ARTICLES

LEGAL REGULATION OF TECHNOLOGICALLY IMPROVED PEOPLE IN THE UNITED STATES AND CHINA

VIKTOR MOROZOV,

Tyumen State University (Tyumen, Russia)

VADIM CHUKREEV,

Deputy Prosecutor of the Sverdlovsk Region (Yekaterinburg, Russia)

DANA RIZAYEVA,

RUDN University (Ashgabat, Turkmenistan)

https://doi.org/10.21684/2412-2343-2022-9-4-4-20

As humanity improves its use of technologies that can replace parts of a biological organism with ones containing mechanical or electronic components, it raises important legal and political issues. For example, the successful implantation of devices in human bodies could lead to the emergence of new cognitive and motor abilities, thereby resulting in the creation of a new class of people. Undoubtedly, this new class of people with extraordinary abilities would require a legal and governmental response. However, the question that arises is what legal rights might be given to these people, considering that they are more similar to machines than to men or women. The following legal aspects are of the utmost importance: the legal rights and responsibilities of cyborgs; the regulation of access to neuroprosthetic devices by third parties; and the limitation of the illegal use of the damaging capabilities of cyborgs. This article examines a number of laws and regulations from various jurisdictions in the United States, the European Union, South Korea and China that apply to cyborg technologies, with a particular focus on a legal doctrine that applies to neuroprostheses.

Keywords: cyborg; improvement technology; neuroprosthesis; copyright; cognitive freedom.

Recommended citation: Viktor Morozov et al., *Legal Regulation of Technologically Improved People in the United States and China*, 9(4) BRICS Law Journal 4–20 (2022).

Table of Contents

Introduction

As we currently experience yet another technological revolution, scientists around the world have turned their attention to the technical improvement of human beings to give them additional useful properties, qualities and capabilities that can be portable or embedded in the body. In the global community, the advent of the cyborg age is a topic of conversation.

Today, millions of people around the world are equipped with various forms of cyborg technology, ranging from prosthetic limbs and thought-activated prosthetic arms to brain-implanted neural prostheses, as well as pacemakers, defibrillators or cochlear implants. There are positive examples of scientists working on an artificial hippocampus to restore memory.[1]

Unfortunately, the prevalence of limb loss is expected to increase: the number of people living with limb loss is projected to rise to 3.6 million by 2050 in the United States.[2] As more people become equipped with cyborg devices or complex technological prosthetics, important legal issues arise that lead to a redefinition of the very concept of "human being." Problems may arise when cyborg people are

---

[1] Nuffield Council on Bioethics, Novel Neurotechnologies: Intervening in the Brain (2016) (Sept. 15, 2022), available at http://nuffieldbioethics.org.

[2] Kathryn Ziegler-Graham et al., *Estimating the Prevalence of Limb Loss in the United States: 2005 to 2050*, 89(3) Arch. Phys. Med. Rehabil. 422 (2008).

encroached upon (for example, by tampering with an implanted medical device or by interfering with the wireless signals of devices worn by individuals equipped with cyborg devices), or, conversely, when their misconduct is enhanced by additional devices.[3]

Thus, in the age of cyborgs, there must be regulations governing the lawful manufacture, circulation and carrying of cyborg devices, as well as measures that are developed to counteract the unlawful actions of such people. As we continue to advance technologically, laws must be enacted to protect our identity as "homosapiens."

1. "Cyborg Technology": A New Term in a New Era

Scientists and policymakers are already working on the problem of legal regulation for cyborg technology. For example, in the United States, the White House Presidential Commission on Bioethics has produced a technical report that reflects the ethical, political and legal issues surrounding advances in neurobiology.[4] Similarly, in the United Kingdom, the Nuffield Council on Bioethics has produced an article discussing "brain-computer" interfaces.[5]

In a special issue of *Cyberphenemonology: Technominds Revolution*, Kevin Warwick, Woodrow Barfield and Alexander Williams identified the term "cyborg technology" as follows: technology that is integrated into the human body and that not only restores lost functions but also enhances the anatomical, physiological and informational capabilities of the body.[6] This includes everything from medical implants (e.g. pacemakers) to brain implants of the near future that can alter memory and cognitive abilities. In addition, the term "cyborg prosthesis" is provided – which is used to refer to the artificial body enhancements that provide computational capabilities that function as a feedback system. These enhancements can be upgraded, and in some cases, they can be controlled by thought or implanted directly into the body itself.

An ear device with a stimulator under the skin sending signals to the inner ear and a speech processing unit, a "cochlear" implant can be considered as an example of calculative abilities of man-machine combination with the function of cyborg prosthetic devices. Main advantage of such device is that its calculative ability is rather swift. The process of functioning of such device is the following: microphone is receiving the outer sound and change it into the electric signals by the processing unit which dispatches

---

[3] Marc Goodman, *Future Crimes: Everything Is Connected, Everyone Is Vulnerable and What We Can Do About It* (2015).

[4] Amy Gutmann, *Gray Matters: Topics at the Intersection of Neuroscience, Ethics, and Society, Vol. 2*, Presidential Commission for the Study of Bioethical Issues (March 2015) (Sept. 15, 2022), available at https://bioethicsarchive.georgetown.edu/pcsbi/sites/default/files/GrayMatter_V2_508.pdf.

[5] Nuffield Council on Bioethics, *supra* note 1.

[6] Woodrow Barfield & Alexander Williams, *Cyborgs and Enhancement Technology*, 2(4) Philos. 4 (2017).

the results by way of skin using the transmitter. In addition, the receiver picks up sound signals and sends them to an electrode array, which is positioned so that it can transmit patterns of electrical activity to the auditory nerve, similar to those delivered by healthy human cells. In terms of increasing a person's ability to process information, these individuals are able to detect sounds they heard before the damage and, in some cases, even sounds outside of their normal range.

Another category of cyborgs are people with implanted artificial intelligence, who are more powerful and more of a concern than, for example, people with a prosthetic leg. Cyborgs with implanted artificial intelligence have significantly enhanced cognitive capabilities, and it is they who could potentially pose the greatest threat in the future when encroaching on protected interests.

Cyborgs of the modern age are equipped with prostheses attached to their bodies or even implanted in their bodies for a variety of purposes, ranging from medical necessity to voluntary self-improvement. In general, cyborgs choose not only to be equipped with implants and devices to restore lost functions but also, in some cases, to enhance their performance, abilities and skills – whether cognitive, sensory or physical.

2. Current Legal Issues of Cyborg Technology

2.1. Present Legislation in the United States of America, South Korea and the European Union

As more and more people are equipped with cyborg technology, there is a serious problem of regulating the legal rights and responsibilities of such people, as well as regulating and controlling the technologies that are used to repair, upgrade and improve the human body.

As an example, consider a prosthesis attached to the body and a neuroprosthesis implanted in the brain.

In the United States, such devices receive protection as intellectual property under patent law and the software receives the same protection as for copyrights. However, it may be illegal to interfere with the wireless communication of such devices, so defective (illegally attached) prosthetic devices are subject to the Product Liability Act, which provides for cases of design or manufacturing defects in the product. But, if a third party intentionally alters a product after it has been purchased, the manufacturer cannot be held liable for damages caused by a product that has been altered for body enhancement itself.

Similarly, the law applies to a neuroprosthetic device implanted in the brain, since the software controlling the device can be modified by others remotely, such as over a wireless network. In any case, once cyborg devices are treated by humans as parts of their bodies, the distinction between property rights and human rights becomes blurred, making the establishment of liability increasingly problematic.

In addition, with regard to the procedures used for attaching such devices to the body or implanting them into the body, medical malpractice can result in harm to the person.

For reasons of public safety, U.S. lawmakers are addressing not only the legal regulation of cyborg devices and discussing whether to classify them as either consumer products or medical devices, but also the resulting problems of applying provisions of constitutional law, such as the right to privacy and the Search and Seizure Act, in the event that law enforcement agencies monitor the life of a person without a proper warrant and gain access through their prosthetic devices to gather private information.

Consider the case of *Riley v. California*, a case in which the justices of the United States Supreme Court unanimously ruled that police officers could not conduct a data search on a suspect's seized cell phone without a warrant. The Cyborg Act was relevant to the case, and the Chief Justice said that

> modern cell phones today are so common and integral to everyday life that the proverbial visitor from Mars might think they are an important human anatomical feature.[7]

In the United States, this was the first time the Supreme Court had considered the concept of "cyborg" in case law.

The basic laws governing the legal rights and responsibilities of cyborgs in the United States are the same as those governing the legal issues of prosthetics and implants, that is, as medical devices, in particular for people with disabilities. For example, there is a federal law titled "On the Food and Drug Administration (FDA)," which governs authority over medical devices, including prosthetic devices and implants.[8] Under this law, devices are divided into classes based on the degree to which patients are likely to be exposed to any potential health risks and hazards. The less complex devices have far fewer regulatory provisions that do not require FDA approval, while the most complex ones require clinical safety studies before a product can be marketed.

For example, in South Korea, legislation regarding cyborg-like devices is similar to that of the United States in that it has an elaborate classification system for regulating medical devices and also addresses the issue of proper manufacturing. The Ministry of Health and Welfare, which acts in accordance with the rules stipulated for prosthetic devices under the Disabled Persons Welfare Act, is in charge of exercising oversight.

---

7 *Riley v. California*, 573 U.S. 373 (2014).

8 21 U.S.C. Ch. 9: Federal Food, Drug and Cosmetic Act, Sec. 360c: Classification of Devices Intended for Human Use (Sept. 14, 2022), available at http://uscode.house.gov/view.xhtml?path=/prelim@title21/chapter9&edition=prelim.

In addition, South Korea's Ministry of Food and Drug Safety regulates pharmaceuticals and medical devices, including implants, under the Medical Device Act and the Pharmaceutical Act.[9] In Japan, the Pharmaceutical and Medical Device Agency classifies medical devices in a similar way: by risk level and by introducing manufacturing standards to protect public health.

In the European Union (EU), there is a directive on active implantable medical devices together with directives on machinery and medical devices and on the safety in relation to prosthetic devices.[10] In some countries, prostheses and implants that are not medically necessary are either prohibited or are considered reconstructive enhancements.

In certain cases, it would be useful to link legal regulation of cyborg technology to the advancements being made in robotics, which are constantly improving in terms of both intelligence and their increasingly human-like appearance. On the other hand, as robots become more intelligent, the law is bound to become more complex, for example, in terms of establishing liability against a robot for harming a human being. And as humans become increasingly similar to cyborgs, it becomes more difficult to distinguish between cyborgs and mechanically integrated body enhancements, as well as to separate them from biological ones. Nevertheless, it is important to make this distinction when establishing criminal liability in cases involving violations of property rights or infringements of bodily integrity.

2.2. Current Legislative Initiatives Related to Robotics Development

Governments around the world are attempting to regulate robotic technology, particularly cyborgs. The development of such devices offers hope for combating a number of incurable diseases. For example, improvements in the algorithms of computer cyborg technology could help those suffering from brain injury, Alzheimer's disease or vision loss.

Addressing the legal regulation of robotics requires financial, ethical and legal support. In the United States, for example, the Presidential Commission on Bioethics advises the executive branch on the ethics and current direction of biotechnology, artificial intelligence and neuroscience research.[11]

In 2014, the European Union finalized a law titled "Regulating Emerging Robotics in Europe: Robotics Facing Law and Ethics" (RoboLaw) in relation to emerging

---

[9] South Korea – Welfare Laws for Persons with Disabilities, Disability Rights Education & Defense Fund (Sept. 15, 2022), available at https://dredf.org/legal-advocacy/international-disability-rights/international-laws/south-korea-welfare-law-for-persons-with-disabilities.

[10] Council Directive 90/385/EEC of 20 June 1990 on the approximation of the laws of the Member States relating to active implantable medical devices (Sept. 14, 2022), available at http://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/implantable-medical-devices_en.

[11] Presidential Commission for the Study of Bioethical Issues, U.S. Department of Health and Human Services (Sept. 13, 2022), available at https://bioethicsarchive.georgetown.edu/pcsbi/node/851.html.

robotics.[12] This comprehensive document reflects the current legal status and ethical implications, as well as the impact of robotics and other technologies on the future of society.[13]

South Korea's legislators recently passed the Intelligent Robotics Development and Dissemination Act, which declared the creation of an intelligent robot industry[14] as a national strategic goal. Measures to achieve this goal include financial incentives for research and development, the establishment of the Robotics Promotion Institute and the development of a high-tech theme park focused on robots.

2.3. Copyright Regulation

The most controversial issue is the legal regulation of devices used to improve the quality of human minds, specifically, the circulation of chips and software for neuroprosthetic devices and other implants. Chips implanted in the brain and the software associated with such technology represent the latest advances in technology being developed to improve the cognitive abilities of a cyborg. As an example, consider the development of a neuroprothesis such as the artificial hippocampus, which is designed to restore and improve memory.

The neuroprosthesis has strong potential not only to repair brain damage from disease or injury but also to enhance brain abilities, such as downloading information from the Internet, engaging in mental communication and editing memories.

When computer chips are integrated into a neuroprosthesis, they become part of the cyborg brain architecture and contribute to the technological improvement of human mental capabilities. In this case, the United States employs the Copyright Act to protect the programs stored on the chips. This means that the programs stored on the chip implanted in the cyborg's advanced brain are protected under the Copyright Act. The software that controls the implant must also be protected, but under U.S. Intellectual Property Law, objects that are considered utilitarian are not subject to copyright protection, and microchips are utilitarian in function.

In the United States, the issue of copyright protection for software encoded on chips was resolved in the case *Apple Computer, Inc. v. Franklin Computer Corp.*,[15] in which the court rejected the argument that software encoded on chips should be considered utilitarian and therefore not copyrightable. The court noted that

---

[12] RoboLaw Regulating Emerging Robotics in Europe: Robotics Facing Law and Ethics Regulating (Sept. 4, 2022), available at http://www.robolaw.eu.

[13] Regulating Emerging Robotic Technologies in Europe: Robotics Facing Law and Ethics, European Commission (Sept. 15, 2022), available at http://cordis.europa.eu/project/rcn/102044_en.html.

[14] Intelligent Robots Development and Distribution Promotion Act (2008), Korea Legislation Research Institute (Sept. 8, 2022), available at http://elaw.klri.re.kr/eng_mobile/viewer.do?hseq=17399&type=sogan&key=13.

[15] *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240 (3d Cir. 1983).

the medium on which the software is encoded should not determine whether the software itself would be protected by the Copyright Act.

This case is of great importance in the history of cyborg litigation because it was the first time an appellate court in the United States ruled that a computer operating system could be protected by copyright.

A second important aspect for cyborg rights regulation is the ruling's clarification that binary code, a machine-readable form of software, is also subject to copyright protection (as is the human-readable form of software). Thus, the software aspects of a neuroprosthetic device receive copyright protection. This ensures that legally protected thinking or ways of thinking are possible if thoughts pass through and are stored on these chips, since their programs have a significant impact on the brain's thought process.

There is another type of legal protection in the United States that applies directly to computer-enhanced brains. This is the Semiconductor Chip Protection Act.[16] Given the importance of protecting integrated circuits from piracy, several countries, including Japan and the EU, have followed the U.S. lead and adopted similar directives recognizing and protecting integrated circuit designs (also called semiconductor chip topography).

In 1989, a diplomatic conference was held between countries at which the Intellectual Property Treaty with respect to integrated circuits was partially implemented by reference in the World Trade Organization's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).[17] TRIPS is an area of intellectual property law that covers: copyright and related rights (that is, the rights of performers, record producers and broadcasters); trademarks, including service marks; geographical indications, including appellations of origin; industrial design; patents, including protection of new plant varieties; integrated circuit topologies; and undisclosed information, such as trade secrets and test data.[18]

As previously noted, the primary purpose of semiconductor chip protection laws is to prohibit 'chip piracy', that is, the unauthorized copying and distribution of semiconductor chip-based products copied from the original creators of such works. The use of computer chips in pacemakers and neuroprosthetic devices makes it possible to direct computing resources to actions such as using thought to control prostheses, which will help to restore and improve memory as well as other cognitive functions.

---

16 Semiconductor Chip Protection Act of 1984.

17 Overview: the TRIPS Agreement, World Trade Organization (Sept. 13, 2022), available at https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm.

18 Jan Busche et al., *Article 35. Relation to the IPIC Treaty* in *WTO – Trade-Related Aspects of Intellectual Property Rights* (Peter-Tobias Stoll et al. eds., 2008) (Sept. 14, 2022), available at http://booksandjournals.brillonline.com/content/books/10.1163/ej.9789004145672.i-910.229.

3. Cyber Hacking

Legal systems must also consider the problem of protecting the active memory of cyborgs as programs are stored and downloaded to various devices implanted in their brains. Memory chips such as EPROMs (erasable, reprogrammable, read-only permanent memory) can retain their data even when power is removed. Such chips are protected by the U.S. Semiconductor Chip Protection Act, but it does not cover information such as computer programs, which are protected by the Copyright Act. For example, the U.S. Court of Appeals for the Ninth Circuit in *MAI Systems Corp. v. Peak Computer, Inc.*[19] ruled that when software was loaded into a computer, its RAM (RAM-operative storage device) was created as a "copy," potentially infringing "reproduction" under the U.S. Copyright Act. This means that even if no hard copy was made, temporarily storing the program in RAM was still considered reproduction and potentially copyright infringement. Thus, turning on a computer constitutes reproduction of operating system programs because they are automatically stored in RAM whenever the computer is powered on or when a file is transferred from one user of a computer network to another.

The possibility that the implant technology in the human brain can be hacked raises the question of what rights people have over the reliability of the sensory information transmitted to their brains and the memories stored in their brain structures. Editing or altering memories are aspects of improved technology that await future cyborgs. If third parties are able to hack into brain implant technology, the possibility of a bleak future for humanity should not be underestimated. For example, a retinal prosthesis could be hacked to place images on the back of the retina that a person has never seen. Or, in the case of cochlear implants, previously unheard sounds may be transmitted to the auditory nerve. It is also possible to hack into the artificial hippocampus in order to implant memories in the brain of events the person has never encountered before. Thus, there is the potential technological ability to hack into the brain, which means it will not remain a bastion of privacy. That is, having access to a person's brain and gaining the ability to manipulate it creates an even greater danger, namely the loss of a person's identity as an individual.

When a third party gains access to neuroprostheses implanted in another person's brain, a number of negative consequences can arise, requiring an immediate legal prohibition. For example, if a person committed a crime because someone had remote access to their brain and affected their mind, this suggests that the person lacked the intent to carry out the crime (*mens rea*). Would they be exempt from liability? According to law professors Jeffrey Rosen and Owen Jones, who have scanned the brains of prison inmates, the neurological disorder prevents defendants from

[19] *MAI Systems Corp. v. Peak Computer, Inc.*, 991 F. 2d 511 (9th Cir. 1993).

controlling their actions.[20] In this regard, it is necessary to create software to study the programming language and algorithms that control neuroprosthetic devices and identify the intentions of their wearers to commit crimes. If it is proved that the person wearing the neuroprosthetic device has no intention of committing a crime, we should talk about indirect infliction of harm and a new kind of perpetrator.

4. Right to Change Memories

The use of neuroprosthetic devices may lead to other problems, such as in the case of scanning a person's brain and recording his thoughts or changing the content of his memory. Recording unspoken thoughts or altering memory content is a violation of privacy, that is, an infringement of a person's basic rights.

It is currently impossible to directly reconstruct visual or auditory information stored in the human brain. However, this may become quite possible in the future given the capabilities of cyborg technology, because once cyborgs have the technology to sense the world, they will have an electronic (or digital) record of what they have seen and heard.

According to the findings of the U.S. President's Bioethics Commission and the Nuffield Report, the ability to record thoughts is possible in the foreseeable future. Hence, it would be possible to subpoena cyborgs equipped with neuroprostheses and to use the data stored on the prosthesis as evidence. However, here the legal difficulty arises in terms of testifying against oneself.

Cognitive freedom, or the "right to mental self-determination," is a vital part of human rights in international law and is especially relevant in the era of technologically advanced minds. For example, in the Universal Declaration of Human Rights, adopted by U.N. General Assembly Resolution 217A (III) of 10 December 1948 (as of 16 September 2016), freedom of thought is protected by Article 18, which states, "Everyone has the right to freedom of thought, conscience and religion."[21] Clearly, maintaining cognitive freedom in the age of brain implants must be a major social concern as humanity approaches a cyborg future and possible human-machine fusion. In fact, a growing number of legal theorists view cognitive freedom as an important basic human right and argue that cognitive freedom is a principle underlying a number of recognized rights in the constitutions of most developed countries.

The state's obligation to protect cognitive freedom applies directly to neuroprosthetic devices and should be aimed at protecting people from altering or

---

[20] Jeffrey Rosen, *The Brain on the Stand*, The New York Times, 11 March 2007 (Sept. 14, 2022), available at http://www.nytimes.com/2007/03/11/magazine/11Neurolaw.t.html?pagewanted=all&_r=0.

[21] The Universal Declaration of Human Rights (1948) (Sept. 14, 2022), available at http://claiminghumanrights.org/udhr_article_18.html.

observing their mental processes without their consent.[22] In the wake of the new cyborg law, Jan Bublitz and Reinhard Merkel propose the introduction of a new type of punishing interventions for crimes that attack the mental integrity of another person by undermining mental control or exploiting pre-existing mental weaknesses, arguing that these are direct interventions that reduce or impair cognitive abilities such as memory, concentration and willpower; alter preferences, beliefs or behaviors; cause inappropriate emotions or invasive clinically identifiable mental.[23]

Wrye Sententia of the Center for Cognitive Freedom and Ethics also expressed concern that nongovernmental organizations could use new neurotechnologies to alter people's mental processes without their consent. For example, taking away people's ability to think the way they want to think. People have the freedom to change or improve their own minds. One way to do this, even if perhaps controversially, is to stimulate the pleasure centers of the brain with a neuroprosthetic device. This element of cognitive freedom is of great importance to the supporters of the transhumanist movement, the key principle of which is the improvement in human functions.[24]

Let us cite as an example a case on cognitive freedom that was brought before the U.S. Supreme Court. The defendant, Dr. Charles Sell, was accused by a U.S. federal court of making false claims to health insurance companies, which led to allegations of fraud and money laundering.[25] Sell had previously sought help from a psychiatrist and was voluntarily taking neuroleptics but found the side effects unbearable. After the initial charge, Dr. Sell was found to be insane but not socially dangerous. As a result, an administrative hearing was held during which it was concluded that Sell could be forcibly drugged to regain competency. The government's decision to force Sell to take drugs that would alter his mental processes raised serious legal issues. On this point, Harvard University Professor Laurence Tribe has been quoted as previously saying:

> The crime is ultimately the same-government intrusion and election abuse which together make up the human psyche.[26]

The court's conclusion that one can forcibly administer antipsychotic medication to a person who poses no danger to another in order to get him to stand trial is moot in this case.

---

22 Wrye Sententia, *Neuroethical Considerations: Cognitive Liberty and Converging Technologies for Improving Human Cognition*, 1013(1) Ann. N.Y. Acad. Sci. 221 (2004).

23 Jan C. Bublitz & Reinhard Merkel, *Crime Against Minds: On Mental Manipulation, Harms, and a Human Right to Mental Self-Determination*, 8(1) Crim. L. Philos. 51 (2014).

24 Sententia 2004.

25 *Sell v. United States*, 539 U.S. 166 (2003).

26 Laurence Tribe, *Rights of Privacy and Personhood*, 8 Const. L. (1988).

Subsequently, courts will be able to "redact" the information from the prosthesis in order to restore the person's competency. In the case of Dr. Sell, the government sought to directly manipulate and alter his thought processes by forcing him to take mind-altering antipsychotic drugs. In generally, the courts can only force medication in exceptional cases.

A similar case, *R. v. Hardison,* was heard in Great Britain, which involved a defendant in violation of the 1971 Illegal Drug Use Act.[27] Hardison argued that his freedom was guaranteed by Article 9 of the European Convention on Human Rights. He also claimed that "individual sovereignty over his inner environment is the very essence of what it means to be free" and that, since psychotropic drugs are a method of changing a person's mental processes, their prohibition under the Misuse of Drugs Act was a violation of the convention. The court, however, disagreed with Hardison's arguments and denied him the right to appeal to the superior court.

According to Mark Blitz (University of Oklahoma City Law School), freedom of thought should not only protect our ability to reflect, but it should also encourage courts to identify and protect technologies and resources that support mental autonomy and outward thinking. In this respect, freedom of thought must run parallel to freedom of speech.[28]

5. Advancements in the Militarization of Nanotechnology

The opportunities associated with future advances in nanotechnology may well be overshadowed by new threats. One of the most serious threats may come from powerful new nanotechnologies, which could enable armed forces to access unprecedented forms of destructive capability for their application, seriously affecting the existing military balance.

The prospect of revolutionary advances in the military will stimulate competition, and given the opportunity, a nation that has achieved leadership in nanotechnology could completely disarm any potential competitors.

Thus, in 2020, Harvard professor Charles Lieber, one of the world's leading nanotechnology experts, was arrested for his involvement in China's Thousand Talents program and for helping China in its arms race with the United States. Since 2008, Dr. Lieber has led a Harvard University research group specializing in nanoscience and has received more than US$15 million in grants from the National Institutes of Health (NIH) and the U.S. Department of Defense (DOD). These grants require disclosure of significant financial conflicts of interest abroad, including financial support from foreign governments or foreign organizations. At the beginning of 2011, without

---

27 *R. v. Hardison* [2006] E.W.C.A. Crim. 1502, [2007] 1 Cr. App. R. (S.) 37.

28 Marc J. Blitz, *Freedom of Thought for the Extended Mind: Cognitive Enhancement and the Constitution*, 4 Wis. L. Rev. 1049 (2010).

the knowledge of Harvard University, Lieber began working as a "strategic scientist" at Wuhan University of Technology (WUT) in China, and from approximately 2012 to 2017, he was a participant in China's Thousand Talents Plan, which is one of the most prominent talent recruitment plans to attract and develop high levels of scientific activity to benefit China, its economic prosperity and national security. The Thousand Talents program involves recruiting foreign specialists and experts to bring their knowledge and experience to China. Under the terms of Professor Lieber's three-year contract with Thousand Talents, WUT paid the professor $50,000 per month plus living expenses of up to 1 million Chinese yuan (about US$158,000 at the time) and provided him with more than US$1.5 million to set up a research laboratory at Wuhan University of Technology. In return, Lieber was obliged to work at the university for at least nine months a year, working on international cooperation projects and nurturing young doctoral students.[29]

During the course of the trial, it was discovered that Lieber had lied about his participation in the Thousand Talents plan and his affiliation with WUT. The U.S. government accused Professor Lieber of withholding information about his work in China, specifically the fact that in 2015 he had been elected a foreign member of the Chinese Academy of Sciences.

The same year that Lieber received a patent allowing nanotech implants for the human brain, Pentagon officials sounded the alarm that China was working on its own cyborg project. This project aims to create a new kind of soldier by connecting the human brain to machines, millions of sensors and the cloud of a computer. If successful, the capabilities of the human brain will expand exponentially, and the full integration of sensors with arrows and near-perfect situational awareness will create a formidable soldier who will be a very powerful opponent for the enemy. China is rapidly catching up with the U.S. Army, which is causing deep concern in Washington. Concerns have been raised in the United States about China's use of military nanotechnology solutions, including directly connecting soldiers' brains to computers. As an increasing number of military operations are planned using artificial intelligence (a field that the Chinese People's Liberation Army is actively pursuing), the line between man and machine is beginning to blur. Connecting the human brain directly to computers and systems that perform critical calculations will cause the character of a soldier to change forever. Ray Kurzweil, one of the world's leading inventors and scientists, believes that the mind-machine interface will be in place by 2030. He also suggests that the 300 million "recognizers" in the human brain could be expanded by creating synthetic neocortices that link the brain to the cloud and integrate artificial and human intelligence together. Achieving this is

[29] Harvard University Professor and Two Chinese Nationals Charged in Three Separate China Related Cases, U.S. Department of Justice, 28 January 2020 (July 11, 2022), available at https://www.justice.gov/opa/pr/harvard-university-professor-and-two-chinese-nationals-charged-three-separate-china-related.

possible with nanoscale brain implants. Thus, by 2030 or 2050, or even within the next few years, the first cyborg warrior may indeed emerge.

It is common knowledge that cyborg technology is being commercialized. For example, Elon Musk's company, Neuralink, which has now entered the animal testing phase, has announced that it will begin experimenting on humans in 2020. Professor Lieber is one of the consulting scientists at Neuralink. Musk has invested $100 million in the startup and continues to raise additional funds.

A team of researchers from Zhejiang University in China has developed a brain-to-brain interface (BBI) that links the human brain with a rat in which microelectrodes are implanted, thereby creating what is known as a "rat cyborg."

According to the study, published in Nature's Scientific Reports, control instructions issued by the human brain were transmitted to the rat by microelectrical stimulation. The rats were implanted with electrodes in their brains before they were trained to associate the delivered stimulation with certain movements. The stimulation was transmitted through a wireless microstimulator mounted on the animal's back. The human controller wore a device to measure brain signals using an electroencephalogram (EEG) and thought about steering the rat to the left or right or blinking to steer it forward. The movement information was sent to a nearby host computer, which relayed instructions to a stimulator mounted on the rat's back and told it to move through the maze. The researchers noted that the test was deemed successful when the rat made the correct turns and reached the end of the target arm.[30]

Thus, we can say that China is the most advanced in terms of the creation and development of nanotechnology, artificial intelligence and robotics. In 2016, sales of industrial robots in China reached 87000 units, accounting for approximately 30 percent of the global market. In comparison, sales of robots throughout Europe and America in 2016 amounted to 97,300 units (according to the International Federation of Robotics). In the period from 2005 to 2019, the operational fleet of industrial robots in China increased by an average of 38 percent per year.[31] The rapid development of the robotics industry in China has opened up new opportunities. Zhang Jin, vice president of Siasun Robot & Automation Co. Ltd., said that because of the COVID-19 pandemic, overseas demand for industrial robots continued to grow and the company's exports more than tripled.

However, the legal framework of China does not contain separate rules governing nanotechnology. China's Ministry of Science and Technology has issued a set of ethical principles for artificial intelligence (AI), emphasizing increased user autonomy

---

[30] Shaomin Zhang et al., *Human Mind Control of Rat Cyborg's Continuous Locomotion with Wireless Brain-to-Brain Interface*, 9(1) Sci. Rep. (2021) (Sept. 15, 2022), available at https://www.nature.com/articles/s41598-018-36885.

[31] Hong Cheng et al., *The Rise of Robots in China*, 33(2) J. Econ. Perspect. 71 (2019).

and privacy protection. In July 2017, the State Council of China released the country's strategy for developing artificial intelligence, titled "Next Generation Artificial Intelligence Development Plan" (新代一 人工智能 发展 规划). This strategy outlines China's goals, which include becoming the world leader in AI by 2030; turning AI into a trillion yuan (about US$150 billion) industry and being a driving force in defining ethics and standards for AI. Several reports analyze specific aspects of China's AI policy or assess the country's technical capabilities.[32]

Since 2013, China has published a number of national policy documents that reflect the intention to develop and deploy AI programs across various sectors. For example, in 2015, the State Council issued China's "Internet Plus" action guidelines, with the goal of integrating the Internet into all elements of the economy and society. The document states the importance of developing new artificial intelligence industries and investing in research and development. In the same year, the 10-year "Made in China 2025" plan was approved with the goal of making China a dominant player in the global market of high-tech industries, including artificial intelligence.[33] Another important document is the 13th Five-Year Plan of the Central Committee of the Communist Party of China,[34] which was published in March 2016. This document identifies artificial intelligence as one of the six most important areas of the country's emerging industries as well as an important driver of economic growth. Furthermore, these documents show that for some time now, even before the advent of satellites, there has been a conscious effort in China to develop and use artificial intelligence. However, up until the year 2016, it was presented simply as one of many other technologies that could be useful for achieving a number of political goals.

Conclusion

The research and discussion of the Cyborg Act presented in this article suggests that existing laws in the United States are insufficient to regulate and develop cyborg technology and that further legislative work is needed. Some countries have taken a proactive stance and developed a strategy for a technological future, while others are still debating the ethical issues raised by altering the human body and its capabilities. Existing structures of intellectual property law and constitutional law provide the basis upon which new norms concerning cyborg technology can develop. However, when such technologies affect the human brain, it becomes

---

32 Huw Roberts et al., *The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation*, 36(1) AI Soc. 59 (2021).

33 James McBride & Andrew Chatzky, *Is "Made in China 2025" a Threat to Global Trade?*, Council on Foreign Relations, 13 March 2019 (Sept. 15, 2022), available at https://www.cfr.org/backgrounder/made-china-2025-threat-global-trade.

34 Sebastian Hellman & Oliver Melton, *The Reinvention of Development Planning in China, 1993–2012*, 39(6) Mod. China 580 (2013).

important to consider it from both an ethical and civic perspective. For example, neuroprosthesis, a body-integrated technology, can alter the functioning of the brain, which is the basis of human mental functioning and therefore has significant legal implications.

As we move deeper into the twenty-first century, the rate of technological progress is undoubtedly increasing. Attempts to reconstruct the brain's neural circuitry are opening the door to the development of cyborg devices that can be used to extend the brain's capabilities. In fact, neuroprostheses that can serve to restore lost human cognitive function are now being developed.

The legal systems in the United States and China for regulating liability with respect to nanotechnology and artificial intelligence are currently underdeveloped.

This development will undoubtedly challenge existing legal doctrine and established public policy. The global community needs to develop forward-looking laws regarding the production of cyborgs, trafficking of cyborgs, protection against encroachment by cyborgs and safeguarding against attacks by cyborgs.

References

Barfield W. & Williams A. *Cyborgs and Enhancement Technology*, 2(4) Philos. 4 (2017). https://doi.org/10.3390/philosophies2010004

Blitz M.J. *Freedom of Thought for the Extended Mind: Cognitive Enhancement and the Constitution*, 4 Wis. L. Rev. 1049 (2010).

Bublitz J.C. & Merkel R. *Crime Against Minds: On Mental Manipulation, Harms, and a Human Right to Mental Self-Determination*, 8(1) Crim. L. Philos. 51 (2014). https://doi.org/10.1007/s11572-012-9172-y

Cheng H. et al. *The Rise of Robots in China*, 33(2) J. Econ. Perspect. 71 (2019). https://doi.org/10.1257/jep.33.2.71

Goodman M. *Future Crimes: Everything Is Connected, Everyone Is Vulnerable and What We Can Do About It* (2015).

Roberts H. et al. *The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation*, 36(1) AI Soc. 59 (2021). https://doi.org/10.1007/s00146-020-00992-2

Sententia W. *Neuroethical Considerations: Cognitive Liberty and Converging Technologies for Improving Human Cognition*, 1013(1) Ann. N.Y. Acad. Sci. 221 (2004). https://doi.org/10.1196/annals.1305.014

Tribe L. *Rights of Privacy and Personhood*, 8 Const. L. (1988).

Ziegler-Graham K. et al. *Estimating the Prevalence of Limb Loss in the United States: 2005 to 2050*, 89(3) Arch. Phys. Med. Rehabil. 422 (2008). https://doi.org/10.1016/j.apmr.2007.11.005

Information about the authors

Viktor Morozov (Tyumen, Russia) – Associate Professor, Head of the Department of Criminal Law Disciplines, Tyumen State University (38 Lenina St., Tyumen, 625000, Russia; e-mail: v.i.morozov@utmn.ru).

Vadim Chukreev (Yekaterinburg, Russia) – Deputy Prosecutor of the Sverdlovsk Region (21 Moskovskaya St., Yekaterinburg, 620014, Russia; e-mail: Chukreevva@mail.ru).

Dana Rizayeva (Ashgabat, Turkmenistan) – Associate Professor, Law Institute, RUDN University (223/1 Bitarap Turkmenistan Ave., Ashgabat, Turkmenistan; e-mail: dana.rizaeva@mail.ru).