Chapter 4
Cognitive Liberty, Brain Implants, and Neuroprosthesis

Introduction

In previous chapters, I described several technologies that are leading humanity closer to a merger with artificially intelligent machines. Perhaps the two most critical technologies necessary to create a human-machine merger are artificial intelligence (discussed in Chap. 3, *The Law of Artificial Intelligent Brains*); and the development of brain implants that function as neuroprosthesis. As we move towards a cyborg future consisting of information technologies integrated into our bodies and mind, we are becoming more vulnerable to government supervision, privacy invasions, and the possibility of third party access to our internal thoughts and memories. With more technology being integrated into the human body, the legal divisions between man and machine is beginning to blur and is becoming arbitrary. This brings up a host of legal and policy issues ripe for the twenty-first century. For example, lawyers Benjamin Wittes and Jane Chong describe a woman equipped with a heart pacer—technology clearly integrated within her body—but she has no rights to the data on the functioning of her heart which is produced by the implant.[1] Based on this example and others presented throughout this book, numerous jurisdictions are beginning to recognize that the law must change to accommodate the integration of technology into the human body. This observation is even more relevant with the development of neuroprosthesis that have the capacity to restore or enhance cognitive functions.

With technologies to study the brain improving exponentially, and given remarkable advances in neuroscience, researchers are unlocking the mysteries of how the brain computes, and writing algorithms to model the functioning of the

[1]Benjamin Wittes and Jane Chong, 2014, Brookings Report, We Are All Cyborgs Now, at: http://www.brookings.edu/blogs/techtank/posts/2014/10/8-we-are-all-cyborgs.

W. Barfield, *Cyber-Humans*, DOI 10.1007/978-3-319-25050-2_4

brain's neural circuits. As a result, the capabilities of neuroprosthesis are improving dramatically; in fact, by midcentury, "able bodied" people may opt to receive neuroprosthetic devices for reasons other than for a medical necessity. However, once technology is implanted in the brain (read on, it's happening now), governments, corporations, and other third parties could remotely access the implants creating a cybersecurity nightmare not the least of which would be a serious threat to the person's "cognitive liberty". This chapter discusses how third party access to neuroprosthetic devices will impact a person's ability to exercise control over the content of their mind, including the memory of their lived experiences, and thus raises significant questions of law and policy for the coming cyborg age.

Based on the use of brain implants to treat illness such as Parkinson's disease, dystonia, chronic pain, and depression, the first generation of cyborgs are beginning to emerge. This generation of cyborgs, equipped with neuroprosthetic devices, are benefiting from remarkable progress in the treatment of neurological disease. For example, for cognitively intact patients locked-in their bodies, technology to "read their brain" is allowing them to communicate to loved ones by moving a cursor on a computer screen, and to experience mobility by using thought to control the motion of a robot's arm or prosthetic limb. But the first generation of cyborgs, while equipped with amazing technology implanted within their brain, will pale in comparison to the capabilities of future cyborgs. That is, within decades, neuroprosthetic devices will improve significantly, giving people the ability to augment and enhance the functions of their brain and the ability to edit the content of their memories. Clearly, cyborg technologies are improving exponentially, and an amazing human-machine future awaits us all.

An important observation about the use of cyborg technologies for the brain is that the nature of information processing is beginning to shift from a neuronal based system using the relatively slow transmission rates associated with electrochemical signals (10–120 m/s over myelinated neurons), to a digital-based architecture operating with orders-of-magnitude greater processing speed and storage capacity. However, one consequence of equipping people with brain implant technology is the ease in which third parties will be able to manipulate, edit, and change a person's mental functions, including the information stored in their memories. Clearly, by making the content of our mind available to a host of third parties, neuroprosthetic devices being used now, or which should be available by the time of the Singularity (as predicted by computer scientist Ben Goertzeil and Google's Ray Kurzweil), have the potential to dramatically alter our relation to governments and corporations—these possibilities alone raise important issues of law and policy that should be addressed sooner rather than later while humanity still has time to control the direction of our cyborg future.[2]

Based on the law of accelerating returns, around mid-century, a major paradigm shift in information technology will have occurred. A cyborg equipped with

[2]Ben Goertzel on Singularity 1 on 1: The Future Is Ours To Create, 2010, Youtube video at: https://www.singularityweblog.com/ben-goertzel-on-singularity-1-on-1/.

neuroprosthetic devices will be able to download information to implants within his or her brain and to sensors on or within its body. This fusion of mind with information technologies will allow cyborgs to become fluent in new languages, process information faster and more efficiently than those lacking cyborg technologies, store and share memories between minds; and with continuing improvements, communicate telepathically with other cyborgs and artificially intelligent machines. However, as technologies to augment the cognitive functions of the brain and record and edit memories mature, ethicists, lawyers, and scientists have begun to raise questions of how emerging neuroprosthetic devices might be practically used and what policies might govern their use. On this point, the use of neuroprosthetic devices for deception detection, neuromarketing, and editing memories, will have major legal and policy implications not only for an emerging body of cyborg law, but also for the cognitive liberty of the mind, and therefore will warrant significant public debate and legislative attention.

While cyborg technologies integrated into the brain may seem like the subject of a science fiction novel (and have been the subject of sci-fi novels!) they are quickly joining the information technology revolution characterized by exponential growth. Peter Diamandis and Steven Kotler in their co-authored book, *Abundance: the Future is Better than You Think,* describe the characteristics of exponentially increasing technologies.[3] These are technologies that represent the information revolution, and are based on the miniaturization of electronics and advances in digital technology; both of which are necessary for rapid improvements in neuroprosthesis. For the reader interested in the technical aspects of the cybernetic revolution, a primer for neuroprosthetic devices can be found in Theodore Berger and Dennis Glanzman's co-edited book, "*Toward Replacement Parts for the Brain: Implantable Biomimetic Electronics as Neural Prostheses.*" But here's the take-home message—the future is approaching rapidly, we will all be cyborgs, and we will enhance our brains with neuroprosthesis, it's just a matter of time.

Medical Necessity and Beyond

As discussed throughout this book, the main reason that people are opting for and receiving neuroprosthetic and other implants is due to medical necessity. However, I expect this rationale to change as we approach midcentury and people decide to replace or enhance cognitive functions with brain implants providing superior information processing capabilities to those unenhanced. A few examples of the use of implants for medical necessity include the treatment of Parkinson's patients,

[3]Peter Diamandis and Steven Kotler, 2014, Abundance: The Future Is Better Than You Think, Free Press; Peter Diamandis and Steven Kotler, 2015, Bold: How to Go Big, Create Wealth and Impact the World, Simon & Schuster.

assisting people suffering from depression, and the repair of damaged senses. For mental illness, by using devices implanted in a person's brain, scientists are targeting and correcting malfunctioning neural circuits to treat conditions such as clinical depression, addiction and anxiety disorders. However, the reader may be wondering why people not suffering from illness would replace normally functioning tissue with a prosthesis; that is, why would someone become a cyborg if not for medical necessity? Several of the reasons are discussed in the chapter on *Modifying, Enhancing, and Hacking the Body*, but from a "large-picture" perspective, a central reason relates to the survivability of our species when we are more directly in competition with strong artificial intelligence.

As I discussed in previous chapters, as the technical Singularity approaches, without enhancing our brain using neuroprosthetic implants, humanity will be left behind by artificially intelligent machines possessing faster processing speeds, greater memory, greater access to information, and vastly superior reasoning skills. In fact, Hans Moravec, robotics expert and author of *Robot: Mere Machine to Transcendent Mind* and *Mind Children: The Future of Robot and Human Intelligence*, has argued that the way to keep up with cyborg technology is by accelerating our own evolution.[4] 'We can change ourselves,' he says, 'and we can also build new children who are properly suited for the new conditions- robot children.' Thus, a major paradigm shift in information technology will occur this century—taking the form of human evolution moving from biology to principles based on technology. An interesting result being that "able bodied" people will use neuroprosthetic devices to enhance their senses, memory, and cognitive abilities to levels beyond normal, and will do so as part of the future human-machine merger awaiting humanity.

People often fail to recognize that progress in information technologies is exponential, and thus the reader may be surprised to learn that the number of people already equipped with neuroprosthetic devices is in the hundreds-of-thousands, and soon will be in the millions. Already, more than 25,000 Parkinson's patients have received a "deep-brain" implant (placed either in the Thalamus, Globus Pallidus, or Subthalmic nucleus), which functions like a pacemaker to reduce tremors and other movement problems. In addition, because the visual and auditory modalities are critical for functioning in the world, there has been intense interest from the scientific community to design neuroprosthetic devices to alleviate problems involving our senses. For example, to aid those with visual deficiencies, cyborg technology in the form of a retinal prosthesis, is being used to detect light coming into the eye via electrodes implanted underneath the patient's retina. The light energy is fed to a microchip that transduces the signals; which are sent to the brain for further processing. Neuroprosthetic devices are also creating a generation of cyborgs equipped with cochlear implants. According to the Food

[4]Hans Moravec, 2000, Robot: Mere Machine to Transcendent Mind, Oxford University Press; Hans Moravec, 1990, Mind Children: The Future of Robot and Human Intelligence, Harvard University Press.

and Drug Administration (FDA), several hundred thousand people worldwide have already received cochlear implants to improve their hearing. The cochlear implant consists of an external portion that sits behind the ear and a second "cyborg" portion that is surgically placed under the skin. Signals generated by the implant are sent by way of the auditory nerve to the brain which recognizes the signals as sound. In the U.S. alone, tens-of-thousands of adults have received cochlear implants. And since 2,000, cochlear implants have been FDA-approved for use in eligible children beginning at 12 months of age—creating the first generation of cyborgs raised from early childhood. With at least nine doublings of computing power before these young cyborgs bear children, one has to wonder what capabilities future generations of cyborgs will possess.

Sometimes to know where technology is headed, one needs to follow the money; this is especially true for cyborg technology. On this point, the European Union has committed to spend $1.3 billion to study how the brain functions, and in the U.S., the Human Brain Project has received $1 billion for basic research on brain science. I should point out that both of these initiatives will provide critical information about the structure of neuronal circuits necessary to reverse engineer the brain (one way to create artificial general intelligence). Further, the combined $2.3 billion in funding for neuroscience research just mentioned, is not the complete funding picture. For example, in the U.S., the Defense Advanced Research Projects Agency (DARPA) has been one of the major government agencies funding research to develop brain chips and other technologies to interface the brain to computers. On this point, DARPA is currently working with different groups of researchers to develop a neuronal prosthetic implant that can be used to treat severe memory loss in human patients. The project is part of DARPA's Restoring Active Memory (RAM) program, aimed to help reinstate normal memory activity for the U.S. war veterans who have suffered some kind of brain injury.[5] If successful, the program will be immensely beneficial for patients with schizophrenia, amnesia, dementia and other brain disorders. In another DARPA project, the goal is to put "chips in the brain" to enhance the cognitive and the sensory capability of soldiers. The defense agency is specifically seeking to develop a portable, wireless device that "…must incorporate implantable probes" to record and stimulate brain activity—in effect, a memory triggering 'black box' device.[6] The implantable probe would consist of wires inside the brain, and under the scalp, with the capability to send electrical impulses through a transmitter placed under the skin of the chest area. The aim of the project is to develop technology that "promises to directly read thoughts from a living brain—and even instill thoughts as well…"[7] If successful, the technology developed by DARPA's RAM projects, will help create

[5]Eliza Strickland, 2014, DARPA Project Starts Building Human Memory Prosthetics, at: http://spectrum.ieee.org/biomedical/bionics/darpa-project-starts-building-human-memory-prosthetics, and http://www.unwittingvictim.com/BostonGlobe.html.

[6]*Id.*

[7]*Id.*

technology necessary for a future cyborg world, making the coming human-machine merger more likely.

If we consider medical necessity as a motivating factor to design neuroprosthetic devices, one of the most promising areas of brain neurotechnology is the treatment of Alzheimer's disease. Professor Theodore Berger and his research team at the University of Southern California has made remarkable progress towards developing an artificial hippocampus, a structure of the brain which plays important roles in the consolidation of information from short-term memory to long-term memory and that also contributes to spatial navigation.[8] Alzheimer's disease is known to damage the hippocampus and affects about 5.2 million people in the U.S. alone. Thus creating an artificial hippocampus may help millions suffering from a serious and debilitating neurological disease; but to restate a point made throughout this book, cyborg technologies designed to assist people based on medical necessity may also have the effect, intended or not, of contributing to our cyborg future and eventual merger with machines.

Professor Berger's research on the design of prosthesis supports this view. His work involves a detailed analysis of the various activities taking place in the hippocampus, followed by the development of algorithms that enable Berger and his team to replicate and integrate hippocampal function into a microchip. Of course, "chips in the brain" is an essential technology if humans are to become cyborgs and to merge with artificially intelligent machines. In fact, a breakthrough came in 2011 when Wake Forest University scientist Samuel Deadwyler, in collaboration with Professor Berger, managed to create the very first memory prosthetic device that proved to be successful in improving memory retention capacity in rats.[9] The resultant device was in the form of a microchip implant, consisting of thirty-two electrodes and an algorithm that could decode and reproduce the neural signals sent from one end of the hippocampus to the other. Later, the scientists were able to produce an artificial hippocampus that could not only read the information collected by the electrodes, but also repeat them when prompted to do so. Since then, the device has been successfully tested in non-human primates, such as monkeys, and human testing is around the corner.

[8]Berger, T.W., Baudry, M., Brinton, R.D., Liaw, J-S., Marmarelis, V.Z., Park, Y., Sheu, B.J., and Tanguay, Jr., A.R., 2001, Brain-implantable biomimetic electronics as the next era in neural prosthetics. Proceedings of the IEEE.

[9]See generally, Berger, T.W., Ahuja, A., Courellis, S.H., Deadwyler, S.A., Erinjippurath, G., Gerhardt, G.A., Gholmeih, G, Granacki, J.J., Hampson, R., Hsiao, M-C., LaCoss, J., Marmarelis, V.Z., Nasiatka, P., Srinivasan, V., Song, S., Tanguay, Jr., A.R., Wills, J., 2005, Hippocampal-cortical neural prostheses to restore lost cognitive function. IEEE EMBS Special Issue: Toward Biomimetic Microelectronics as Neural Prostheses, 24, 30–44.

Third-Party Access to Our Minds

The potential that brain implant technology could be hacked, raises the question of what rights people have to the veracity of the sensory information transmitted to their brain? If third parties were able to hack the technology of brain implants, the possibility of a dystopian future for humanity cannot be underestimated. For example, a retinal prosthesis could be hacked to place images on the back of the retina that a person never saw; or in the case of cochlear implants, sounds could be transmitted to the auditory nerve that a person never actually heard. Further, an artificial hippocampus could be hacked to place memories in a person's mind for events they never experienced. What law and policy might apply to these scenarios? If the First Amendment blocks the government from putting words in a person's mouth, surely it would also block the government from putting words, sounds, or memories in a person's head. Based on this observation, it is relevant to ask—if the technological ability to hack the mind is in the hands of governments and corporations will the mind remain a bastion of privacy, safe from the preying eyes of technology? Further, if the government or a corporation can access our thoughts and edit the content of our minds, will the integrity of our mind remain under our individual control, if not, who then as a person are we? The law and policy of such questions are discussed throughout this chapter.

Once third parties can access a neuroprosthetic device implanted within another person's brain, what could go wrong? Not surprisingly, lots of things. For example, if a person committed a crime, and did so because someone had remotely accessed their brain, would they be absolved of responsibility? Already lawyers routinely order scans of convicted defendant's brains and argue that a neurological impairment prevented the accused from controlling their actions. In the coming cyborg age would a software expert be called upon to examine the programming language and algorithms controlling a neuroprosthetic device to see if they had been tampered with? If so then the *mens rea* for a crime would have been supplied remotely by a third person. But the use of neuroprosthetic devices could lead to other important issues of law and policy. For example, third party access to brain implant technology could allow advertising agencies to place pop-up ads into our consciousness, or our thoughts to be searched by the government without our even knowing it. Could there be any more egregious violation of a person's privacy than if a government or corporation scanned a person's brain, recorded their unspoken thoughts, or changed the content of their memory?

If the brain is equipped with neuroprosthetic devices such that it essentially operates as a von Neumann computer, in the coming cyborg age should the mind be regarded as a network or as a computer, and should the mind receive an identifying URL? With future improvements in technology, just as spending spam to a cell phone or computer is actionable under the law; the possibility of sending spam to a mind equipped with a neuroprosthetic device would be far more annoying and therefore, should be the subject of even stricter laws. Just consider the work of Professor Theodore Berger, discussed above on the design of an artificial

hippocampus, a device which could allow information to be sent directly to an implant within a person's brain. If a corporation could access the neuroprosthetic device, what would stop them from sending advertisements directly to a person's brain? Perhaps the regulations on cybersecurity for medical implants being considered by the FDA would provide appropriate protection. Alternatively, in the U.S. most states have already enacted laws that pertain, directly or indirectly, to spam email. These laws often parallel, and in some cases are directly connected to other state laws that address telemarketing practices, or commercial solicitation through other media (e.g. text messages). As the law of cyborgs develops, I believe that much of the former law in areas related to information technology and commercial email will serve as precedence for disputes involving cyborgs; the law related to spam email is an example.

Often legal scholars and practitioners tend to treat anti-spam law as part of a larger computer-related law. Canada's Anti-Spam Law can be seen as drawing these two strands together in an effort to create a comprehensive legal framework for internet-based commerce.[10] In the U.S. the CAN-SPAM Act (Controlling the Assault of Non-Solicited Pornography and Marketing) establishes the rules for commercial email and commercial messages.[11] The Act gives recipients the right to have a business stop emailing them, and outlines the penalties incurred for those who violate the law. Surely, a similar law should be enacted to protect a neuroprosthetic device from receiving unwanted commercial solicitation. It's one thing to walk by a display in a store and receive an ad designed specifically for the person based on facial recognition technology, it is quite another to have the ad pushed to a device implanted in the brain.[12] The CAN-SPAM Act covers all commercial messages, which the law defines as 'any electronic mail message whose primary purpose is the commercial advertisement or promotion of a commercial product or service,' including email that promotes content on commercial websites.[13] It does, however, exempt transactional and relationship messages; a deficiency which will need to be addressed once people are equipped with neuroprosthetic devices with wireless capability.

It is not currently possible to directly recover the visual or auditory information stored in a person's brain that results from perceiving the world. However, this could become a possibility with cyborg technology, because once equipped with a technology to sense the world, a cyborg will have an electronic record of what they view or hear. On this point, one argument Professor Steve Mann has proposed for the benefits of wearable computers is to provide a record of a person's life. In the context of cyborgs equipped with neuroprosthesis to sense the world, would

[10]Canada's Anti-Spam Legislation, accessed 2015, at: http://www.crtc.gc.ca/eng/casl-lcap.htm.

[11]*Id*, see also *infra* note 13.

[12]See generally, Woodrow Barfield, 2006, Commercial Speech, Intellectual Property Rights, and Advertising Using Virtual Images Inserted in TV, Film, and the Real World, UCLA Ent. Law Rev, Vol. 13, 154–186.

[13]CAN-SPAM Act, Pub. L. 108–187.

courts be able to subpoena the data stored on the prosthesis to use as evidence in court? This question implicates rights afforded by the U.S. constitution. If the mind is equipped with computing technology, the most basic Fourth Amendment question in computer cases asks whether an individual enjoys a reasonable expectation of privacy for electronic information stored within computers (or other electronic storage devices) under the individual's control. For example, do individuals have a reasonable expectation of privacy for the contents of their computers, and disk storage devices? If "yes," then the government ordinarily must obtain a warrant based on probable cause before it can access the information stored inside. Because individuals generally retain a reasonable expectation of privacy in the contents of closed containers, they also retain a reasonable expectation of privacy in data held within electronic storage devices. Would the same conclusion hold for cyborgs equipped with neuroprosthetic devices storing memories? And would it make a difference if the information was in the form of software or algorithms, and comprised part of the actual structure of the being?

The privacy of the mind, whether enhanced with technology or not, should receive the highest protection by the courts. Under *Katz. v. United States*, the test used by the Court to determine privacy rights when a government actor is involved is whether the person thought they should have a reasonable expectation of privacy, and whether the expectation of privacy was one society was prepared to recognize.[14] If confronted with the issue of determining whether a cyborg has a reasonable expectation of privacy in the information stored on a neuroprosthetic device, based on precedence, courts may analogize the neuroprosthetic device to that of a closed container such as a briefcase or file cabinet. The Fourth Amendment generally prohibits law enforcement from accessing and viewing information stored in a computer without a warrant if, in comparison, it would be prohibited from opening a closed container and examining its contents in the same situation. It seems reasonable to view files stored on a neuroprosthetic device in the context of a file cabinet, closed to the outside world, and that the Fourth Amendment would protect the content stored on a neuroprosthetic device. However, although courts have generally agreed that electronic storage devices can be analogized to closed containers, they have reached differing conclusions over whether each individual file stored on a computer or disk should be treated as a separate closed container. With this background, would an individual file stored on a computer be analogized to a file stored on a neuroprosthetic device? If so, if the government accessed the information, would the use of such information by the government be protected by the Fifth Amendment's prohibition against self-incrimination? As we will see later, Law Professor Nita Farahany of Duke University, has spoken extensively on this topic.

[14] *Katz v. U.S.,* 389 U.S. 347 (1967).

Concerns and Roadblocks

Some of the critics of enhancement technology, such as Stanford's Francis Fukuyama, have focused on the existential threat to humanity that may occur from implementing biotechnologies, such as genetic engineering. However, an existential threat to humanity could also result from developments in the field of bioelectronics: sensors, and brain implants that involve creating interfaces between neural systems and computers. As cyborgs become equipped with brain implant technology an important point to make is that even with the benefits that will result from neuroprosthesis, there are potential negative outcomes associated with brain implant technology which our future technological progeny must avoid. For example, as neuroprosthesis are improved and become a viable option for "able bodied" people, the number of people equipped with brain implants will increase dramatically. When this happens, an important concern is that a cognitive digital divide could exist between those enhanced with neuroprosthetic devices and those lacking such technologies. Through numerous laws and policies, society generally tries to address inequalities between people, but the cyborgization of people could work to exacerbate inequalities; therefore, now is the time to develop policies on cyborg equality, which give all people equal access to enhancement technologies.

Clearly, as the use of brain implant technology is used to enhance our senses, improve our memories, and help fight disease, important legal and policy issues related to the privacy of our thoughts and the integrity of our mind will be raised. For example, with continuing improvements in neuroprosthesis, the ability to hack the mind will become an important concern among legal theorists and technologists as well as for individuals equipped by cyborg technology. Just consider that former Vice President Dick Cheney was so concerned that terrorists might hack the medical device implanted near his heart that he disabled a function that allowed the defibrillator to be administered wirelessly. This revelation echoes concerns that researchers have raised for years about the vulnerability of implanted medical devices which are equipped with computerized functions and wireless capabilities that allow the devices to be administered without requiring additional surgery. The Chaney example also highlights the tradeoff between benefits and potential hazards that will come with the use of cyborg technologies to enhance the human body and mind. For example, as a positive, in the coming cyborg age the use of neuroprosthesis opens up the possibility that maladaptive circuits leading to mental illness can be permanently changed, essentially curing some patients of their psychiatric disorders. However, on the negative side, by reprogramming neuronal circuits, governments or corporations could edit the content of a person's mind—in this scenario the fundamental question of what constitutes reality would need to be debated by lawyers, ethicists, and the public.

Another concern about the use of cyborg technology for enhancement of human cognitive abilities is that brain implant technology could be used by governments and corporations to "seize" a person's private thoughts; and to download unwanted information directly to a storage device in a person's brain. This

observation is a call for action—now is the time to think about protecting the right for individuals to control access to technologies of the mind, as well as the right to avoid their compelled use. For example, if governments could hack the mind, this capability would affect people's ability to participate in democratic institutions, as without accurate representations of life events, people would be unable to make independently informed choices. Because vastly improved neuroprosthetic devices are an extremely probable future technology, it is sensible to devise policies, regulations, and laws that will mitigate potential deleterious effects before the technology is widespread.

As the technology to access the mind matures, governments could punish a person not only for the actual expression of their thoughts, but just for formulating a thought contrary to government dogma. On this point, law scholar Jeffrey Rosen of George Washington University, wonders whether punishing someone for their thoughts rather than their actions, would be a violation of the Eight Amendments ban on cruel and unusual punishment?[15] This isn't an observation relevant only to the plot of a science fiction novel, because before centuries end, it will be technologically possible for governments and corporations to access brain-implants to edit the long-term memories representing a person's life experiences. Surely, using technology to access and edit a person's memory of an actual lived experience would be actionable under the law—a trespass, an assault and battery, or even extortion. On this last point, former Secret Service agent Marc Goodman worries that holding people's memory hostage could be a form of extortion in the future.[16] Therefore, for reasons of ensuring freedom of the mind, in the coming cyborg age, it is imperative that the human body and mind be considered sacrosanct; to invade a person's mind without their consent should be an egregious human rights crime and punishable under criminal law statutes.

Stanford Law School's Henry Greely acknowledges that memory-retrieval technologies could pose a serious challenge to our freedom of thought, which in his view, is currently defended largely by the First Amendment protections for freedom of expression. According to Greely, "… freedom of thought has always been buttressed by the reality that you could only tell what someone thought based on their behavior."[17] In light of advances in brain recording technology Greely commented, "This technology holds out the possibility of looking through the skull and seeing what's really happening, seeing the thoughts themselves."[18] Greely argues that this possibility may challenge the principle that we should be held

[15]Jeffrey Rosen, 2007, The Brain on the Stand, New York Times, at: http://www.nytimes.com/2007/03/11/magazine/11Neurolaw.t.html?pagewanted=all&_r=0.

[16]Marc Goodman, 2015, Future Crimes: Everything Is Connected, Everyone Is Vulnerable and What We Can Do About It, Doubleday.

[17]Jeffrey Rosen, *Id*., note 15, discussing comments by Stanford's Henry Greely on neurolaw.

[18]Jeffrey Rosen, *Id*., note 15, discussing comments by Stanford's Henry Greely.

accountable for what we do, not what we think. And he adds, "It opens up for the first time the possibility of punishing people for their thoughts rather than their actions."[19] Discussing the possibility of a future totalitarian state, Greely commented, "One reason thought has been free in the harshest dictatorships is that dictators haven't been able to detect it."[20] And that now they may be able to, this is putting greater pressure on legal constraints against government interference with freedom of thought.

While ensuring cognitive liberty will be an important issue in the coming cyborg age, other technology currently being used has already brought the issue of cognitive liberty to the attention of the U.S. Supreme Court. For example, in a First Amendment case that dealt with a statute prohibiting the sale of books without a license, Supreme Court Justice Frank Murphy stated that freedom to think "is absolute of its own nature; the most tyrannical government is powerless to control the inward workings of the mind."[21] Recent support for the proposition that governments should be prohibited from efforts to control the inner working of the mind comes from Law Professor Marc Blitz who argues that it would be a grave infringement of "…free thought any state measure which prevented us from using our brains to access and store our memories."[22] Professor Blitz also observed that before the development of cyborg technologies, the government could not do much to restrict the freedom of thought except to attack the expression of that thought in speech and worship. That is, Blitz indicated that "the government could not manipulate our minds from the inside, its only way of restricting mental activity was to target communication or other expression that embodied such activity."[23] But as shown in this chapter, based on the law of accelerating returns for information technologies, much has changed, technology that could allow the government to manipulate our minds from the "inside" is not only rapidly being developed but also currently being used to treat psychological and neurological illness.

A Focus on Cognitive Liberty

Considering that a variety of brain-computer interfaces and neuroprosthetic devices are being used to treat patients, and that brain implant technology will be dramatically improved within a few decades, necessitates a serious discussion of

[19]Jeffrey Rosen, *Id*., note 15, discussing comments by Stanford's Henry Greely.

[20]*Id.*

[21]See *Jones v. Opelika*, 316 U.S. 584, 1942, (Murphy, J. dissenting), noting that while "freedom to think is absolute of its own nature," the government may target it by targeting "freedom to communicate the minds message to others by speech and writing".

[22]Marc Blitz, Freedom of Thought for the Extended Mind: Cognitive Enhancements and the Constitution, Wisconsin Law Review, 2010, 1049–1118, see p. 1075.

[23]*Id*, see generally, *Jones v. Opelika*, *id*., note 21.

"cognitive liberty." Essentially, cognitive liberty is the personal freedom to have sovereignty over one's own mind; it is an extension of the concepts of freedom of thought, and to a lesser extent, bodily integrity. As a basic observation, freedom of thought can be distinguished from cognitive liberty in that the former is concerned with protecting an individual's freedom to think "*whatever*" they want, whereas cognitive liberty is concerned with protecting an individual's freedom to think "*however*" they want.[24] This last aspect of freedom to think directly relates to the use of neuroprosthetic devices designed to enhance cognitive processes. As legal precedence for protection of cognitive liberty, the U.S. Supreme Court has previously held that freedom of the mind is "the broad concept" of which freedom of speech is but one "component."[25] Reflecting the importance of freedom of thought for cyborg technologies, Law Professor Marc Blitz, commented that the Supreme Court has placed freedom of thought at the center of our First Amendment American jurisprudence saying that our whole constitutional heritage "rebels at giving the government the power to control men's minds."[26]

A range of computer scientists, neuroscientists, and legal scholars have questioned the desirability of pursuing technology that may allow the mind to be hacked, and have argued that the "cognitive liberty" of the mind should receive the strongest protection possible by government legislation. With exponentially improving technology to manipulate and study the mind, what is at stake for humanity given that governments, corporations, and third parties could access a person's inner thoughts and memories through their implants? Something fundamentally important for all humanity is the right to "cognitive liberty." Roughly speaking, cognitive liberty is the personal freedom to have absolute sovereignty over one's own mind. It is related to the concepts of freedom of thought, and as I stated above, to a lesser extent, bodily integrity. In the coming cyborg age, neuroprosthetic technology could dramatically impact the cognitive liberty of the mind thus necessitating a serious discussion on the extent to which cyborg technologies should be regulated.

Cognitive liberty, or the "right to mental self-determination", is a vital part of international human rights law. For example, in the *Universal Declaration of Human Rights*, which is legally binding on member states of the *International Covenant on Civil and Political Rights,*[27] freedom of thought is found under Article 18 which states: "Everyone has the right to freedom of thought, conscience and religion…" Clearly, maintaining cognitive liberty in an age of brain implants

[24]Bublitz, Jan Christoph; Merkel, Reinhard, 2014. "Crime Against Minds: On Mental Manipulations, Harms and a Human Right to Mental Self-Determination." *Criminal Law and Philosophy*, Vol. 8: 61.

[25]*Wooley v. Maynard*, 430 U.S. 705, 1977, quoting *W.Va. State Bd. of Educ. v. Barnette*, 319 U.S. 624, 1943.

[26]Mark Blitz, *id.,* note 22.

[27]As of April 2014, the Covenant has 74 signatories and 168 parties.

should be a major objective as humanity moves closer to a cyborg future and eventual human-machine merger. In fact, a growing number of legal theorists see cognitive liberty as an important basic human right and argue than cognitive liberty is the principle underlying a number of recognized rights within the constitutions of most industrialized nations; freedom of speech being an example.

Given that scientists have discovered that people engage in "internal speech," that is, we use language to navigate within our own thoughts, the development of technology to read our "thoughts" is troubling as it could impact our cognitive liberty, First Amendment, and other constitutional rights. Since the U.S. Constitution directly references "freedom of speech," an important question is whether freedom of speech also protects "internal speech"—that is, the very speech that governments could access through a neuroprosthetic device. And in addition to considering internal thought as speech, what about thought transmitted by cybernetic technology from one brain to another—would this constitute a form of speech eligible for protection under the First Amendment? Additionally, what Federal Communication Commission (FCC) regulations on spectrum would apply to telepathic communication mediated by cyborg technology? Given the rate at which progress is being made in implant technologies, such questions remain to be resolved within the next few decades.

The debates about the government's ability to spy on people by monitoring their communications is especially relevant in an age when cyborgs will be equipped with neuroprosthetic devices and networked sensors. On this point, the government does currently regulate in areas that relate to emerging cyborg technologies. For example, for telepathic communication, as just noted, the transmission of thoughts from one person to another requires the use of spectrum. The FCC currently regulates the usage of electromagnetic spectrum by a management process called frequency allocation which involves managing and licensing the electromagnetic spectrum for commercial users and for non-commercial users including: state, county and local governments. The FCC management process considers public safety, commercial and non-commercial fixed and mobile wireless services, broadcast television and radio, satellite and other services. Further, the FCC has also developed regulations for a body area network consisting of wearable and implantable medical devices.

In the area of privacy, what if the government intercepts a signal from one mind to another? Not only would FCC regulations apply but the Fourth Amendment rights of the individual for protection against an unreasonable search and seizure would apply. One way law enforcement intercepts a signal is to attach a "bug" to a person's telephone line and record the person's conversation. Similarly, in the cyborg future, I imagine it could be possible to attach a "bug" to a neuroprosthetic device, which would allow inner thoughts to be surveilled even before they were vocalized or transmitted electronically. For telephone communication, courts have held that attaching a bug to the line constitutes a search under the Fourth Amendment because the Fourth Amendment protects an individual's privacy rights for situations in which the person has a legitimate expectation of privacy. Surely, people would expect the highest expectation of privacy for the creation of their

unspoken thoughts in the coming cyborg age and for the transmission of thoughts from one mind to another.

Interestingly, from a jurisprudence perspective, the definition of what constitutes speech is not straight forward and clearly cyborg communication will raise a host of issues which will "stress" current law. In fact, the courts have identified different types of speech, each protected at a different level of scrutiny by the courts. This means that depending on the type of speech produced, the government is more or less empowered to restrict that speech. In the U.S., one type of speech is considered symbolic speech which is a legal term or art used to describe actions (not spoken language) that purposefully and discernibly convey a particular message or statement to those viewing it. However, of particular relevance for cyborg technology, is the category of "pure speech," which is the communication of ideas through spoken or written words or through conduct limited in form to that necessary to convey the idea. If the prior restraint of speech is prohibited under the First Amendment, the prior restraint of thought would be more egregious. The courts have generally provided strong protection of pure speech from government regulation; and prior cases in this area could serve as legal precedence for cyborg speech using telepathic communication. In the future, perhaps the court should recognize a new form of speech—cyber speech, the conveyance of ideas using thought; if so, what level of scrutiny would it receive from the government?

In numerous cases, the U.S. Supreme Court has recognized freedom of thought as a fundamental right, describing freedom of thought as: "… the matrix, the indispensable condition, of nearly every other form of freedom…"[28] Without freedom of thought, the First Amendment right to freedom of speech is moot, because you can only express what you can think. Constraining or censoring how a person thinks (i.e., cognitive censorship) is the most fundamental kind of censorship, and is contrary to some of our most cherished constitutional principles. Supporters of cognitive liberty seek to impose both a negative and a positive obligation on states: to refrain from non-consensually interfering with an individual's cognitive processes, and to allow individuals to self-determine their own "inner realm" and control of their own mental functions.

The first obligation on a state, to refrain from non-consensually interfering with an individual's cognitive processes, directly applies to government access to neuroprosthetic devices, and also seeks to protect individuals from having their mental processes altered or monitored without their consent or knowledge. Though cognitive liberty is often defined as an individual's freedom from *state* interference with their cognition, Jan Bublitz and Reinhard Merkel of the University of Hamburg, suggest that cognitive liberty should also prevent other non-state entities from interfering with an individual's mental "inner realm".[29] Of relevance for an emerging law of cyborgs, Bublitz and Merkel propose the introduction of a new criminal offense punishing "interventions severely interfering with another's mental

[28] *Palko v. Connecticut,* 1937, 302 U.S. 319, 326–327.

[29] Jan Christoph Bublitz and Reinhard Merkel, *id*, note 24.

integrity by undermining mental control or exploiting pre-existing mental weakness."[30] And that, "…direct interventions that reduce or impair cognitive capacities such as memory, concentration, and willpower; alter preferences, beliefs, or behavioral dispositions; elicit inappropriate emotions; or inflict clinically identifiable mental injuries would all be *prima facie* impermissible and subject to criminal prosecution."[31] Weighing in, Wyre Sententia and Richard Boire of the *Center for Cognitive Liberty and Ethics* have also expressed concern that corporations and other non-state entities might utilize emerging neurotechnologies to alter individuals' mental processes without their consent.[32]

While one obligation of a state is to refrain from non-consensually interfering with an individual's cognitive processes, another, freedom to think *however* a person wants, seeks to ensure that individuals have the freedom to alter or enhance their own consciousness; one way to do this would be by stimulating the pleasure centers of the brain by accessing a neuroprosthetic device. An individual who enjoys this aspect of cognitive liberty has the freedom to alter their mental processes in any way they wish to; whether through indirect methods such as meditation or yoga, or more directly through neurotechnology. This element of cognitive liberty is of great importance to proponents of the transhumanist movement, a key tenet of which is the enhancement of human mental function.[33]

Allowing people to determine their own "inner realm," is directly related to the use of neuroprosthesis to access one's own brain. For example, "self-stimulation" is a phenomenon whereby an animal (including a human being) will repeatedly stimulate its brain electrically, sometimes to the point of exhaustion. This phenomenon is robust and readily reproducible in many areas of the brain. Interestingly, the discovery of "pleasure centers" in the brain is one of the more famous findings from brain stimulation research. It occurred by accident. Professor James Olds, working with Peter Milner, both of McGill University, inserted an electrode into a rat's brain, aiming for the reticular system.[34] The electrode curved off its intended course and landed in a different area, probably near the hypothalamus. Olds put the rat in a box and stimulated its brain whenever the rat approached a certain corner. He expected the rat to stay out of that corner, but instead Olds observed the rat was "coming back for more," acting as though the brain stimulation was pleasurable. Further research showed that stimulation of areas in the limbic system produced pleasure in humans, and that individuals in pain or depressed were most likely to find electrical stimulation of the brain very pleasurable.

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[30] *Id.*

[31] *Id.*

[32] Richard G. Boire, 2005. Searching the Brain: The Fourth Amendment Implications of Brain-Based Deception Detection Devices, The American Journal of Bioethics, Vol. 5, Issue 2, doi: 10.1080/15265160590960933.

[33] Cognitive Liberty, Wikipedia, http://en.wikipedia.org/wiki/Cognitive_liberty.

[34] The Pleasure Centers, at: http://www.intropsych.com/ch02_human_nervous_system/pleasure_centers.html.

In the decades since Olds and Milner reported the existence of pleasure centers in the brain, scientists have observed that once stimulated, several regions of the brain are activated by feelings of triumph, euphoria, sexual pleasure, and addictive behavior of all types, including non-drug addictions such as gambling. If people, or third parties, using neuroprosthetic devices can "electronically create" these and other behaviors, a host of legal and policy issues would be implicated. For example, third parties accessing a neuroprosthesis to stimulate the pleasure centers within a person's brain, could easily cause the person to become addicted to cortical stimulation, and thus come under the third party's control. Surely the government would regulate heavily in this area. Just consider what Harvard Law Professor Lawrence Tribe said: "The guarantee of free expression," "is inextricably linked to the protection and preservation of open and unfettered mental activity…"[35] In a Supreme Court case, *United States v. Reidel*, which held that a postal regulation that banned the sale of adult materials was constitutionally permissible, Justice Hugo Black dissented arguing that the First Amendment of the United States Constitution "denies Congress the power to act as censor." And also on the topic of government control of thought, in *Stanley v. Georgia,* the Court stated: "the First Amendment right of the individual to be free from governmental programs of thought control…" is imperative, and that the "freedom from governmental manipulation of the content of a man's mind…" must be preserved.[36] The Court seems to be a strong supporter of the general principles underlying cognitive liberty, which I view as an indispensable line of defense against government or corporate control of our thoughts and mind, when the technology to do so is readily available.

Reading the Brain, Lie Detection, and Cognitive Liberty

Thanks to advances in neuroimaging technologies, such as functional magnetic resonance imaging (fMRI), magneto encephalography (MEG), and positron emission tomography (PET), the brain's structure and functions are being observed at increasing levels of resolution and fidelity. The ability to read brain waves is an essential technology for telepathy and for other "cognitive" capabilities that future cyborgs will possess. From a cognitive liberty perspective, telepathic communication could provide government's access to a person thoughts at two levels—through the implant itself, and by interception of the electronic signals transmitted from one mind to another.

While scientists have not as yet developed working brain-to-brain communication interfaces for the general public, much progress is being made in technology

[35]Laurence Tribe, Rights of Privacy and Personhood, American Constitutional Law, Sec. 15–7, at 1322 (2nd ed. 1988).

[36]*United States v. Reidel*, 402 U.S. 351 (1971); *Stanley v. Georgia* 394 U.S. 557 (1969).

to record the functions of the brain and to makes sense of the output. For example, functional magnetic resonance imaging is used to measure brain activity by detecting the changes in blood oxygenation and flow that occurs in response to neural activity—when a brain area is more active it consumes more oxygen, to meet this increased demand, blood flow increases to the active area. Private companies such as *No Lie MRI* are currently working to improve the capability of fMRI technology for lie detection so that the fMRI results can be admitted as evidence in court. Judy Illes, Canadian Research Chair in Neuroethics, sees brain-scanning technology to detect lies evolving quickly—commenting that we will have technology that is sufficiently reliable at getting at the binary question of whether someone is lying that it may be utilized in certain legal settings."[37] Another company using fMRI technology for lie detection has developed a system called *Guilty Knowledge*. The system, developed by Daniel Langleben and his research team at the University of Pennsylvania was tested as follows—Langleben gave subjects a playing card before they entered an fMRI machine and told them to answer no to a series of questions, including whether they had the card in question. Langleben and his colleagues found that certain areas of the brain lighted up when people lied about whether they possessed the card suggesting that fMRI could be used to detect lying for binary events.

Interestingly, recent advances in the use of reading brain waves using cyborg devices are based on a technology that has been around since the early twentieth century—EEG. An electroencephalogram (EEG) can be used to detect electrical activity in a person's brain using small, flat metal discs (electrodes) attached to the person's scalp. A person's brain cells communicate via electrical impulses and are active all the time, even when a person is asleep. Recently, commercial products that use EEG technology to read the activity of the brain are entering the marketplace. For example, *This Place*, out of London, has developed an app, *MindRDR*, which consists of head-mounted hardware and the Neurosky EEG biosensor (an off-the-shelf sensor), which is used to create a communications loop between displays such as Google Glass and the EEG sensor by picking up brainwaves that reportedly correlate with a person's ability to concentrate. The app translates the person's brainwaves into a meter reading that gets superimposed on the camera view displayed in Google Glass. With more "focus" the meter reading increases and the app takes a photograph of what a person is seeing in front of them; if the person continues to focus, the photo gets posted online. In my view, access to what a person "concentrates on," that is, what they are consciously attending to, should only be possible by first obtaining a warrant from a magistrate, else this would be a violation of the person's Fourth Amendment privacy rights and a violation of the person's cognitive liberty.

As the use of fMRI data and other brain recording techniques become increasingly common in courtrooms, judges and juries may be asked to draw new and

[37]Judy Illes, Neuroethics in a New Era of Neuroimaging, American Journal of Neuroradiology, at: http://www.ajnr.org/content/24/9/1739.full.

sometimes troubling lines between "normal" and "abnormal" brains. Such judgments could impact the cognitive liberty rights of anyone charged with a crime. Ruben Gur, a professor of psychology at the University of Pennsylvania's School of Medicine, has appeared as an expert witness in numerous cases requiring a determination of the mental competency of a defendant.[38] One such case was the high-profile trial of a convicted serial killer who was known as the "classified-ad rapist," because he would respond to classified ads placed by women offering to sell household items, then rape and kill them. Professor Gur was called as a national expert in PET scans to help determine whether the accused was responsible for his actions.

A PET scan (brain positron emission tomography) is an imaging test of the brain that uses a radioactive substance called a tracer to look for disease or injury in the brain. After examining the defendant's PET scans, Gur testified that a motorcycle accident that had left the defendant in a coma had also severely damaged his amygdala (which has a role in memory, decision making, and emotional reactions). It was after emerging from the coma that the defendant committed his first rape. If courts consider whether a "damaged brain" could absolve a person from responsibility, then I would argue that courts should also consider whether thoughts implanted on neuroprosthetic devices by a third party should absolve a person from responsibility for their actions. In an extension of Gur's work, Michael Gazzaniga, a professor of psychology, and author of *The Ethical Brain*, has noted that within a few years, neuroscientists may be able to show that there are neurological differences when people testify about their own previous acts and when they testify to something they saw. Gazzaniga notes, "If you kill someone, you have a procedural memory of that, whereas if I'm standing and watch you kill somebody, that's an episodic memory that uses a different part of the brain."[39] Perhaps, by accessing information stored on neuroprosthetic devices, the government could distinguish between procedural versus episodic memories, and thus either convict or absolve a person accused of a crime. Whether this is desirable, that is, to scan a person's brain to obtain evidence for a trial, is a constitutional issue and a topic that the public and legal community should debate. Even if witnesses don't have their brains scanned, neuroscience may lead judges and jurors to conclude that certain kinds of memories are more reliable than others because of the area of the brain in which they are processed.

[38]Jeffrey Rosen, *id*, note 15, discussing Rubin Gur's experience as an expert witness.

[39]Jeffrey Rosen, *id*., note 15, quoting Michael Gazzaniga, Michael Gazzaniga, 2006, The Ethical Brain: The Science of Our Moral Dilemmas, Harper Perennial.

Towards Telepathy

While EEG and fMRI technologies are leading to significant advances in the use of brain scans for lie detection, other research in neuroscience is more directly on the topic of telepathic communication. Professor Miguel Nicolelis from Duke University is a pioneer in developing technology for the brain. His research is oriented toward brain-to-brain communication, brain machine interfaces and neuroprosthesis in human patients and non-human primates. As a result of his studies, Dr. Nicolelis was one of the first to propose and demonstrate that animals and human subjects can utilize their electrical brain activity to directly control neuroprosthetic devices via brain-machine interfaces. In his 2012 book *Beyond Boundaries*, Professor Nicolelis speculated about the possibility that two brains could exchange information. Later, publishing in *Scientific Reports* Nicolelis reported that his research team at Duke University Medical Center had achieved a back-and-forth exchange between two rodent brains. To test his brain interface technology, his team trained two animals to press one of two levers in exchange for a drink of water, when an LED turned on. Microelectrodes were placed in each of the two animals' cortices and when one rat pressed the correct lever, a sample of cortical activity from that rat's brain was wired to the second animal's brain located in a chamber where the "it's-time-to-drink" LED was absent. As evidence that information was exchanged between the two brains, the rat on the receiving end of the prosthesis proceeded to press the correct lever (to receive a drink) that had been messaged over the brain link. Summarizing the results—Nicolelis and his team provided proof-of-concept technology and results that telepathy may be possible as a future form of communication.

Related to Professor Nicolelis's work, results from studies with human subjects show that telepathy may in fact be a viable technology for the public within a few decades (or less!). For example, using EEG technology, researchers at the University of Southampton, England, successfully demonstrated communication from person-to-person using thought.[40] And more recently, at the University of Washington, researchers demonstrated a working brain-to-brain interface with human subjects also using EEG technology.[41] In their study, two people were located in different rooms where they were not allowed to communicate other than with their brains using EEG technology. Both subjects looked at a video game where they had to defend a virtual city by firing a cannon. But one person had his brain connected to an electroencephalography machine that read his brain signals,

[40]Communicating person to person through the power of thought alone, 2009, University of Southampton, at: https://www.southampton.ac.uk/mediacentre/news/2009/oct/09_135.shtml.

[41]Rao R. P. N, Stocco, A, Bryan, M, Sarma, D, Youngquist, T. M, Wu J, et al. 2014, A Direct Brain-to-Brain Interface in Humans, PLoS ONE 9(11): e111332. doi:10.1371/journal.pone.0111332.

which were used to fire a virtual cannon. That is, rather than using an input device to fire the canon the person was instructed to *think* about moving his hand to fire the cannon. That thought was transmitted over the internet to another person whose hand was situated on a touchpad that would twitch and tap in the right direction if the signals were successfully received. Based on their experience with the system, the University of Washington researchers were confident that the technology worked as intended. Further, according to the researchers, the next step is to determine *what* kind of information can be sent between people's brains. For example, they want to know if one day, a teacher could download information directly to a student's brain—I believe the answer is yes, and that this will be a future capability of cyborg technology.

Creating Artificial Memories

Neuroscientists foresee a future world where minds can be programmed in order to create artificial memories. Based on recent advances in brain-to-brain communication, some scientists argue that memories may be implanted into a person's mind, and that memories from one mind can be transferred to another. This may sound like technology for another century, but in fact, scientists have already successfully implanted a false memory into the brain of a mouse. Given these results, what could be more important for an emerging law of cyborgs than protection of the integrity of our memories? To create a memory prosthesis, MIT scientists Steve Ramirez and Xu Liu tagged brain cells associated with a specific memory and then tweaked that memory to make the mouse believe an event had happened when it hadn't, other neuroscience laboratories are producing similar results. While implanting a memory in humans equipped with a neuroprosthetic device won't happen in the immediate future, Ramirez and Liu have shown that in principle, it should be possible to isolate a human memory and activate it.[42] In fact, Michael J. Kahana, who serves as director of the University of Pennsylvania's Computational Memory Lab commented on the MIT study, "We would have every reason to expect this would happen in humans as it happened in mice."[43] Clearly, improvements in neuroprostheread your mindtic technologies are occurring rapidly.

[42]Meeri Kim, 2013, MIT Scientists Implant a False Memory into a Mouse's Brain, The Washington Post, at: http://www.washingtonpost.com/national/health-science/inception-mit-scientists-implant-a-false-memory-into-a-mouses-brain/2013/07/25/47bdee7a-f49a-11e2-a2f1-a7acf9bd5d3a_story.html,

[43]*Id.,* quoting Michael J. Kahana.

Before discussing the technology of implanting false memories in more detail, let's digress to first discuss some of the law and policy issues associated with the technology. Duke University Professor of Law, Nita Farahany has observed that the mind stores a large amount of information that could be of value to the government and to businesses. For example, she notes that our brains can uniquely identify speakers, sounds, and images. Interestingly, technologies integrated into the brain could also detect this information, which could be very valuable to a criminal investigation. But should it be permissible to scan a person's brain or to access the data stored on a neuroprosthetic device to access our recognition of objects or people? Maybe so, because in courtrooms, eyewitness testimony has a high rate of falsity and sometimes witnesses lack memories of key information. Therefore, in criminal law cases directly accessing a person's memory of an event would be helpful. However, what if false memories could be planted in an eyewitnesses? Most people would agree that it would be impermissible for the government to create its own "star witness," Farahany maintained.[44]

Given her expertise in Constitutional law issues related to brain recording technologies, Professor Farahany has argued in law review papers that a right guaranteed under the U.S. Constitution and which has relevance for government access to cyborg technology is the Fifth Amendment protection against self-incrimination.[45] She asks—if the government could "read your mind," and use the output as evidence in court, would the Fifth Amendment protection against self-incrimination still have meaning in a cyborg age?[46] In the light of the increasing ability to access human memory using implant technology, Professor Farahany has proposed legislative protection of cognitive liberty as a way of safeguarding the right against self-incrimination found in the Fifth Amendment.[47] In a Stanford Law Review article, Farahany reviewed *Schmerber v. California*, in which the U.S. Supreme Court held that under the *Self-Incrimination Clause* of the Fifth Amendment, no person shall be compelled to "prove a charge [from] his own mouth," but a person may be compelled to provide real or physical evidence (for example, DNA or a blood sample).[48] Therefore, while a defendant in a criminal case cannot be compelled to "take the stand" and serve as a witness against himself; the government could collect samples from their body and use that as evidence. With advances in brain reading technologies, Farahany argued that based on modern applications of neuroscience there exist the need to redefine the taxonomy of evidence subject to

[44]Nita Farahany, 2012, Incrimination Thoughts, Stanford Law Review, Vol. 64. 351.

[45]*Id*.

[46]*Id*.

[47]*Id*.

[48]*Schmerber v. California*, 384 U.S. 757 (1966), was a decision by the U.S. Supreme Court, which held that a State may, over the suspect's protest, have a physician extract blood from a person suspected of drunken driving without violating the suspect's rights under the Fourth or Fifth Amendment to the United States Constitution.

the privilege against self-incrimination.[49] This is because evidence can arise from government access to a neuroprosthetic device or by directly recording brain activities—and neither represent the type of physical evidence permissible for the court to obtain. For this and other reasons, an interesting question of jurisprudence in the coming cyborg age, is whether Constitutional rights, such as the Fifth Amendment applies to data stored on neuroprosthetic devices?[50]

Litigating Cognitive Liberty

The concept of cognitive liberty is broad and therefore there may be different avenues of protection for cognitive liberty among different jurisdictions. On this point, in the U.S. the free speech prong of the First Amendment while relevant is not the only protection of cognitive liberty. For example, under the U.S. Constitution, the Due Process Clauses of the 5th and 14th Amendments offer some protection against unwarranted bodily intrusion. Why is this dual level of protection of importance for our cyborg future? When the state is not restricting the expression of ideas, but altering brain physiology that may impact cognition (for example by requiring the administration of antipsychotic drugs), it may not be a First Amendment argument that provides protection for cognitive liberty, but rather the due process protection under the Constitution which can be used to protect the integrity of our bodies. Discussing this issue, Professor Jonathan Blitz of Oklahoma City University School of Law argues that the power to reshape our thinking process biologically, should be recognized as one form of a more general power that our freedom of mind is intended to place in our hands and not in the hands of government officials.[51]

Cyborg technologies, which could be hacked by a government, have profound implications for cognitive liberty. Technology which allows the government to manipulate mental processes, is a direct effort to alter the content and form of a person's thoughts—the essential substrate for free speech and expression. A basic question in an age of cyborg technology, is whether the government can access the content of the mind before it is externalized? This question has not been directly litigated in the context of cyborg technologies, but in related cases, cognitive liberty has been argued as a right that a citizen should be afforded by the state. For

[49]Nita Farahany, *id*. note 44.

[50]See *Reno v. ACLU*, 521 U.S. 844 (1977), noting that the Internet allows for "unlimited low-cost capacity for communication of all kinds."

[51]Marc Blitz, 2010, Freedom of Thought for the Extended Mind: Cognitive Enhancement and the Constitution, Wisconsin Law Review, Vol. 2010, No. 4, 1049.

example, in the U.K., the case of *R v. Hardison*, involved a defendant who was charged with violating the *Misuse of Drugs Act 1971*.[52] Hardison claimed that cognitive liberty was safeguarded by Article 9 of the *European Convention on Human Rights*. Specifically, the defendant argued that "individual sovereignty over one's interior environment constitutes the very core of what it means to be free," and that because psychotropic drugs are a potent method of altering an individual's mental process, prohibition of them under the *Misuse of Drugs Act 1971* was in opposition to the Act. The court however disagreed, and denied Hardison's right to appeal to a superior court. In the U.S., the Supreme Court has written in *NAACP v. Button*, that "… only a compelling state interest… can justify limiting first Amendment freedoms."[53] In the coming cyborg age, what such interests should be, and under what conditions they should be protected is a topic ripe for debate and legislative action.

After the *Hardison* decision in Great Britain, the U.S. Supreme Court heard arguments on an important case that dealt directly with issues related to the cognitive liberty of the mind.[54] As background, the defendant Dr. Charles Sell was charged in federal court with submitting false claims to Medicaid and private insurance companies resulting in counts of fraud, and one of money-laundering. Dr. Sell had previously sought psychiatric help and had voluntarily taken antipsychotic drugs; however, he found the side effects intolerable. After the initial charge, Dr. Sell was declared incompetent to stand trial (but not dangerous), as a result, an administrative hearing was held and it was decided that Dr. Sell could be forcibly drugged to regain mental competence; a decision Dr. Sell challenged. The decision by the government to force Dr. Sell to take medication which would change his mental processes raised significant Constitutional law issues. On this point, Law Professor Lawrence Tribe of Harvard University commented, "whether the government decides to interfere with our mental autonomy by confiscating books and films or by denying us psychiatric medications; "the offense" is ultimately the same: "government invasion and usurpation of the choices that together constitute an individual's psyche."[55]

Could a person who did not pose danger to another, be forcibly injected with antipsychotic medication solely to render him competent to be tried for crimes that were described by Judge Kermit Bye of the 8th Circuit Court as "nonviolent and purely economic"?[56] In Dr. Sell's case, the government sought to directly manipulate and modify Dr. Sell's thoughts and thought process by forcing him to take mind-altering "antipsychotic" drugs. Generally, the government can administer

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[52]*R v Hardison,* 2007, 1 Cr App R (S) 37.

[53]*NAACP v. Button*, 371 U.S. 415 (1963); *Palko v. Connecticut*, 302 U.S. 319, 326–327 (1937).

[54]*Sell v. United States*, 539 U.S. 166 (2003) is a landmark decision in which the U.S. Supreme Court imposed stringent limits on the right of a lower court to order the forcible administration of antipsychotic medication to a criminal defendant who had been determined to be incompetent to stand trial for the sole purpose of making them competent and able to be tried.

[55]Lawrence H. Tribe, *id*., note 35.

[56]Sell, *id.,* note 54.

drugs only "in limited circumstances", and in Dr. Sell's holding the Court imposed stringent limits on the right of a lower court to order the forcible administration of antipsychotic medication to a criminal defendant who had been determined to be incompetent, for the sole purpose of making him competent and able to be tried. Thus since the lower court had failed to determine that all the appropriate criteria for court-ordered forcible treatment had been met, the order to forcibly medicate the defendant was reversed.[57]

While the *Sell* case involved altering the defendant's mind by forced drugging, what are the implications of the case for government access to neuroprosthesis and other brain implant technologies that could also alter a person's thought processes or even edit their memories? Clearly, the *Sell* court did not completely ban the government from altering a person's brain chemistry, which begs the question as to whether the government could access, or even edit a person's memory by accessing an implant within their brain. While prosecuting an incompetent defendant is widely viewed as denying that defendant a fair trial, because such defendants cannot participate adequately in their own defense; those who oppose using forced drugging to *ensure* a fair trial argue that the drugs are often so overwhelming as to make adequate participation in the person's defense impossible as well. The reliance on freedom of thought and Due Process rights under the 5th and 14th Amendments as arguments against the government "manipulating" a person's mind seems to me compelling: how can a person's *speech* be free from government control if the government can forcibly administer drugs or edit the mind by accessing technology which allows them to change the *thoughts* that prompt a person to speak in the first place?

The "cognitive liberty" interest in Dr. Sell's case can be thought of as an interest forged by the union of Dr. Sell's liberty interest in bodily integrity with his freedom of thought and his Due Process right under the 5th and 14th Amendments. Such a government invasion of bodily integrity—one aimed at directly manipulating the person's thoughts and thinking processes should clearly infringe on the First Amendment right to free speech. If "at the heart of the First Amendment is the notion that in a free society one's beliefs should be shaped by his mind and his conscience rather than coerced by the State," then there can be no doubt that the government infringes on the First Amendment when it seeks to change Dr. Sell's thinking by forcibly changing his brain chemistry.[58] Further, by altering a person's mind with the forced administration of drugs, the government commits an act of cognitive censorship and mental manipulation, an action surely more disfavored under the First Amendment than even the censorship of speech. A government that is permitted to manipulate a citizen's consciousness at its very roots—by forcing a person to take a mind-altering drug or hacking a neuroprosthetic device—need not censor speech, because it could prevent *a priori* ideas from ever occurring in the mind of the speaker. By directly manipulating the

[57]Sell, *id.,* note 54.

[58]Sell, *id*, note 54.

manner in which Dr. Sell's brain processes information and formulates ideas, the government *ipso facto* manipulates and alters both the form and content of Dr. Sell's subsequent expression and thus renders the First Amendment's free speech guarantee meaningless.

With the exception of the cases in criminal law dealing with the defendant's mental capacity to stand trial, the fundamental question, in what ways people may legitimately change the mental state of others, is largely unexplored in legal thinking but will be a central issue in the emerging field of cyborg law. While every constitution guarantees the right to bodily integrity, few afford protection to mental integrity. Perhaps if a cybernetically enhanced mind received the legal rights afforded computers, future cyborgs would receive a range of protections beyond those of biological humans. On this point, just as a computer can be hacked, so too could a brain equipped with neuroprosthetic devices; thus, would affording cyborgs the same rights found in anti-hacking statutes be appropriate in a cyborg age? Future hacking crimes could take a decidedly sinister twist; not hacking to breach computer systems but brains, bodies and behaviors. In fact, it's possible now to hack insulin pumps or to use jamming signals to stop hackers from lethal pacemaker attacks.

Implanting a Software Virus in the Mind

In violation of internet, telecommunication, and criminal law statutes, future hackers could use wireless technology to disrupt the functioning of a person's neuroprosthesis or even to implant a software virus into a person's mind. On this last point, a British scientist and former student of Professor Kevin Warwick, Dr. Mark Gasson, has claimed to be the first person to become infected with a computer virus. How can this be possible? In Dr. Gasson's case, purposively as part of a proof-of-concept study, but in the future, cyborg hackers could spread a virus to a person's mind by accessing brain-implant technology or by hacking into a network of wirelessly connected brains. In Dr. Gasson's study, a chip was inserted in his hand which was then infected with a software virus.[59] Of relevance to a law of cyborgs, Dr. Gasson showed that the chip was able to pass on the computer virus to external control systems—meaning a person with cyborg "infected" technology could transmit a virus to a machine external to the cyborg. But more importantly, if other implanted chips within a person's body, including neuroprosthesis, had been connected to the system they too would have been infected by the virus.

Experts in cybersecurity are especially alarmed at the ease in which implants can be hacked. For example, Professor Kevin Fu, a leading expert on medical-device security at the University of Michigan has written extensively on this topic.

[59]Cellan-Jones, Rory, 2010, First human 'infected with computer virus, *BBC News online* (BBC). Retrieved 26 May 2010.

His concerns relate directly to neuroprosthetic devices and implants that are connected to an internal network that is itself connected to the Internet, and that are also vulnerable to infections from laptops or other device. The problem of implants being affected with a software virus is exacerbated by the fact that manufacturers often will not allow their equipment to be modified, even to add security features. "I find this mind-boggling," Fu says.[60] This particular issue, lack of patches for software could be a serious hindrance to cognitive liberty when hacking of brain implants is possible.

With others, I have often thought that the transmission of a software virus is not unlike the transmission of a disease-causing virus that enters the body. On this point consider Mark Gasson's comment on the experience of receiving a software virus: "Many people with medical implants also consider them to be integrated into the concept of their body, and so in this context it is appropriate to talk in terms of people themselves being infected by computer viruses."[61] A virus has to have a host, and in some cases can be transported through the air we breathe, similarly, a software virus can be transported through the air using spectrum to a cybernetically enhanced host. In terms of hacking into computers, there are some laws which regulate in this area. In the U.S., the *Computer Fraud and Abuse Act* deals with the issue of making and using devices and programs to gain unauthorized access to secure computer systems. Further, the *Computer Fraud and Abuse Act* prohibits access to government computers to anyone without authorization. Hackers who are convicted of crimes that violate this law may be required to pay fines, be placed on probation, or serve jail time, depending on the severity of the damages.

Under U.S. law, if a disease is purposively transmitted to another person, there could be criminal liability for the act. For example, criminal transmission of a sexually transmitted disease may be actionable through state laws that typically include both HIV as well as other communicable or contagious sexually transmitted diseases. However, we currently don't employ the disease transmission model to the spread of a software virus: instead we use other legal options for those who transmit malware.[62] If the means of software virus transmission is through the Internet, the potential impact could compromise millions of hosts. Just consider a "*harmless experiment*" by a Cornell University student that involved the release onto the Internet of a type of malware called a "*worm*" that compromised thousands of computers and required millions of dollars-worth of time to eradicate. As several computers operated by the U.S. Government were damaged, the student

[60]See generally, David Talbot, 2010, Computer Viruses Are "Rampant" on Medical Devices in Hospitals, MIT Technology Review, quoting Professor Fu, at: http://www.technologyreview.com/news/429616/computer-viruses-are-rampant-on-medical-devices-in-hospitals/.

[61]Mark Gasson, 2005, Extending human interaction via invasive neural implants (PhD thesis). University of Reading.

[62]Malware (short for "malicious software"), is a file or code, typically delivered over a network that infects, explores, steals or conducts virtually any behavior an attacker wants, would be deleterious to the bodily integrity of any cyborg.

was prosecuted and convicted under the *Computer Fraud and Abuse Act* described above.[63] Other jurisdictions also punish those who infect computers with a virus. For example, in the U.K., the introduction of malware to a computer is covered by Section 3 of the *Computer Misuse Act*. The Act states that a crime is committed if a person "does any act which causes an unauthorized modification of the contents of any computer" and the perpetrator intends to "cause a modification of the contents of any computer" which may "impair the operation of any computer", "prevent or hinder access to any program or data held in any computer" or "impair the operation of any such program or the reliability of any such data".[64] Relating this law to cyborg technology, access to software and algorithms in the artificial hippocampus (which is a computer) created by Professor Berger, could hinder memory processes and be actionable under the U.K. Act.

Clearly, Dr. Gasson's findings that a virus can spread from one implant to another, has important implications for a cyborg future where brain implants storing memories and sensory information could be accessed by third parties, and in which medical devices such as pacemakers, cochlear implants, and retinal prosthesis, could be contaminated by a virus infecting another neuroprosthetic implant. Dr. Gasson's findings show that when third party access to neuroprosthesis become possible, the spread of a computer virus will also become possible and thus maintaining cognitive liberty will be an important consideration for anyone equipped with neuroprosthetic technology.

Conclusion

As cyborg technologies improve and continue to be integrated into the human body, significant issues of law and policy will need to be addressed; if not, humanity could be subjected to a host of unexpected and negative outcomes. For cognitive liberty, perhaps the most troubling outcome would be the risk that a totalitarian government could gain access to neuroprosthetic devices—this could lead to a dystopic future not unlike the societies discussed in the popular novels written by Aldous Huxley in *Brave New World*, or George Orwell in *1984*. Hopefully, given the high stakes for humanity, this chapter has convinced the reader that in the cyborg future accessing the mind for nefarious purposes is completely possible, and not just the warning of overzealous futurists and novelists

[63]Computer Fraud and Abuse Act (CFAA), 18 U.S.C. 1030; There is an obligation for prosecution under the CFAA that a non-public computer is damaged where the term "damage" means any impairment to the integrity or availability of data, a program, a system, or information. Computer Misuse Act 1990 (c. 18), 1990 CHAPTER 18. The PCI-DSS at section 5 requires that "Anti-virus software must be used on all systems commonly affected by viruses to protect systems from malicious software." The Consumer Protection Act 1987 (Products Liability) (Modification) Order 2000 (Statutory Instrument 2000 No. 2771).

[64]Computer Misuse Act, *Id*.

from the first half of last century. In an age of cyborgs, the over worked saying that technology is a "dual edge" sword, in that it can provide amazing benefits to humanity, or lead to unintended negative outcomes; is especially true. Therefore, the need to vigorously debate how cyborg technologies will be used in the future and how they will be regulated is especially meaningful.

For cognitive liberty, freedom of thought is the natural human right of each person to be secure in their ability to perceive the world to the best of their ability. To have true cognitive liberty in a world with people equipped with brain implants would mean that first we must have access to truthful and unbiased information about the actions of others and the general state of the world—will this be possible in a world consisting of cybernetic enhancements to our bodies and mind? Because this is an important consideration for our cyborg future, consider the definition of cognitive liberty proposed by an organization which focuses on the concept. *The Center for Cognitive Liberties* defines the term as "the right of each individual to think independently and autonomously, to use the full spectrum of his or her mind, and to engage in multiple modes of thought."[65] Without the ability to think independently and to receive accurate representations of external events we cannot make independently informed choices which is an essential requirement to participate in liberal democracies; and without the ability to engage in all modes of thought, we may be subject to control by governments, corporations, and other third parties. These are areas which need vigorous debate and legislative action within the next decades; clearly, we need to ensure that cognitive liberty is a basic right as we move forward toward a cyborg future.

As we enhance our bodies with technology, the clear trend is that we are becoming vulnerable to more government supervision and privacy invasions. For these and other reasons we need to ask—how should the law account for violations of our rights which may accompany the emergence of cyborg technologies? Should the technology integrated within our bodies and brains have the rights afforded natural people, or only the rights associated with property? This is a difficult question to answer but a timely question to pose because the legal division between humans and machines is beginning to blur as technology is implanted within the body and performs functions once done by organic parts. Interestingly, Mariella Pazzaglia and colleagues from Sapienza University, have found that wheel-bound people with spinal cord injuries perceive their body's edges as being plastic and flexible to include the wheelchair.[66] If the law continues to view the machine parts integrated into the human body as separate from the body, then not only will this decision be incompatible with how we view our cybernetically enhanced bodies, but lead to situations where the law is not equipped to handle

[65]Center for Cognitive Liberties and Ethics, at: http://www.cognitiveliberty.org/faqs/faq_general.htm.

[66]Science Daily, 2013, Human brain treats prosthetic devices as part of the body, at: http://www.sciencedaily.com/releases/2013/03/130306221135.htm. Mariella Pazzaglia, Giulia Galli, Giorgio Scivoletto, Marco Molinari. A Functionally Relevant Tool for the Body following Spinal Cord Injury. *PLoS ONE*, 2013; 8 (3): e58312 doi: 10.1371/journal.pone.0058312.

disputes involving cyborg technology. For example, data has tremendous value, but who owns the data produced by technology implanted within the body? Consider that a heart pacer produces data concerning the functioning of the heart, including heartbeat, blood temperature, breathing, and heart electrical activity. However, under current law, the data produced by cyborg devices, such as a pacemaker, is not viewed as the property of the cyborg, but of the manufacturer, vendor, or licensor of the medical implant. As noted by Benjamin Wittes and Jane Chong in a Brookings Law Report, "The more we come to see the machine as an extension of the person—first by the pervasiveness of its use, then by its physical integration with the user—the less plausible will seem the notion that these are simply tools which with we choose to use…"[67] And the less the machine parts are viewed as tools, the more relevant the question—why not view the human-machine combination as a fully integrated being, deserving of the rights afforded natural persons?

Issues of ownership for cyborg technology and the data produced by implants, while important for the law of property and contract, are just one of many areas of law and policy that will be impacted by the emergence of cyborg technologies. For example, the spread of cyborg technologies throughout the population, will likely influence the very structure of society itself. This is because cyborg technologies designed to enhance cognitive functions could create multiple classes of people, differing in intellectual abilities; with different needs, rights, and aspirations. How would the law deal with a society consisting of different types of cyborgs and also of unenhanced people, differing vastly in intellectual abilities? Thinking about this question, Harvard University Professor Michael Sandel, has expressed concern that enhancement technology could create two classes of human beings—those with access to enhancement technologies, and those who must make do with an unaltered memory that fades with age.[68]

My concerns that emerging cyborg technologies which are directed at the mind could lead to a dystopic future, are compatible with Stanford's Francis Fukuyama's comments on the dangers of biotechnology as he discussed in *Our Posthuman Future: Consequences of the Biotechnology Revolution*.[69] For example, just as with biotechnology, our human dignity and human rights could be changed as we morph into more machine than biological human. According to Fukuyama, it is unquestionable that our equal moral status, or worth, rests on certain properties we share, or as Professor Fukuyama puts it, on our common human nature. The concern is that future advances in cybernetic technology which lead to modification of "our complex evolved natures" could "disrupt either the unity or the continuity of human nature, and thereby the human rights that are

[67]Benjamin Wittes and Jane Chong, *id*., note 1.

[68]Michael J. Sandel, 2007, The Case against Perfection: Ethics in the Age of Genetic Engineering. Cambridge, Massachusetts: Harvard University Press. ISBN 9780674036383.

[69]Francis Fukuyama, 2003, Our Posthuman Future: Consequences of the Biotechnology Revolution, Picador Press.

based on it."[70] Clearly, cybernetic technologies could dramatically change the mix of human to machine parts, and thus affect the balance of our common human nature. The contrary view, expressed by those who believe that it is advantageous that we are becoming posthuman, is to think of our species, like other species, as continually evolving, and it is unnecessary to freeze it in place to protect human dignity and human rights. In this view "human rights" will evolve as we integrate technology into our bodies, and that this is the result of a natural process.

However, before the warnings presented in this chapter motives the reader to call for a ban on all cyborg technologies aimed at the mind, perhaps a balancing of cognitive liberty against government rights must be considered. This is because preventing the government from regulating in any area related to the creation, receipt, or transmission of information, would effectively prevent it from governing—in fact, in the U.S. a whole body of First Amendment law addresses just this issue, when, where, and how the government can restrict speech. Further, banning or heavily restricting cyborg technologies directed at the mind could also condemn some people to a lifetime of mental illness that (with continuing advances in cyborg technology) could have been alleviated with a neuroprosthetic device. And if brain enhancement technologies were banned, then unenhanced people could be condemned to a future in which their information processing abilities would be orders of magnitude less than artificially intelligent machines; would we then be subservient to the machines?

Perhaps as some argue, only thought that is expressed in vocalized, symbolic, or commercial speech should be regulated to some extent—and that unspoken thought should receive blanket protection. In either case, government regulation of speech, through prior restraints (such as by assessing a brain implant and disrupting the thought process), should be heavily frowned upon—the Supreme Court generally supports this view. The Court in *Ashcroft v. Free Speech Coalition* commented that thought is most in danger "…when the government seeks to control thought or to justify its laws for that impermissible end."[71] This dicta raises a question that requires serious debate on just what government motive to regulate thought would count as permissible: insuring public safety under the state's broad police powers could be one. However, the idea of holding people accountable for their predispositions as discovered by accessing their thoughts through a neuroprosthetic device rather than their actions poses a challenge to one of the central principles of Anglo-American jurisprudence: namely, that people are responsible for their behavior, not their proclivities—for what they do, not solely what they privately think (although I should note that crimes have a *mens rea* component combined with an *actus reus*).

The full range of issues that will be implicated by third party access to neuroprosthetic devices are not only too numerous to discuss in one book chapter, but

[70] *Id*.

[71] *Achcroft v. Free Speech Coalition*, 535 U.S. 234, 2002.

not possible to present comprehensively, because we are just at the beginnings of developing a law of cyborgs, therefore, much remains to be determined. However, an important issue to briefly review concerns the possibility of a third-party cyberstalking a person equipped with a neuroprosthetic device, as this relates to the topic of the chapter—a person's ability to exercise cognitive liberty. Just consider—if repeated harassing phone calls to a cell phone are threatening, imagine repeated calls or access to an implant in the brain that functions as a communication device. In general, cyberstalking can involve using the Internet or other electronic means to harass an individual, which can also be accompanied by a credible threat of serious harm. And clearly, by accessing a neuroprosthetic device the psychological damage resulting from cyberstalking could be especially egregious as the damage could result from actually editing a person's memory. Given third party access to implantable devices, if a brain implant was accessed by a stalker, the results could be incredibly threatening and physically damaging—implicating criminal assault, battery, and other appropriate statutes. There is no current law directly on cyberstalking through access to brain implant devices, but just as California was the first state to enact an anti-chipping statute. California was also the first state to pass an anti-stalking law.[72] Under the law, courts may issue restraining orders to prohibit stalking and a victim of stalking may bring a civil lawsuit against the stalker and recover monetary damages. Because cyberstalking will take on a new meaning if third party access to a neuroprosthesis is done to threaten the integrity of a person's mind; this is obviously a great concern and an area ripe for legislation before midcentury.

To summarize, neuroprosthetic devices have joined the information technology revolution, they are now exponentially improving technologies. As a result, the law and policy impacted by the revolution occurring with neuroprosthesis, has not kept up. Chris Gray, writing in *Cyborg Citizen* has suggested that as we move toward the cyborg future, perhaps we need to consider granting basic rights to cybernetically enhanced individuals.[73] According to Gray, for freedom of speech, we should grant cyborgs an equivalent *freedom of electronic speech*, which would protect the right without government interference, to engage in electronic and other nonphysical forms of transmitting information—this would be an important right when telepathy is possible. Further, given the possibility of third party access to cybernetic devices implanted in the brain, the privacy of cyborgs could be threatened far beyond that of unenhanced individuals. Therefore, Gray proposes that the *right of electronic privacy* be granted to cyborgs. This right would protect cyborgs from third party access to their neuroprosthetic devices, and the right to privacy when they engage in electronic communication. And finally, Gray suggests that cyborgs be afforded the right to f*reedom of consciousness;* that is, the right to

[72]California Civil Stalking Law, Cal Civ. Code § 1708.7 (2014); Stalking Cal. Pen. Code § 646.9, Stalking (2008).

[73]Chris Gray 2002, Cyborg Citizen: Politics in the Posthuman Age, Routledge.

have one's very consciousness free from outside interference.[74] In conclusion, just as in most of the world today in the U.S. we are a nation of law and also of technology, in that spirit, we now need to decide the appropriate balance between the use of cyborg technologies and their impact on our human freedoms as afforded by our laws, statutes, and policies.

[74] *Id.*