetically enhanced humans. The closest thing is the emergence of cyborg humans, which is already beginning to happen, but the prospects for other types should not be ignored. Cyborgs and genetically enhanced individuals are people, they will be subjects of law anyway; the question is only about the specificity of their status. However, intelligent robots and chimeras are new types of entities that are not human, but have cognitive functions and are able to make an intellectually directed impact on the environment and subjects of law.

The inertia of the regulatory environment, which is generally useful in terms of maintaining the status quo, will increase inequality in the society objectively "drifting" towards posthumanism. The problem is aggravated due to the lawyers' poor understanding of some technological innovations when they propose changes to legislation. Nevertheless, attempts to construct a legal regulation adequate to Society 5.0 are useful because they help to form a coherent image of the future society and outline the trajectory of moving towards it. In any case, the approach will be based on calculating risks, since a risk-based approach seems to be the best possible option under high uncertainty.

Assessing the parameters achieved so far while forming the national and regional approaches to artificial intelligence regulation, one may say that some states will regulate the use of artificial intelligence and other technologies more strictly. Others will adhere to a softer regulation, because this will stimulate the technological development and give outsiders a chance to "get ahead"; however, the consequences may be extremely hard. The creation of national legislation, although differing by country, is inevitably tied to the international level. This enables the main political actors to coordinate their positions. Thus, we should expect a controversial and difficult period, which will end with forming of principles common for all.

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Author information

Irina A. Filipova – Cand. Sci. (Law), Associate Professor, Department of Labor and Environmental Law, National Research Lobachevsky State University of Nizhni Novgorod; Head of the Central Asia Research Center for artificial intelligence regulation, Samarkand State University named after Sharof Rashidov
Address: 23 prospekt Gagarina, 603922 Nizhniy Novgorod, Russia; 15 Universitetskiy bulvar, 140104 Samarkand, Uzbekistan
E-mail: irinafilipova@yandex.ru
ORCID ID: https://orcid.org/0000-0003-1773-5268
Scopus Author ID: https://www.scopus.com/authid/detail.uri?authorId=57327205000
WoS Researcher ID: https://www.webofscience.com/wos/author/record/R-1375-2016
Google Scholar ID: https://scholar.google.com/citations?user=opJc7fcAAAAJ
RSCI Author ID: https://elibrary.ru/author_profile.asp?authorid=461586

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Интеллектуальные роботы, киборги, генетически усовершенствованные индивиды, химеры: будущее и задачи права

Ирина Анатольевна Филипова

Национальный исследовательский Нижегородский государственный университет имени Н. И. Лобачевского, Нижний Новгород, Россия;
Самаркандский государственный университет имени Шарофа Рашидова, Самарканд, Узбекистан

Ключевые слова

биотехнологии,
генная инженерия,
искусственный интеллект,
киборг,
нейротехнологии,
право,
риск,
робот,
цифровые технологии,
человек

Аннотация

Цель: выявить теоретико-правовые проблемы, связанные с неуклонно расширяющимся распространением на практике продуктов развития цифровых и биотехнологий, оценить сопутствующие этому процессу риски, способные изменить положение человека в обществе будущего, а также выработать и аргументировать предложения по минимизации рисков и устранению выявленных проблем с помощью правового регулирования.

Методы: в основе исследования лежат методы обобщения научно-технической информации и теоретического анализа, применявшиеся в процессе изучения исходных материалов, аксиологический и системный подходы, формально-юридический метод и, кроме того, методы правового прогнозирования, в первую очередь экстраполяции, позволившие осветить перспективы реформирования права вследствие технологической экспансии.

Результаты: включают описание динамики развития цифровых и биотехнологий; характеристику меняющегося социального ландшафта с возникновением новых типов сущностей, способных повлиять на фактический статус человека; классификацию рисков, угрожающих людям из-за совершенствования цифровых и биотехнологий; перечень задач, решение которых на основе права поможет устранить, отодвинуть или, по крайней мере, значительно снизить остроту проблем, увеличивая лимит времени, отведенный человечеству на осмысление ряда концептуальных моментов. Представлены доводы, обосновывающие необходимость разработки специального правового регулирования в отношении новых типов сущностей, появление которых становится неизбежным результатом развития упоминаемых технологий.

Научная новизна: состоит, во-первых, в комплексном изучении развития взаимосвязанных групп цифровых и биотехнологий с учетом их усиливающейся конвергенции, во-вторых, в формулировании юридических вопросов, которые требуют урегулирования из-за потенциального появления новых типов сущностей, располагающих когнитивными функциями и способных оказывать интеллектуально направленное воздействие на окружающую среду и субъектов права.

Практическая значимость: присутствует в ответах, данных на сформулированные юридические вопросы, они содержат предложения и рекомендации по необходимой корректировке правового регулирования и акцентируют внимание правоведов на проблемах, вытекающих из темпов и векторов развития наукоемких технологий.

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Сведения об авторе

Филипова Ирина Анатольевна – кандидат юридических наук, доцент, доцент кафедры трудового и экологического права, Национальный исследовательский Нижегородский государственный университет имени Н. И. Лобачевского; руководитель Центрально-Азиатского исследовательского центра регулирования искусственного интеллекта, Самаркандский государственный университет
Адрес: 603922, Россия, г. Нижний Новгород, проспект Гагарина, 23;
140104, Узбекистан, г. Самарканд, Университетский бульвар, 15
E-mail: irinafilipova@yandex.ru
ORCID ID: https://orcid.org/0000-0003-1773-5268
Scopus Author ID: https://www.scopus.com/authid/detail.uri?authorId=57327205000
WoS Researcher ID: https://www.webofscience.com/wos/author/record/R-1375-2016
Google Scholar ID: https://scholar.google.com/citations?user=opJc7fcAAAAJ
РИНЦ Author ID: https://elibrary.ru/author_profile.asp?authorid=461586

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