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Katelyn Marie Edel
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An Exploration of the Societal Impact of
Neuroethics in Scientific and General Communities

A Capstone Project Submitted in Partial Fulfillment of the
Requirements of the Renée Crown University Honors Program at
Syracuse University

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and Renée Crown University Honors
May 2015

Honors Capstone Project in Neuroscience

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Table of Contents

Abstract..... i

Executive Summary.....ii

Acknowledgements.....v

Chapter One – Introduction: Why are Neuroethics Important?.....1

[Study: Highlights of a Crucial Question that Neuroethics Can Answer](#)1

Neuroethics, an Interdisciplinary and Dynamic New Field.....4

Neuroethics and its Relationship to Bioethics.....6

Neuroethics’ Introduction to Society.....10

Chapter Two: Treatment, Technology, and Safety Concerns.....13

A History of Psychosurgery.....13

Contemporary Surgery Techniques.....14

The Balance of Beneficence and Nonmaleficence.....16

The Technological Imperative.....17

[Study: Herr, Human Improvement, and the Threat to Humanity?](#).....19

Chapter Three – Brain Privacy, ~~and~~ Neuroimaging, and Autonomy.....21

Neuroimaging and its Clinical Significance.....21

Beyond the Clinical Use of Brain Scans.....22

Neuroethics and Brain Scans.....23

Brain Imaging and Personal Autonomy.....24

Privacy and Discrimination.....26

Imaging and Personhood.....29

Study: Herr and Personhood.....30

Chapter Four – Neuroenhancement and Social Justice.....33

Neuroenhancement - Possibilities and Perils.....33

Cognitive Enhancement and Social Justice Concerns.....34

Potential Effects of an Uneven Distribution of Resources.....36

[A Distinction Between Treatment and Enhancement](#).....37

[Study: Herr, Lifestyle Ailments, and Slippery Slopes](#).....39

Other Thoughts on Neuroenhancement40

Chapter Five – Society and Neuroethics.....42

The BRAIN Initiative and the Government.....42

[The Importance of Public Awareness and Discussion](#).....44

[What is the Role of Neuroethics Right Now?](#)47

Chapter Six – What is the Future?50

Revisiting [The Treatment/Enhancement Debate](#).....50

[Where is the Dependence on Technology Leading Us](#).....51

Concluding Thoughts and Questions.....55

References Cited.....57

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Abstract

Neuroethics serves as a roadmap for maneuvering the difficult and often personal concerns that arise concurrently with advancements in neuroscience. It is important to consider these issues at present and to take a proactive, rather than reactive, approach towards assuaging fears and hesitations related to the quickening applications of neuroscience into the non-scientific community. This Capstone explores recent suggestions made by prominent scholars in the neuroethics field related to the integration of neuroscience into society. Three cogent issues in neuroscience are discussed, with a focus on the possible effects that neuroscientific advancements have on society. Using a framework of human enhancement, which is a pressing philosophical question facing society today, this Capstone explores the fundamental and crucial nature that neuroethics plays in the regulation of scientific practice.

Serving as a roadmap for the next decade of science, neuroethics intimately links concerns of privacy, social justice, and a protection of the greater good. With the understanding that society has reached a point in which science is accessible by those outside of the professional scientific community, the Capstone focuses on the development of an intimate connection between science and society with the hope that expanded discussion will serve to highlight the foundations of neuroethical guidelines.

Executive Summary

Both popular culture and the scientific field have determined the twenty-first century to be the age of neuroscience. Over the past fifteen years, vast improvements have rendered the field indispensable in future understandings of the human body, the human mind, and human thought. The promise of neuroscience as a field began with the rapid rise of neuroimaging technologies, from the first rudimentary electroencephalogram (EEG) design, which measured electrical activity in the brain, to the now sophisticated functional magnetic resonance imaging machine, or fMRI, which creates detailed images of neural activation patterns. Further understanding in the connections and mechanisms underlying brain signaling patterns have led to astute developments in both the pharmaceutical industry and in the surgical field, leading to further groundbreaking and seminal discoveries.

Overall, these changes have culminated in the advancement of neuroscience as a field, and neuroscience has come to be recognized as a discipline with great promise and potential. However, as with any powerful force, the advancements in neuroscience also have brought potentially problematic issues to the forefront, especially in terms of the effects on society at large. Neuroethics is the discipline that has arisen as a result of the concerns over the possible implications of neuroscience within a larger, diverse society. The field combines bioethics, philosophy, neuroscience, and plays a role in healthcare, law, and government. Due to its interdisciplinary nature, neuroethics as a field is equipped to answer difficult questions that are currently facing the neuroscience, medical, and general communities.

This Capstone project explores the role that neuroethics can play in answering some of the most difficult questions facing our society today, including that of the role that technology should play in medicine. The world has reached a point, both practically and psychologically, in

which the ability and the desire to use technology for augmentation rather than for treatment has arrived. In the past, medicine's sole purpose was to cure disease and treat pathologies. Over the past decade however, and coupled especially with the advancements in neuroscience and related technologies, the goals of medicine have evolved; instead of treatment, medicine can now serve to enhance, making otherwise healthy humans better, faster, and stronger. One of the most pressing ethical issues of today is whether or not this shift in medical ideology is a moral one, and whether or not human enhancement should be readily accepted into society.

By examining three pressing issues in neuroscience – the use of surgery to treat psychiatric conditions, privacy and brain imaging, and cognitive enhancement - and examining case studies related to the wider problem of human enhancement, this Capstone outlines various dimensions of several neuroethical conflicts. Neuroethics is especially equipped to answer the questions about human enhancement because, as evidenced by the popularity and power of the field of neuroscience, many of the enhancement tools over the coming years will have a neurological component, and there will be a focus on the expansion and the maximization of the power's of the mind. As a result of its interdisciplinary nature, neuroethics can be used as an exemplary framework in considering both the scientific and the philosophical limitations of enhancement.

The neuroethical issues are best described using the framework of the four main bioethical principles: autonomy, beneficence, nonmalficence, and justice. Autonomy can encompass many things, including ideas of personhood and individual privacy. Basically, autonomy acts as a protective principle, emphasizing the rights of the individual patient. Issues of autonomy are most prominent in situations involving neuroimaging and with those that involve extensive, and often invasive, brain scanning. Beneficence and nonmalficence are most

easily described in terms of a physician's obligation to "do no harm" and to act in the best interests of their patients. In neuroscience, these two principles must be carefully balanced when health professionals are developing new technologies, treatments, or clinical trials. Justice refers to the issues of resource allocation, fair and equitable practices, and other social issues. Justice is most relevant in debates surrounding issues of cognitive enhancement and human augmentation.

As evidenced by the scope and enormity of current issues, the neuroscience field has developed at a rapid rate. Perhaps as a result of this quick expansion, there has been a distinct lack in communication between the scientific and lay communities, but no restrictions on the kind of information the general public has access to. While scientists are actively discussing the relevance of neuroethics, the general populace is often missing important information – or relying on inaccurate details - about the potential effects that neurological advancements can have on their lives. By recognizing the importance of neuroscience, and perhaps in an effort to combat this information exchange deficit, President Obama proposed the BRAIN Initiative a few short years ago. The Initiative, led by the National Institute of Health, seeks to develop parameters to make neuroscience accessible and understandable for non-scientists. It is hoped that by providing information some of the fear that often surrounds technological and scientific advancement will be assuaged.

This Capstone does not answer all of the questions that are facing neuroscience – and society - today. Instead, it is an exploration of the different environments in which neuroethical debate is not only present, but also necessary. As a result, this Capstone serves a roadmap for answering the more difficult and pressing questions and concerns. Additionally, this Capstone evaluates the crucial role that technology has played in neuroscientific advancement, and looks towards a more inclusive, ethical, and cognizant future for the field.

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Chapter One – Introduction: Why are Neuroethics Important?

Study: Highlights of a Crucial Question that Neuroethics Can Answer

In 1981, Hugh Herr was a mountain climbing prodigy. By seventeen he had already scaled precipitous cliffs in both the United States and Canada (NPR). Despite his youth, he was recognized as one of the best climbers in America. In 1982, at the age of 18, Herr and his climbing partner Jeff Batzer were set to climb the difficult Mount Washington in New Hampshire (TedMed). During the climb, Batzer and Herr were caught in a blizzard and were stranded in a ravine for three nights. Both suffered from hypothermia and severe frostbite (NPR). On the fourth day a rescue team managed to extract Herr and Batzer from the ravine and take them to the nearest medical center.

Doctors worked for months to salvage Herr's limbs, trying in vain to restore circulation and nourish the dead tissue (TedMed). Unfortunately, three months after the accident Herr underwent a surgery that would result in the amputation of his legs from the knee down (TedMed). Immediately after the surgery, Herr struggled with adapting to his new body, experiencing phantom limb pain and an emotional disconnect from his former self. How was he supposed to live his "old life" without his biological limbs, legs that had allowed him to scale the most difficult rock faces? Determined to not let his disability define him, Herr searched for prosthetics that would allow him to mountain climb. In the years after the amputation, Herr began to notice that the technology supplied by the machine limbs actually enabled him to climb better than he had before the accident, as he was able to manipulate the height of the prosthetics and alter the width of the foot. Herr eventually stopped considering his body as disabled, and

instead focused on the possibilities provided by the prosthetic limbs, a change in perspective that would shape the field of bionics and prosthetics for decades to come.

Perhaps inspired by his ability to continue climbing, Herr was even more determined to create prosthetics that could not only be used for rock climbing amputees, but also for the amputees that wanted to run, jump, swim, or use prosthetics in normal, everyday life. He foresaw machine limbs that would transcend all biological human ability and would make sport and life safer and accessible to all amputees (TedMed). After attending college and receiving advanced degrees from the Massachusetts Institute of Technology and Harvard, Herr began to design his own legs and embarked on his lifetime journey of prostheses development. He himself now has over nine pairs, all suited for different climbing and lifestyle conditions, and he has continued to be an advocate for using technology to restore “normal” biological function (NPR).

Now the head of the MIT’s Media Lab, Herr has devoted his life to the development of advanced machinery designed to make the lives of amputees easier and safer. He works extensively with war veterans from Afghanistan and Iraq, and has recently been a key player in the expansion of advanced brain-machine interfaces, a technology that uses sensors to detect neuronal signals and results in simulated control of the prosthetic (TedMed). True to his vision at the beginning of his career, Herr believes bionics to be a key part in the science of evolution, and he considers prosthetics to be “intimate organic expressions of the human body” and a fundamental tool to change the face of disability (TedMed).

The brain-machine interface proposed and supported by Herr is perhaps the ultimate expression of transcending current human limitations, using technology to make the human species better, faster, and stronger – it not only treats a physical limitation, but it improves upon the biological human condition. In some people’s opinion, Herr has achieved “superhuman”

ability, using technology to surpass what is considered to be normal. The question then becomes: is this right? Undoubtedly, prosthetic legs for amputees are an example of the traditional model of medicine treating pathology. But Herr's design of prosthetics that allow the user to go above and beyond what is possible with biological limbs while still using connections from the brain is an example of the augmentation of normalcy. What happens when there may come a time that perfectly healthy individuals ask for their legs to be amputated so they can use Herr's superhuman prosthetics in order to achieve their rock climbing (or other physical) goals?

Here we confront one of the central questions of neuroethics: is human enhancement permissible? Neuroethics is a discipline that creates an intimate relationship between philosophy and science, which therefore allows neuroethics to serve as a vehicle for answering difficult moral questions such as the one presented by Herr's case. Neuroscience is certainly the science of the future, and the advancements made over the next decade will undoubtedly relate back to the brain in some way. Therefore, neuroethics will soon become even more applicable than it currently is, serving as a means for answering pressing questions arising from the moral demands that science places on society.

As technology continues to improve, it is likely that many of these moral demands on society will come in the form of enhancement. Enhancement capabilities will soon become widespread, as further advancement leads to reduced cost and, subsequently, introduction into the general market. This larger social problem of enhancement could very much be regulated with the help of neuroethics, especially because many of the enhancement capabilities, like memory-sharpening pharmaceuticals and brain-machine interfaces, are intimately related to the science of the mind. Neuroethicists are – and should be – concerned with such issues as enhancement because a successful trajectory of improved technology must contain a regulatory

component, especially when such technology is being embraced by both the scientific and the general communities. The dual dimensions of neuroethics - philosophy and neuroscience - equip scholars in the field to consider the ethical boundaries of advancements in science - not only those boundaries pertaining to enhancement but to other relevant issues as well, later described in this paper - even if that boundary means limiting progress for the sake of the greater good.

Neuroethics, an Interdisciplinary and Dynamic New Field

Neuroethics is a relatively new field, which entered the academic research scene as a sub-discipline of bioethics. Widely discussed in academic circles since the early 2000s, neuroethics has stretched across a variety of disciplines with applications in law, philosophy, and medicine. Currently, for those that are at the forefront of innovation in the field, neuroethics is a discipline that is entirely its own, with principles, guidelines, and research techniques that are specific to the neurosciences itself. There are two primary branches of neuroethics: the *neuroscience of ethics*, and the *ethics of neuroscience*. Both branches have drastic implications for future advances in technology, free will, clinical cases, and moral decision making (Levy, 1).

The ethics of neuroscience is concerned with “the conduct of neuroscience itself.” It addresses issues like patient autonomy and privacy, research methods and consent forms, and inequitable access to new technologies (Levy, 1). This branch, which is the focus of much of this Capstone project, has its widest applications in the clinical and research settings, in which new technologies are advancing at an unprecedented rate and there is a need for reputable, regulated practices in order to answer the pressing questions of today and tomorrow. The other branch, the neuroscience of ethics, “refers to the impact of neuroscientific knowledge upon our understanding of ethics itself,” like how our brain chemistry determines our perceived

autonomous choices, or how structural abnormalities might lead to faulty moral decision-making (Levy, 1). Widely used in law and philosophy, the neuroscience of ethics likely plays a crucial role in considering the role of conscious intentions as they relate to responsibility and morality. Whichever branch is considered, neuroethics as a whole is a quickly developing and wide reaching discipline that “requires serious engagement in the sciences of the mind and in several branches of philosophy” (Levy, 8).

Because of its interdisciplinary nature, neuroethics is equipped to answer difficult questions that are currently facing the neuroscience, medical, and general communities. For this reason, an exploration of three current issues in neuroscience and the ethical implications of them are the main focus of this Capstone, with an extensive discussion about how each can impact individuals at both the professional and general levels. Additionally, this Capstone explores several case studies related to the wider issue of human enhancement in an attempt to demonstrate the crucial role that ethics will play in the science of the future. The following chapters are an exploration of the research addressing specific, cogent issues in neuroscience. Later chapters explore current neuroethics’ initiatives further and look at the government’s impact on the regulation of neuroscience and the perpetuation of fundamental ethical discussions.

The most important aspect of the following pages, however, is the recognition of the call for further discussion and the realization that there is a great societal change occurring that parallels the advances in neuroscience and neuroethics. This change is represented in the dichotomy of using medicine and its associated technology to solely treat pathology versus using it to augment normalcy. As it stands, several of the current issues in neuroethics are rooted in these distinctions. Many of the technologies, like cognition enhancing pharmaceuticals, imaging

technology, and psychosurgeries, were originally developed to only treat various kinds of pathologies. Now however, as the technology improves and becomes more popular, it is being used outside of the traditional clinical domain. Instead, technology is now often prescribed, tested, and designed for those individuals that aren't "sick" in the traditional model, but are merely lacking something that is perceived as normal in society. As a result, these technologies are now being used as enhancement tools, which have created a domino effect that has changed the very aspect of the "normal" human condition. The fact of the matter is that technology can and is being used to go above and beyond what our society has traditionally perceived as normal. Medical technology, especially those technologies related to neuroscience, is no longer solely used for treatment, but for enhancement.

The questions associated with this change are difficult to answer, and I argue that it is the charge of neuroethics to provide a roadmap towards a solution. Of course, this can only be done through sustained discussion, cross-discipline efforts, and community awareness. Many of these things have already begun, but it is not enough to start and not finish, which seems to be the fate of many ethical subtopics. Instead, each consideration, each subsequent mention should be used as a tool to propel and sustain the crucial analysis of the ethical considerations of neuroscience.

Neuroethics and its Relationship to Bioethics

In order to understand the fundamental debates in neuroethics, it is necessary to introduce bioethics, the discipline from which neuroethics stems. The field of bioethics is not that much older than neuroethics, as prior to the 1960s, there was little consideration paid to the ethics of the life sciences. For example, in research settings, consent forms and privacy concerns were things of the future; in medicine, there was minimal discussion about life-saving technologies,

their place in clinical care, their potential limitations, or about the efficacy of clinical practices. With the changing times and evolving concerns, however, it was clear that discussions were needed, and they needed to happen relatively quickly.

Born from Enlightenment ideals and propelled by philosophic claims from the likes of Immanuel Kant, “bioethics was to be a public service that brought a specific kind of analytic, moral philosophy to questions of medical care and healthcare delivery” (Koch, 13). Two catalyzing events that many claim laid the groundwork for bioethical considerations in the United States were the medical experimentation in Germany during World War II, which received global attention, and the questionable methodology behind the Tuskegee Syphilis study, which continues to generate ethical debates even today. A move from paternalism towards individual liberty and autonomy was the true hallmark of the change in bioethical thinking (Koch, 14). Additionally, a movement away from old medical practices, in which the physicians made most of the decisions, began to take root, alongside advances in life sustaining technology, organ donation, abortion and contraception, and a growing awareness of the high costs of healthcare.

The culmination of all of these shifts resulted in the “new” bioethics, which can essentially be described as the study between right and wrong in all aspects of medicine, including clinical situations, research, animal welfare, public health, and biotechnologies. Academics certainly began recognizing a distinct need for a body of philosophical guidelines in the life sciences, wishing to introduce regulatory practices that held physicians and researchers accountable for their actions and that protected patients while also allowing and encouraging further growth in the sciences.

Bioethics is a sizable, comprehensive field, and one that continues to grow proportionally with the current advances in technology. As all encompassing as it may be, however, American based bioethics (and it is important to make this US-centric distinction, as other countries often take different approaches) was founded on just four core principles: autonomy, beneficence, nonmaleficence, and justice. The four principles, originally introduced in *Biomedical Ethics*, represent the core values set forth by researchers, both from the past and from today. The principles are meant to complement each other, essentially creating a framework for the practice of healthcare.

Autonomy is the tenet that is often held as being the most important by the citizens of the United States, reflecting our pervasive individualistic culture and ideology. Autonomy pertains to questions about privacy, personhood, a patient's right to deny life saving treatment, and informed consent. Ultimately, it reflects an overall change from the previously well-instituted paternalism to patient-centered care. Autonomy is often at the center of many conflicts, both in bioethics and neuroethics. How far do patient's rights go? Some argue that the patient's wish is the final word, while others are hesitant to give that much power to individuals that have not gone through extensive medical training in order to know what the best form of treatment is. In terms of neuroethics, the question of autonomy directly relates to issues about brain imaging, privacy, and personhood.

Beneficence is often the principle that makes the most intuitive sense to laypersons; the principle states that in a medical setting, it is the health professional's duty to do what is best for their patients. Beneficence was once believed to be fairly straight forward, as it was assumed that a physician would act only in the patient's best interests, thereby fulfilling their role as a "healer." It is now not so black and white, with different physicians having diverse opinions

about the “right” way to do something. Additionally, “doing best” for a patient no longer only means administering the appropriate medical care, but also providing personal, religious, and emotional support too. It is the multifaceted dimensions of beneficence that make it a highly debated topic, one that is often prone to different interpretations and applications.

The corollary of beneficence is nonmaleficence, the Hippocratic “do no harm” principle. This principle is frequently called in to question in light of current bioethical debates surrounding physician assisted death, the circumstances surrounding extreme life sustaining measures, and the withdrawing of food and water from a patient in a persistent vegetative state. Nonmaleficence holds physicians accountable for protecting their patients. But, like beneficence, nonmaleficence can leave room for interpretation. For example, while many physicians might see assisted suicide as a violation of the Hippocratic Oath, many others might perceive allowing a patient to suffer when they as a physician can provide relief as doing more harm than good. Ultimately, as a pair, beneficence and nonmaleficence are frequently at odds, and play a large role in considerations surrounding the ethics of new technologies and experimental care in neuroscience.

The principle of justice has two aspects, procedural and distributive. Procedural justice is similar to due process; it is concerned with the consistency and equity of procedures and actions. Procedural justice ensures that all individuals, with all other things being equal, are receiving the same kind of care. Of course, especially in the United States, not every citizen does receive this kind of adequate healthcare, and this is a problem related to not only procedural justice, but distributive justice as well. Distributive justice often pertains to resource allocation and healthcare disparity. These disparities are more often than not the result of socioeconomic gaps or gender differences. Distributive justice is usually framed in conjunction with social and public health problems, and this tenet often considers the long-term effects of decisions being made

right now: how will access to new technologies affect different social classes? Will it create a larger disparity gap? As a whole, how will new health interventions affect the entire community? Distributive justice concerns arise in almost every discussion pertaining to neuroethics, as the merits of neuroenhancement and access to resources and technology are considered.

Neuroethics' Introduction to Society

Neuroethics encompasses the four main bioethical principles while simultaneously expounding and calling upon other guidelines and tenets. The ethics of the brain present such specific questions – and the answers to these questions have such vast, wide-reaching consequences – that it certainly seemed almost inevitable that a new branch would be formed from bioethics in order to address them. Over forty years after the inception of bioethics, neuroethics became “official” in 2002, when the Dana Foundation (a neuroscience think tank) held a conference specifically for neuroethical discussion and debate. At this first conference, which was held in San Francisco, prominent New York Times journalist William Safire publically coined the term “neuroethics,” formally introducing it to a number of researchers and academics from all over the world, although it had probably been widely used in academia in the years leading up to the conference.

Since approximately the early 2000s, the field has garnered considerable public attention, noted for its importance but recognized as a difficult and sensitive topic. The numerous advancements in neuroscience technologies and the establishment of a deeper understanding of the mind make many people, both members of the general public and those that are involved with the sciences, uneasy. Medical anthropologists have noted that the unrest is similar to that caused by the sequencing of the human genome, completed fifteen years ago. When the Human

Genome project was started, people often expressed concerns of an invasion of personal privacy and of science's ability to alter the very fundamental nature of "self." Similar concerns and questions are raised by neuroscience. While genes are the fundamental code for who we are, our mind is what allows us to interact with the world, monitors our thoughts and feelings, registers our perceptions of the things around us, and make decisions. In short, the brain is the organ that encompasses our "soul," a fact which has led many philosophers to consider the effects that a further understanding on science might have for our morality and our worldly experiences.

As advancements are made, conversations about neuroethics must continue to penetrate all discourse domains, not just those of academia and clinical research, but of law, legislation, public policy, medicine, and everyday environments. Undoubtedly, the past decade of neuroscience has brought numerous positive clinical advancements to the public, and it is the hope that continued improvements will take place in the future. To be able to harness even a small portion of the brain's power has proven to make the difference in clinical diagnoses, the understanding of neuropathologies, and the introduction of more effective treatment. With a sustained discussion of neuroethics, all of these things and more will continue to be possible.

Catalyzed by President Obama's BRAIN (Brain Research through Advancing Innovative Neurotechnologies) initiative, neuroscience will be receiving an abundance of funds – and probably even more attention in years to come. This will undoubtedly give rise to more ethical dilemmas than those occupying the minds of researchers and academics currently (*Gray Matters, I*). Without the proper considerations, these theoretical ethical dilemmas could soon become wide-spread public health issues. If and when this occurs, it would be difficult to backtrack and establish guidelines and ethical principles for preexisting practices. The best, safest, and most effective approach to the advancements in neuroscience right now is a continued – but expanded

– discussion of the potential issues that could arise, and a definitive approach to implementing solutions to these problems through the application of neuroethics.

Chapter Two – Treatment, Technology, and Safety Concerns

A History of Psychosurgery

“The great promise of neuroscience at the end of the last century was that it would revolutionize the treatment of psychiatric problems” (Carey, 1). This promise, which continues into the twenty-first century, seems to be accurate. As imaging becomes more detailed, the government has begun taking an interest in the neurosciences. Information relating to psychiatric conditions and other medical ailments has become more accessible. Despite all of these advances, there are respects in which “the new, sophisticated version [of neuroscience] is actually an old and controversial approach.” Despite its troubled past, physicians and researchers are still turning to psychosurgery as the main “cure” for mental disorders (Carey, 1). This shift towards a more surgery centered approach for disorders of the mind continues to be disconcerting for ethicists and health professionals on many levels, primarily due to the tumultuous history of psychosurgical practices and the unclear benefits and very real risks that are associated with these surgeries.

In 1949, Egas Moniz was awarded the Nobel Prize in Medicine for the development of his leucotomy technique. The leucotomy was a neurosurgical procedure in which a physician drilled holes in a patient’s skull, while the patient was under general anesthesia. The surgeon then inserted a leucotome into the holes and extracted small amounts of white matter. Wildly heralded as having an incredibly high success rate, the premise of the leucotomy was that it disconnected the fibers in the brain that caused agitation, aggression, or other “psychotic tendencies” in patients. Leucotomies were the preferred method of psychosurgery for a time because it was believed that the procedure cured mental disorders while leaving a patient’s intelligence levels and sense of self intact. Moniz, a Portuguese doctor, expanded his surgical

techniques across much of Europe. Walter Freeman, a respected American physician, was a forceful advocate of the technique in the US, and he soon became wildly popular for his ability to “cure” American patients suffering from different mental disorders.

Unfortunately, Freeman quickly adapted the leucotomy (an already questionable procedure relying primarily on guesswork) to what he felt was a more efficient means of treatment. Freeman’s technique, the prefrontal lobotomy (later to be referred to as an “ice-pick lobotomy”) involved the physician inserting a device through the eye socket, subsequently puncturing the prefrontal cortex. It wasn’t long before Freeman was practicing his ice-pick lobotomy all across America.

Despite the fact that neither Moniz’s nor Freeman’s techniques were supported by empirical evidence, lobotomies were soon practiced all over the world, especially in large mental institutions with difficult patients. Patients that had the surgery often lost all ability to care for themselves, a fate dramatized in many popularized films and books, like *One Flew Over the Cuckoo’s Nest*. It is believed that Freeman performed over 50,000 prefrontal lobotomies throughout his career, and it was not until many years later that experts began noting the multitude of problems (medical, ethical and otherwise) associated with the surgery.

Contemporary Surgery Techniques

Contemporary surgeries are infinitely more advanced than Freeman’s prefrontal lobotomies. However, there is still a stigma associated even with these advanced methods of psychosurgery, especially because the details of the brain circuitry are only partly understood. One FDA-approved surgery is gamma-knife surgery, for the treatment of severe, debilitating OCD (obsessive-compulsive disorder) (Carey,1). This surgery is the first of its kind to be FDA

approved since the prefrontal lobotomy disaster. However, the gamma knife surgery works much the same way as the leucotomy and the prefrontal lobotomies, by severing the connections in the brain that are believed to cause maladaptive behavior (www.mayoclinic.org). Unlike the psychosurgeries of the twentieth century, however, today's surgeries use precise and advanced imaging technology to pinpoint exactly where these troublesome pathways lie.

In addition to gamma-knife surgery, there are many treatment plans that “are holding considerable promise” in psychiatric cases (Fishbach, 349). One surgery, electroconvulsive therapy (ECT) is much like the lobotomy in that it too has a tainted past; many individuals associate the procedure with manic doctors in mental institutions using the seizure-inducing technique as a severe punishment for patients. This is a major hurdle for ECT, a procedure which, in reality, is effective for disorders like severe depression and chronic medication resistance (Fishbach, 349). ECT uses a high frequency stimulator to cause a medically-induced seizure in patients; it seems that the synchronous firing of neurons during the seizure mitigates some of the worst symptoms of depression and makes the brain more receptive to other forms of treatment (like medications) (Fishbach, 350).

The other popular technique – which has gained rapid recognition in recent years – is deep brain stimulation, or DBS. More invasive than ECT, the deep brain stimulation requires actual neurosurgery; a physician implants an electrode to stimulate the subcortical areas of the brain in an effort to compensate for the degeneration or dysfunction of the neurons in those areas (Fishbach, 352). DBS has been widely applied in the treatment of movement disorders, like Parkinson's Disease, but has had limited success in treating psychiatric disorders (most notably OCD and similar conditions). Like the seizures in ECT though, DBS comes with many risks,

including surgical complications and other serious side effects related to resulting problems of neural connectivity.

The Balance of Beneficence and Nonmalficence

Despite these seemingly promising surgeries, it is important to note though that even with the brain scans, advanced medical tools, and the detailed research, “some psychiatrists and ethicists say surgeons still do not know much about the circuits they are tampering with, and the results are often unpredictable” (Carey, 3). What does this mean for individuals that are considering this surgery as a valid treatment method? Does it put them at a potential risk – one that exceeds the possible benefit that a surgery could provide? The discussions surrounding psychosurgery as a popular treatment option are incomplete without a serious consideration of the delicate balance between risk and gain – two concepts that are ensconced in the bioethical principles of beneficence and nonmalficence.

For many health care professionals, “the terms ‘lobotomy’ and ‘psychosurgery’ bring to mind the era before institutional review boards, controlled clinical trials, and codified medical ethics” (Johnson, 369). The procedures are often highly experimental – even if they are government approved. This is a continuous theme in neuroscience; while researchers and scientists have undoubtedly come incredibly far in their understanding of the brain, there are details, like certain pathways that they still don’t understand. Many believe that the movement towards psychosurgery was actually one of the main catalysts for neuroethics, and that neuroethics was deemed important because “it was seen as necessary to have individuals that are trained in the integration of brain science and ethics in order to protect the health and wellbeing of individuals” (Fischbach, 343). This protection is necessary because while it is true that some

surgeries are successful, it is also the case that even non-invasive procedures like ECT can cause lasting damage. The manipulation of the brain hangs in a delicate balance, caught between providing care to afflicted individuals and a hesitation to pursue treatments that haven't been fully explored.

Neuroethicists are especially concerned about the patients that are undergoing these psychosurgeries – individuals that are already considered to be a part of a vulnerable population (Fischbach, 344). In his *Times* article, Carey follows the story of a man that underwent gamma knife surgery in an attempt to ease his OCD symptoms, which caused agoraphobia and a fear of showers. The man hadn't left his house or bathed in years. Already disadvantaged, the surgery did him no favors. Even though there were no surgical complications, the man reported that following the surgery his symptoms were worse, confounded by his hope of being cured and then the resulting disappointment. This is an important risk to consider, one that is just as crucial as the potential surgical complications and mishaps. Patient expectations are often high, filled with trust in the medical professionals and a faith in scientific procedures. A crucial role that neuroethicists and other scientists can play in the face of psychosurgery is helping the public to better understand things like ECT, DBS, and gamma knife surgery, so that it is known that while these therapies are revolutionary, “they are hardly ever perfect” (Fischbach, 351).

The Technological Imperative

Psychosurgery provides a perfect example of the so-called “technological imperative,” a theme found in philosophical texts and discussions. The technological imperative poses a question about ability and obligation – just because we can do something, does that mean we should? In terms of therapeutic surgeries, science undoubtedly holds the tools required to

perform complex, intricate procedures. The knowledge base of the brain has expanded rapidly, and there are review boards and ethical standards to follow. But despite all of these reassurances, does the risk prove greater than the potential reward? Could these surgeries be considered too risky to perform on individuals? Many people believe that the entire drive of scientific advancement is to be able to accomplish new feats. Physicians especially are prone to ask the question “if something [a technique or therapy] is promising, then how can we not rush to relieve suffering” (Carey, 1)? Using human subjects in clinical trials is often justified with this attitude in mind. How will progress ever be made if the envelope isn’t pushed in experimentation?

The fundamental caveat always lies in beneficence and nonmalficence. It is interesting to consider progress, especially as it relates to the American ideologies of success, ambition, and pride. From a narrow perspective, it would appear that psychosurgery is a valid option for those individuals who have tried every other form of treatment. There have been significant advancements in clinical medicine and science that make these psychosurgeries revolutionary. It would so too appear that the surgeries do in fact help some individuals – science is far past the time of Walter Freeman and his cavalier icepick. Still, the most prominent support and push for psychosurgery comes from a desire to succeed. Physicians want to gain recognition and respect, companies may fund clinical trials for potential profit gain, and patients often dismiss any safety risks in their blind hope for a cure (Fischbach, 360). In this age of progress, beneficence and doing what is best for patients often means doing everything that is available – including interventions with risk.

So at what point does “doing good” become doing wrong? This debate is often posed during end-of-life care situations. Many healthcare professionals feel compelled to go to drastic measures (resuscitation, feeding tubes) in order to keep their patient alive. But what comes of the

patient's quality of life? By prolonging life, some argue that extensive life-saving interventions are harming the patient more than if they were just able to die naturally. This same distinction can be seen in psychosurgery. Of course, if the surgery is successful the risk seems less important than the reward – but what if the patient isn't cured or he suffers serious side effects? The question then becomes one of protecting a potentially vulnerable individual and finding other methods to ease their symptoms. One physician interviewed by Carey for the *Times* article said it best: “many promising medical breakthroughs have actually proven to do more harm than good, so future directions must always be pursued cautiously” (Carey, 1).

Ultimately, it is not the task of neuroethics to deem psychosurgeries as an acceptable method of therapy, as these surgeries are already ubiquitous in clinical trials and are practiced in select hospitals all over the country. It is important, however, for ethicists and brain scientists to recognize the possible implications that these surgeries can have, with an intense focus on the negative risks involved. It is through discussions rooted in the principles of nonmalficence and beneficence that a bona fide code of practices can be established, serving as a road map for future treatment options and interventions, but at the same time considering the individual and their unique needs. Today, it is psychosurgery that is at the forefront of innovative therapy options, but like everything else, this will change with time and there will be more questions about the efficacy of potentially life saving – or life-ruining – interventions.

Study: Herr, Human Improvement, and the Threat to Humanity?

The fine line between beneficence and nonmalficence and the tentative decisions surrounding care is applicable to the case of Hugh Herr, and by extension, other double amputees. Herr and his colleagues at the MIT Media Lab are breaking boundaries in their

designs of state-of-the-art prostheses. As previously discussed, these prosthetic designs change the way amputees live, work, and play – but at what potential cost? Clearly the benefits are numerous, but a heavy reliance on prosthetic legs to change the way humans adapt to their environments is equivalent to a heavy reliance on technology. Instead of the prosthetics being solely used as a means to end, in order to help amputees maintain a sense of their lives before amputation, prosthetics are now used almost recreationally, as part of a “cool” new technology that enables wearers to completely change their interactions with the world.

In the same way that the potential negative effects of psychosurgery must be considered, the heavy reliance on technology that comes with widespread use of things like prosthetics must be heeded. In the face of progress, it is imperative to question each step to ensure that improvement does not give way to pitfalls. It is truly the case that there is a moment in any treatment, advancement, or procedure in which benefitting humanity turns into harming society, as the potential effects move into more of a “gray area” and the future directions and implications of the project are unknown. Here in lies the importance of neuroethics, as it is a discipline that can make clearer this intangible boundary. Neuroethics as a whole helps to answer the question posed by the technological imperative by encouraging further discussion, philosophical analysis, and practical applications.

Chapter Three – Brain Privacy, Neuroimaging, and Autonomy

Neuroimaging and its Clinical Significance

Today, many people have had the experience of getting their brain scanned, as it has become a routine procedure in doctor's offices across the developed world. It is hard to even imagine a time when insight into the working of the brain came solely from hypotheses and inferences – only to be confirmed via autopsy. Brain imaging is not even a century old and already the world has seen an unprecedented rate of improvement and advancement in these brain-imaging technologies. For example, in the 1920s, the EEG became the first imaging test used in clinical settings. Still used today, an EEG, or an electroencephalogram, measures the electrical activity of the brain by identifying the currents produced by the neurons in a particular location. EEG scans are primarily used for seizure identification and to monitor sleep disturbance patterns. The scans show a chart that closely resembles a heart rate monitor – a far cry from the vivid, colorful images of brains that people are now accustomed to in public interest pieces (www.mayoclinic.org). Following the EEG, computerized tomography, or CT scans, became readily available in the 1960's. CT scans measured the cerebral blood flow in the brain by using radioactivity detectors. In CT scans, the more active areas have an increased blood flow (Farah, 140).

Over the years, as technology has become more advanced and different machines have become available, careful image analysis has proven to be a fundamentally important tool in diagnosis and prognosis. By far the most widely used brain imaging technique of the 21st century is the functional magnetic resonance image – or the fMRI. Similar to a CT scan, the fMRI machines measure the blood flow in the brain, thereby indicating activation and activity.

However, instead of using radioactive detectors, the fMRI uses a magnet, making the procedure noninvasive and safer than previous imaging technologies. As a result, people can have multiple fMRI scans over the course of their treatment or for the duration of a clinical study with little risk of toxicity. While there are some spatial and temporal limitations to the fMRI interface, it is undoubtedly becoming a “key to the inner-workings of the mind,” able to identify distinct areas in the brain as they relate directly to behavioral tendencies and, some might say, personality traits (Farah, 140).

Beyond the Clinical Use of Brain Scans

However, it is this perception of brain scans as tangible maps of the human thought process that creates a neuroethical issue. While brain scans are extremely useful in the clinical setting “when [they are] properly applied and interpreted,” there exists a threat that the visual nature of the images will create misperceptions and cavalier conclusions (Farah, 140). While brain images are definitely useful in identifying malignancies and aberrations, some researchers claim that it is unwise to rely on brain scans for anything other than these physical, clinical representations.

Despite these reservations, the 1980s brought a change in which “the methods were adapted for the basic science goal of understanding how the mind works and how it is implemented in the brain” (Farah, 140). Brain images were no longer only used for the location of abnormalities like tumors or bleeds. On the contrary, some studies began considering the images as maps for human cognition. By again interpreting blood flow as an indicator of activity, scientists moved towards applying this mapped activity as empirical evidence of things like deception, moral reasoning or aggressive behavior.

In the framework of neuroethics, the shift from the purely clinical application of brain imaging towards the more research-oriented utilization is especially crucial to recognize and understand. As brain imaging is used less for the diagnosis of pathologies and the study of memory, language, and attention and is used instead for describing “affective processes like emotion, mood, and motivation,” there must be an understanding of the drastic affect this could have in both the scientific community and the general populace (Farah, 141).

Neuroethics and Brain Scans

However, the truth of the matter is that brain scans are not perfect cognitive maps of an individual’s motivations, desires, and aggressive tendencies, much to the chagrin of some members of the public who hope to one day use brain scans as definitive evidence against criminals, psychopaths, and other dangerous individuals. These people are inclined to believe that the brain images they see in widely circulated publications are infallible, with no room for individual variation or a possibility of inconsistent results. Therefore, it is the charge of both neuroscientists and ethicists to combat these public opinions, working towards a more informed and knowledgeable general populace. Thankfully, as questions and concerns continue to be raised about brain scans, “neuroscientists are increasingly becoming aware about the potential implications of their research at the bench, in medicine, and in the public domain” and are taking steps to further educate the public (Glannon, 147).

In addition to encouraging public discourse and generating awareness, neuroethicists must too consider the fact that imaging technology is rapidly advancing – and while it may be premature to say that these images currently provide infallible evidence and unerring indications of an individual’s personality, there may come a time when it is in fact possible. Therefore, those

directly involved in brain imaging have a “moral obligation to think proactively about the impact that such effects will have on people” (Glannon, 148).

Brain Imaging and Personal Autonomy

As advancements and improvements continue, the biggest fear is that new insight into the working human brain will lead to new power shifts, in which brain scans could be “potentially used in justifying the denial of access to health insurance, employment, and education” (Glannon, 140). These questions focus on personal autonomy, personhood, and privacy.

Consider a hypothetical situation in which a graduate student agrees to participate in a research study, one that measures fear responses to certain stimuli and thus requires multiple fMRI scans over a period of time. On the first day of the experiment, the researchers – much to their surprise – identify a large, tumor-like growth on the student’s fMRI scan. Despite the fact that the student is completely asymptomatic, there appears to be a serious medical issue at hand. As a result of this incidental finding, a number of problems arise. Does the research team have an obligation to tell the student about his tumor? None of the researchers are medical doctors and they don’t have any clinical training – is it still in their jurisdiction, perhaps as just upstanding citizens, to report this potential health concern? Furthermore, does the graduate student even want to know about the tumor? It seems obvious that the answer would be yes, but it could potentially be the case that the student is hesitant to be aware of any medical condition he might have, understanding that it could impact his perceived quality of life and day-to-day disposition. Additionally, if the tumor is disclosed to the graduate student, does he now have an obligation to report the incidental finding to insurance companies? To potential employers? Should he start considering what the tumor could be doing to his cognition and make adjustments to his

academics? Undoubtedly, the possibility of incidental findings comes with a multitude of risks, threats that have potential personal, public health and safety consequences.

Looking at the first concern of telling the graduate student about the incidental finding, it appears that patient autonomy could be at a distinct risk of being violated. Autonomy encompasses a number of principles, all focusing on the rights of the individual as both a patient and as an informed decision-maker in their medical processes. Autonomy can be violated, however, whenever a patient's rights are undermined, disregarded, or assumed. The existence of the incidental finding now puts the student in a position in which he is no longer the sole informant of his private health information. Many individuals are concerned about this potential dynamic, worried that their medical records will lose their anonymity as brain scans become more advanced - and more personalized.

In a discussion of the student's autonomy, his reaction to the information must be considered. What if the student is so distraught by his new medical diagnosis (but cannot afford the surgery to remove the tumor) and it completely affects his quality of life? Before learning about the tumor, assume the student was a smart, ambitious, and energetic individual. Now, the student has spiraled into a deep depression, always worried about the tumor and when it will begin to shut down his brain completely. He drops out of school, breaks up with his significant other, and eventually has a completely unrecognizable life from the one he previously lived.

While the situation described above, of course, could perhaps be elaborated, it is important to recognize that it is not so seemingly far-fetched. Do the images revealed by brain scans represent "welcomed information or new burdens" (Glannon, 150)? This question is especially relevant in situations where pathology is discovered, but there is no known cure for the disease – like Alzheimer's, schizophrenia, or Parkinson's. Is it better for the afflicted

individual to know that they have a propensity for developing the disease, despite the fact that no medical intervention cure will be available to them? Conversely, is it more moral to allow individuals to come across their medical situations by their own volition and autonomously, without the accompaniment of incidental findings and research teams?

Furthermore, consider the third parties, like guardians, insurance agencies, employers, and educators that could be potentially involved in this situation. If the student in the above example is made aware of the tumor, what obligation does he have to let other individuals know? This extends far beyond questions of family members and close friends to include conversations with insurance agencies, employers, or educators. Before the Affordable Care Act, insurance providers could refuse coverage of the unfortunate student, knowing that he had a malignant tumor that would likely cost them hundreds of thousands of dollars in treatment. But if not for the study, the student would have never known about the tumor until much later on (presumably when he began showing symptoms), so he wouldn't have had anything to disclose to the insurance agency. Again, this is an example in which brain imaging has produced a situation that problematizes personal autonomy in that it creates a predetermined outcome. Knowledge of pathology, even when asymptomatic, may change the way an individual participates in his daily life.

Privacy and Discrimination

Further examinations of the “implications for third parties and neuroimages as potentially sensitive predictors of disease” have raised specific concerns about educators and employers. One day, brain scans may be used as a sophisticated tool of discrimination. It is feared that, like the insurance companies, educators and employers could use brain scans to determine an

individual's propensity for the task at hand, to see if they have aggressive or deceptive tendencies, or to see if they are at risk for early onset Alzheimer's and therefore will need to retire much earlier than their supposedly healthy colleagues. Will access to this knowledge allow employers and educators to become social arbiters, regulating who is able to hold down a job or advance in their education? Consider a time in which brain scans might be used in early childhood education classrooms. It seems like science fiction, but what if brain scans became so precise that they were able to predict what students would be successful in school based on the size of adopted "intelligence centers" in the brain – areas for memory, critical thinking, motivation? Would students that have smaller or less developed areas be demoted to separate classrooms all based on a picture of their brain?

These fears are based on the belief that advancements in imaging technology will continue and that brain scans won't be considered private information. Genetic details, once considered very personal and inaccessible, are now often used in various academic research studies as well as by the government to keep specific records of individuals. The fundamental problem with brain scans is not that they could reveal genetic information, but rather that they might disclose a very different kind of personal data – an individual's thoughts, feelings, and potential prejudices. Again founded in the shift towards using brain scans as a measure of human emotive capacity, "disclosure of information about the brain may violate the privacy of individual thought, which is the core of personality identity and the self" (Glannon, 95). This alone problematizes autonomy.

Many of the most widely discussed fMRI studies are looking at things like social attitudes, human cooperation and competition, the structural differences in violent people, religious experiences, and genetic influences on development – all theoretically discernable from

brain scans and activated brain areas. What does this data mean for individuals, not just those that are involved with the experiments but for all who may come to be affected by the new information? These studies focus on what can be broadly described as discrimination and stigmatization, namely, what is different about the brains of people who are racist? Of homosexuals? Of the extremely religious? Of violent individuals? These recent studies all undoubtedly “touch upon human thought processes that push the envelope of cognitive neuroscience into a domain of significant social concern in which privacy is a vital ingredient” (Farah, 149).

A study done at Yale University looked at the amygdala fear response as it relates to facial recognition (Levy, 10). The amygdala, part of the brain’s primitive center, is often associated with instinctual fear and intense reactions. As a result of evolution, particularly of the prefrontal cortex, humans can monitor these fear reactions; even though the amygdala may be activated, no fear response is readily discernible. The Yale study tested this idea. Researchers had participants look at pictures of faces and then measured the subsequent amygdala activity. The researchers found that the majority of students had a negative amygdala (fear) reaction when the picture shown was of an African American male. Pictures of white males, white females, and African American females showed little amygdala activation. The amygdala fear activation was greatest in white participants.

Overall, the researchers concluded, “the amygdala and behavioral responses to black versus white faces in white subjects reflect cultural evaluations of social groups modified by social experiences” (Gazzaniga, 105). This in itself is a measure of extremely sensitive information, what the researchers of the study called a precondition to racism (Gazzaniga, 105). With this kind of emotional cataloging, how much privacy do we really have? In other words,

what is being sacrificed at the expense of progress in brain imaging and research? The future might bring technology that is able to identify social biases, discrimination, and stigmatization by a simple pattern of activation in a particular brain area. If this turns out to be the case, personal privacy must be evaluated in light of the trade off between society's right to know one's mental state and the fundamental right to privacy that is espoused in the bioethical principle of autonomy (Gazzaniga, 107).

Undoubtedly, "advanced capabilities for understanding and monitoring human thought and behavior enabled by modern technologies have brought new ethical, social, and legal issues to the forefront" of discussions (Glannon, 140). Brain imaging, once only a tool, now poses a serious threat to the fairness of neuroscience. Hence, it is the charge of all involved to develop a stringent code of ethics and rules of practice that can be applicable in all brain imaging situations. Questions of privacy and patient autonomy are the main concerns, although unsettling information related to discrimination, stigmatization, and unfair practices confounds these primary issues. Today, brain imaging is primarily contained in the world of clinical and academic research, but it could very well extend far beyond these boundaries and become commonplace amongst the general populace. Even before this happens, however, it is crucial to inform the public about the current limitations – and the possible capabilities – of brain imaging and how it can affect our daily lives.

Imaging and Personhood

The questions regarding the power of the computerized brain image to reveal detailed maps of an individual's thoughts and feelings exist only because of several revolutionary advancements in technology over the past decade, like better spatial and temporal resolution and

magnetic-based imaging (www.nih.gov). While privacy is a primary concern related to autonomy, there is also an additional layer to the role that machines and technology may play in autonomous decision-making. Technology undoubtedly has the power to affect what is known as “personhood,” a complicated notion that is often referred to in legal and philosophical circles (Peace and Roy, 1).

Personhood is the idea that human beings are agents that are capable of making their own decisions, decisions that must be both accepted and supported within the boundaries of society. It is often the case that any unethical act is viewed as a direct attack on an individual’s personhood, thereby reducing their personal power and sense of self. A major bioethical argument for personhood is presented by Claire Roy and William Peace in their dismissal of the Ashley Treatment, a medical procedure that was performed on a severely mentally disabled girl resulting in the removal of her sexual organs and the administration of hormone therapy to keep her at a smaller stature (Peace and Roy, 1). Roy and Peace argue that the Ashley Treatment – and other injustices inflicted on individuals with cognitive and physical impairments – reflect the belief that people seen as non-normative (of able body and mind) are less than human (4). Procedures like the Ashley Treatment further sacrifice the autonomous decision-making that is already lacking for these individuals, and by extension, rob them of their right to personhood.

Study: Herr and Personhood

The balance between personhood and technology is an interesting one. Above, I described how medical science could be used to diminish an individual’s personhood through clinical interventions like the Ashley Treatment. However, in the case of Hugh Herr, technology can also be used to restore a sense of autonomy and personhood. With his prosthetic legs, which

over time became more advanced and specialized for his rock-climbing needs, Herr regained a sense of self and was able to continue what he considered to be a “normative” lifestyle.

Eventually, as noted in his Ted Talks and radio interviews, Herr’s prosthetic designs became even **better** than what he refers to as his “original limbs” (TedMed). It wasn’t long before Herr was able to accomplish climbing feats that would have been impossible with his biological legs and feet. With his prosthetics, Herr is able to reach heights of eight feet and can fit his “foot” into niches in the rock that are a width of a quarter. Really, Herr has gone beyond his own boundary of normal and enhanced his personhood, or more directly, the agency he possesses to complete goals and make decisions.

It is this potential improvement that poses a problem for some ethicists, especially those concerned with human enhancement and the obliteration of all traits considered pathological. For now, access to the kinds of technologies that Herr is using is limited to a very small subset of individuals, as is the case with most scientific commercial goods. But consider a time in the future when access is more equitable, and enhancement with technologies like prosthetics or brain chips become the norm. When does society stop that enhancement, even if it means putting an end to superior ability and improvement? This relates to personhood because the case could be made that by continued enhancement, humans start to resemble machines more than people. Do machines have personhood? If the time comes when almost everyone is using technology to fulfill some skill, are we truly human? Is personhood a uniquely human characteristic? As noted in Aldous Huxley’s novel *Brave New World*, when society became dependent on technology, humanity became weak. A reliance on technology creates a disconnect from the many traits that we hold as being “human,” like compassion, empathy, and perseverance, largely because machines make these things easier for us or make it so these things are not necessary in life. It

can be argued that there is no substitute for moral decision-making and personal autonomy – not even machines that make the impossible possible.

As it stands, technologies, both brain imaging tools and brain-machine interfaces, pose a unique threat to science. While the possibilities made available by these advancements are at first glance beneficial, it is prudent to take pause and consider the potential negative consequences of them. Brain imaging technology could soon have a place in social contexts outside of clinical diagnosis, meaning that scans could reveal private thought and personality inclinations, a possibility that some believe is an attack on personal privacy and individual autonomy. In regards to personhood, the integration of machines with the human body for the direct goal of human enhancement poses a threat. At what point can it be said that certain amounts of improvement and enhancement are enough, for fear that humans will begin to more closely resemble robots and machines? The question of personhood, while rooted in concerns for autonomy, is found to have a place in social justice, which is explored further in the next chapter.

Chapter Four – Neuroenhancement and Social Justice

Neuroenhancement – Possibilities and Perils

Neuroenhancement is similar to plastic surgery and prosthetics in that it serves to augment a person's biological foundation. Neuroenhancement uses pharmaceuticals, specifically memory-enhancing drugs called nootropes, to improve memory and attention. Cognitive enhancement, of course, can have many different forms – millions of people drink coffee or practice meditation to enhance their mental functioning – but people can also take drugs and supplements to achieve their desired cognitive effects: more efficient computing skills, a more astute memory, and better recall ability. So while cognitive enhancement is often framed as harmless self-improvement, it is much more than that. It is a phenomenon made possible not by personal striving but only by the advancements in neuroscience and pharmacology that allow certain individuals to obtain an “edge” over others.

At its core, enhancement “refers to interventions that make normal, healthy brains better,” which is a direct opposition to the traditional definition of using pharmaceuticals to treat only abnormal brains (Farah, 2). Training has always been perceived as an acceptable way to increase one's natural talents – athletes improve their bodies, academics study new material, and recently meditation has been cast as a tool to help improve everyone's brain functioning. Undeniably, “training is one aspect of brain enhancement, and it seems intrinsically acceptable – work hard and your efforts will be rewarded” (Gazzaniga, 71). This concept, however, is violated when pharmaceutical use is introduced; instead of through hard work and perseverance, neuroenhancement by way of drugs or medications reduces superiority in memory and intelligence to an easily accessible side effect. The fear is that when nootropes become widely

marketed and sold, members of society will stop actively trying to improve their minds and will instead rely on synthetic methods of improvement with severe social consequences.

Several respected researchers and academics in the field of psychopharmacology have noted that these “smart drugs” are currently being widely tested in clinical trials, and they will very likely be available to the general population in five years time (Gazzaniaga, 71). These drugs, originally developed for people with memory disorders and to combat the normal aging process, are suitable for healthy individuals too – those that are performing at a normal level, but just want a “brain boost” (Gazzaniaga, 71). Critics of cognitive enhancement feel that these drugs should stop being produced because of this widespread applicability; while the drugs are helpful to those suffering from cognitive decline, like Alzheimer’s disease, they have the potential to be “misused” by otherwise healthy individuals.

Cognitive Enhancement and Social Justice Concerns

The real threat of cognitive enhancement however lies not with the ramifications of the potential abuse of prescription medications, but rather with the distribution and allocation of goods. At its core, arguments against cognitive enhancement are built on the foundation of the bioethical principle distributive justice. Critics are concerned that with the advent of so-called “smart pills,” the wealthy and the well connected will have unlimited access to the drugs – leaving the poor to “scrape by” with their non-enhanced intelligence. The fear is that this unequal allocation could lead to a further widening of the gap between the rich and the poor, creating yet another social barrier for disadvantaged populations to overcome.

As it is, the wealthier members of society are already often perceived as more intelligent. This phenomenon is, of course, a social construct, with no empirical evidence to support it.

However, it is likely that this perception exists because the wealthy “are already better off than average, and their advantages extend to their minds” (Levy, 92). While of course there is no correlation between income level and intelligence quotient, the rich are often “better placed to develop their intelligence to the full,” owed to the advantages of better school districts, access to private tutors, a potentially more stable home environment, more opportunities, and better nutrition and lifestyles (Levy, 92). It is a fact that those who can afford “extra” societal services are at an advantage, just by the sheer opportunities that these services provide.

Neuroenhancing pharmaceuticals are currently only available through clinical trials, but it is likely that members of the general public will soon have access to them. Like many goods and services – particularly those associated with health care – it can be expected that “neurocognitive enhancement will not be fairly distributed” (Farah, 36).

Academics predict that in terms of access, the wealthy will undeniably have a greater ability to obtain the neuroenhancing drugs. This will be especially true if the drugs are not covered by insurance and are only available through privatized purchasing, thereby restricting the availability of the drugs to a very narrow socioeconomic class. If neuroenhancement becomes widely accepted in society and comes to be seen as a “treatment” for the normal, everyday lapses in memory, insurance companies could begin to cover the drugs under certain healthcare plans. In this case, cognitive enhancing drugs would no longer be available only to the wealthiest individuals, but to people who have comprehensive insurance plans through their employers or through the government. In considering the poorest individuals in society though, it is unlikely that they would have a healthcare policy – if they have one at all - that would include the purchase of these kinds of drugs, thereby ensuring that cognitive enhancement has the potential

to turn into an issue of justice and equity as certain socioeconomic groups and demographics find themselves unable to pay for the cost of enhancements.

Potential Effects of an Uneven Distribution of Resources

Looking into the future, consider an environment in which fifty percent of the individuals have access to cognitive enhancement drugs and the other fifty percent do not have access or chooses not to use the pills. The privileged fifty percent are able to retain more information, stay focused for longer periods of time, and are more efficient throughout the work or school day. Those who don't take the medications are still considered "good" workers and students, but they always seem to fall short in their studies or jobs compared to their enhanced colleagues. As a result, it is often those who don't use neuroenhancing drugs that get fired from their positions or who fall behind in school. In evaluating the social consequences of cognitive enhancement, dissenters are concerned that "with the advance of widespread neurocognitive enhancement, employers and educators will face new challenges in the management and evaluation of people who might be enhanced or unenhanced," with the unenhanced consistently falling short of society's efficient-minded work ethic (Farah, 34).

If the individuals that are unenhanced are disproportionately from a lower socioeconomic class, as they probably would be due to access problems, cognitive enhancement could become another social barrier for disadvantaged groups. This could further limit these disadvantaged individuals in the domains of education, employment, and social standing, creating a wider disparate gap between the rich and the poor and the opportunities available to them (Farah, 36). The introduction of neuroenhancing pharmaceuticals as an acceptable means of drug use would be a catalytic event towards a less equitable, limited-access society.

A Distinction Between Treatment and Enhancement

The use of drugs by otherwise healthy people is often considered wrong and morally reprehensible - using drugs for enhancement has long been perceived as cheating. This debate is the central issue of cognitive enhancement, and certainly has extensions into social justice concerns and access problems. However, in order to fully explore the question of access and social justice consequences as it relates to the distribution of neuroenhancing pharmaceuticals, there must be a more definitive distinction between enhancement (going above the norm) and treatment (meeting and maintaining the norm).

The difference between the two is subtle, and it is often hard to discern. To better highlight the distinction, consider the following case studies in which amphetamines are prescribed to two different individuals. Despite the fact that the medications are the same, one patient's position is considered to be exponentially more acceptable than the other's. The difference lies in the fundamental reasoning for the prescription. In the first case, the patient is seeking an amphetamine prescription because it not only improves her productivity, but treats a disease that she has. Patient One, Jane, suffers from multiple sclerosis, a progressive neurodegenerative disease that affects the conduction of neural signals. Jane was diagnosed at the age of 20, and has been treated quite successfully. However, as is often the nature of multiple sclerosis, relapsing is common. Hence, Jane is interested in exploring a treatment plan that addresses more of her symptoms. Part of her desire for a more all-encompassing medication is that while her day-to-day life is going "really well," the patient is studying for a difficult qualifying exam in medical school. The stress of the exam is causing more fatigue than usual, so her physician (who has treated her since making the diagnosis of MS) suggests a drug that not only ameliorates the nerve issues associated with MS but also combats fatigue and sharpens

attentiveness. The physician feels that due to her high-stress academic schedule and her MS diagnosis, it is morally and ethically acceptable to give Jane a drug that addresses attention and memory. The medication is prescribed (Neuroethics, Columbia University).

Conversely, Patient Two, John, is not ill, but simply is seeking amphetamines as a means to an end, a way to get ahead in his job in order to secure a higher-ranking position (Neuroethics, Columbia University). John is not the prescribing physician's own patient, but is the son of a long-time close friend. John has recently been employed at a prestigious law firm, where he has been given the opportunity to travel to Japan to act as the lead attorney on an important case. The only problem is, John must speak Japanese nearly fluently – and he only has a few months to prepare. John's parents, the friends of the doctor, ask the physician to see him, mentioning that John suffered from ADHD in elementary school and was given amphetamines to help him concentrate in the past. John is hoping for another amphetamine prescription to help facilitate the acquisition and recall of the Japanese language, intending to use the drugs while he studies Japanese in preparation for his business trip (Neuroethics, Columbia University).

Most individuals presented with these case studies (usually medical students learning about ethics in the health professions) are uncomfortable with John's situation. Not only does the physician that would prescribe the medication not regularly see John, but John seems to be seeking a prescription for his own personal gain rather than for a health concern. On the other hand, Jane's situation is seen as being much more morally acceptable. Like John, Jane's primary motivation for pursuing a different medication is to assist her with studying for her qualifying exam (a personal gain), but the prescription will also be used in order to treat the symptoms of her disease (multiple sclerosis) – with the *added* bonus of memory and concentration improvements.

These two case studies highlight the distinction between treatment and enhancement, and the differences of social acceptability between the two. Treatment, which is the case for Jane, has long been taken as an acceptable healthcare measure. Enhancement, which is what John is seeking, is often perceived as cheating. Using technology or medication to go above and beyond a normal baseline (enhancing) is believed to provide an unfair advantage, whereas using drugs to reach a baseline (treatment) somehow “levels the playing field.” It is a widely held belief that “interventions to treat diseases and impairments are regarded as significantly more permissible than interventions aimed at enhancing normal capacities” (Levy, 88).

Study: Herr, Lifestyle Ailments, and Slippery Slopes

In today’s world, however, where people continue to seek medical treatment for a variety of ailments, the definition of illness becomes a slippery slope and treatment versus enhancement becomes even more difficult to define. Do we continue to define illness traditionally, or do we begin changing “natural expressions of human behavior into a ‘disease’ that requires or would benefit from drug treatment,” thereby allowing individuals with unfulfilled desires to have access to prescription medications (Farah, 21)? Society has come to a point in which there is practically a “cure” for everything, and where “everything” has come to be a medical issue. Our world has been medicalized, conditioned to believe that there is a very small definition of “normal,” and that anything that falls outside of the stringent parameters is abnormal and therefore must be fixed. The problem lies in the fact that modern healthcare caters to these beliefs, and pills and surgeries are readily offered to provide relief – especially in the Western World.

At present, enhancement concerns and “lifestyle ailments” have begun to warrant aggressive medical attention. It is now considered normal for people to undergo extensive

surgeries because they don't like the way they look. Plastic surgery, once a medical specialty that focused on reparations from catastrophes like burns and congenital disfigurements, is now a multibillion-dollar industry, a medical service that even has its own reality show (like Fox's *The Swan*, which completely transform participants through extensive cosmetic surgery and procedures.) Similarly, people often seek out expensive medical treatment to "cure" balding, poor eyesight, and other superficial "ailments" that do not conform to society's definition of normality.

Looking again at Herr's use of prosthetics, treatment versus augmentation plays a key role. Herr pursued the development of more advanced prosthetics because he wanted to be able to participate in activities that he did before the amputation of his biological limbs in a more efficient way, not solely as a treatment. Historically, the fundamental belief however, is that medicine exists to *treat* and not to *enhance*. Is Herr's use of prosthetics to rock climb an immoral use of technology? Herr's first set of prosthetics effectively increased his mobility, thereby treating his disability. It was Herr that set off to develop better prosthetics that enabled him to go above and beyond his previous abilities. Are Herr's actions a gateway for others to begin looking at available technology as a means to make themselves better and faster, even though they are healthy and function perfectly "normally" as they are?

Other Thoughts on Neuroenhancement

As important as the discussion about inequality and the serious problems it causes is, public health experts and ethicists say that unfortunately there is "nothing new about it" (Levy, 127). There has always been – and perhaps always will be – an inequitable distribution of resources, services, and goods amongst individuals in society. Therefore, it is often argued that

cognitive enhancement really doesn't pose an ethical issue on the grounds of social justice, because resource allocation is a built-in societal issue of today – it exists with almost all of the goods that are available to society. Instead, it is believed that the real, true argument against cognitive enhancement is strictly a moral one, a debate that hinges on the acceptability of treatment versus enhancement. If this is the case, it is likely that neuroenhancement will be easily accepted into the general public as a verified means of self-improvement, because society has already made a colossal moral shift towards the acceptance of enhancement instead of treatment.

Conversely, It is often argued that even if cognitive enhancement became readily accessible, many individuals would likely choose to not partake in neuroenhancement. As in sports, many athletes do not exercise the use of anabolic steroids, despite their widespread availability. It is a cogent point to make that even if advanced neuroenhancing drugs become procurable, the widespread perception of enhancement as cheating might prevail. If this turns out to be the case, only a small population would use the drugs and it would always be at the cost of enduring a negative social perception. This argument relies on the belief that humans, in general, are often fundamentally concerned with the moral acceptability of their actions. As our society has long held cheating as a terrible act against fellow community members, it is possible that neuroenhancements would be too far out of the realm of accepted improvement methods and would never gain enough popularity amongst the general population to be cause for true concern – but this is widely regarded as an optimistic belief.

Chapter Five – Society and Neuroethics

The BRAIN Initiative and the Government

Over a decade after the Dana Foundation conference and the first formal introduction of neuroethics, the discipline has undoubtedly become significantly more prominent in both the scientific community and the public eye. As advancements in neuroscience continue to improve, as laypeople develop a further interest in the workings of the mind, and as brain science permeates further into all aspects of society, the pressing need for the discussion and implementation of a codified body of ethics is readily apparent. Reaching beyond the boundaries of science, this fundamental need for ethical guidelines has even been recognized by the American government. In July of 2013, as part of the BRAIN (Brain Research through Advancing Innovative Neurotechnologies) initiative, President Barack Obama requested that the Presidential Commission for the Study of Bioethical Issues “consider the potential implications of the discoveries that we expect will flow from studies of the brain...questions relating to privacy, personal agency, and moral responsibility for one’s actions” (Charge from the President, www.bioethics.gov). The Presidential Commission for the Study of Bioethical Issues, a formal bod made up of leading scholars in medicine, law, philosophy, and engineering was charged with “identifying and promoting policies and practices that ensure scientific research, health care delivery, and technological innovation are conducted in a socially and ethically responsible manner” (www.bioethics.gov).

In response to the President’s request, the Bioethics Commission released *Gray Matters*, a report that identifies a number of subsets in neuroscience research, each with its own ethical underpinnings and societal implications. The concerns addressed by the Bioethics Commission

are practices that many current neuroscience researchers, ethicists, and policy makers find potentially troubling. The work done by the Commission certainly provides an excellent baseline for exploring the present and future concerns of neuroethics. *Gray Matters* is by far the most comprehensive approach relating neuroethics to greater society. The report tackles a difficult issue: neuroscience and philosophy are both very complex disciplines, and very different in their approaches to problem solving. The fundamental issue facing the continued development and improvement of neuroethics is that it combines two totally separate disciplines – a hard, natural science and a theory based subject of the humanities. How then can specialized scholars collaborate effectively so that these two subjects can merge to create a unified system of both applied clinical and ethical standards? *Gray Matters* looks to answer this question, by introducing the theme of “ethics integration,” which is “a process by which scientists and ethicists engage with each other, and often others...like communities, to understand the social and ethical dimensions of their work” (*Gray Matters*, 12).

The Commission sees ethics integration as a gateway for further understanding not only between experts but also amongst the members of larger communities, like the general public. While the first step in ethics integration is developing that dialogue between scientists, clinicians, and ethicists, the second – and perhaps the most crucial – part is fostering an appreciation for the complex relationship between “science and the societal context in which it operates,” and understanding the pivotal role that communities play in shaping scientific discourse (*Gray Matters*, 12).

In his book *Thieves of Virtue*, Tom Koch discusses the importance of ethics integration – even though he doesn’t give it that title. Koch is very concerned with the direction that current bioethical discussions have taken, with a distinct interest in “understanding how moral

philosophers became practical ethicists who are adjudicators of medical practice and planning” (Koch, 14). Ethics’ biggest down fall, Koch says, is that it no longer seeks to generate public debate about pressing issues in healthcare but rather acts as a guideline for “professional ethics,” which “reduces medicine to one more commodity distributed by one more professional” (Koch, 152). Like the minds behind *Gray Matters*, Koch supports a broadening of bioethics – including neuroethics – in which all “bioethical questions must be posed differently and considered through a very different reference system,” one that includes expanded discussion and a more inclusive set of participants (19).

The Importance of Public Awareness and Discussion

It is important to establish a public awareness and encourage conversation because, as several scholars have noted, brain science is applicable in many contexts and has moved away from the traditional sense of clinical use. Part of this is due to the fact that the brain is perceived as the “organ of the soul,” encompassing information that is fundamental to what makes us individuals. While DNA might make up our genetic code, somehow the mechanisms of the brain seem much more personal and intrinsic to our own personal selves. The fondness for and the fascination about the way we think and the science behind it doesn’t just manifest itself in academic circles, either; instead, it is practically a pop culture phenomenon. Countless articles in popular entertainment, news, and health magazines tout flashy headlines with neuroscience studies and advancements. The fluorescent images of brain maps are ubiquitous and there seems to be a proven neurological study – and a way to rewire your brain - for every aspect of life, including addiction, sex, hobbies, aggression, and sleep patterns.

This pervasive interest in brain science is not a bad thing, any academic discipline that proves to be intriguing should be celebrated and revered by everyone, not just those holding advanced degrees. However, the piqued interest could certainly have negative consequences, namely stemming from a lack of understanding, a misplaced faith in the infallibility of science, and a fostering of false hopes. A combination of these misconceptions could potentially create an environment in which brain science facts are misconstrued and misrepresented. Therefore, it is crucial and should be an integral part of good scientific practice for “researchers to consider the potential societal implications of their research, such as how the results of a well-intended study might yield unintended applications” (*Gray Matters*, 14). If neuroethics evolves into a discipline that is devoted to the integration of ethics and neuroscience, the resulting relationship will benefit not just the advancement of applied brain science but will also provide insight into the social consequences of such advances. Ultimately, this integration will adequately demonstrate and predict the effects that micro-level bench science has on macro-level communities.

Gray Matters, through the suggestion of ethics integration, seeks to turn science into a “means for social improvement,” highlighting the “broader obligation [society has] to support scientific research that furthers the public good” (*Gray Matters*, 25). The Presidential Commission holds that the way to do this is through a multifaceted approach that places ethics at the forefront of each subsequent advancement in science. The first step of this is via ethics integration at all levels of education, so that it “becomes natural for scientists to have ongoing engagement with the societal dimensions of their work” (*Gray Matters*, 16). This includes sweeping education reforms that place ethics within the science classroom as early as middle school. The Bioethics Commission acknowledges that while younger students might not fully grasp the broader social implications of scientific advancement, by the time many of these

adolescents are beginning to seriously pursue a science career they will have had extensive exposure to various ethical problems posed by science. It is suggested that in university level classes, ethical discussions can be focused on a student's particular major allowing for deep introspection and exposure to the various issues arising from biology, engineering, and the social sciences.

The educational component suggested by the Commission goes hand-in-hand with their next suggestion, which is to foster the maturation and development of budding citizen-scientists (*Gray Matters*, 17). We are no longer living in a world when science exists in its own bubble, unaffected by society. Conversely, the current political and economic societal climate has consequences for the field of scientific research. Overall, it can be said that having scientists that are aware of their contribution to the public good as well as having citizens that are interested and invested in scientific advancements would be beneficial and conducive to a successful, integrated social environment.

This development at an individual level would be further facilitated by ethics integration through institutional infrastructures. Taking it further than their proposed educational approach, the Commission suggests “engaging conversations with people other than neuroscientists, students and ethicists, including policy makers, community members, institutions, and technical experts” (*Gray Matters*, 22). It is the hope that by including as much of society as possible in the conversations surrounding neuroethics, a more thorough understanding will be realized, enabling future dynamic and innovative conversations to take place. In fact, as Koch notes, “bioethics began with citizens engaged in public debate over healthcare,” and this was an important factor in the success of early bioethical reforms (13). It is only over time that bioethics “became a profession whose members spoke a language generally inaccessible to the average person,

thereby closing off any future input from the public and guaranteeing a focus only on what experts deemed important (Koch, 13).

In their list of suggestions, the Commission makes a special point to consider the past, explaining that “measures can be taken to ensure the likelihood that modern neuroscience will benefit from an awareness of history without being paralyzed by it,” using education, collaboration, and discussion to determine proper protocols (*Gray Matters*, 16). It has been widely noted that the past of neuroscience is rife with failed attempts and questionable morals, and it is important to consider these past setbacks and derive approaches for the future that will avoid the same mistakes. Undoubtedly, past cases in biomedical ethics “can be applied to neuroethics as a guide,” including those related to genomics, questions of human dignity, and other scientific advancements (Farah, 772).

What is the Role of Neuroethics Right Now?

While the past is an important component to preparing for the future, it is crucial to recognize that neuroethics presents a milieu of new challenges as well. Without these new challenges, there would be no need for the further development of the field. Celebrated neuroethics scholar Martha J. Farah proposes a cataloguing of these new challenges, in order to better develop a comprehensive approach towards a more ethically aware society.

Farah’s first suggestion is similar to that proposed by the Presidential Commission, a movement towards genuine “neuroliteracy for the neurocentury” (Farah, 773). Farah emphasizes the importance of enlarging the current sphere of dialogue surrounding scientific advancement and discovery to include people who are not considered experts in the field. Both Farah and the Presidential Commission, however, are relying on the idea that education is the key for

combatting ignorance, an optimism that might be misplaced. Neuroscience has already experienced a considerable amount of “celebrity,” owing mostly to the fact that it is what could be considered a flashy discipline. Members of society are interested in neuroscience because it is exciting and it appears to hold the answer to the everlasting question of what makes humans “tick.” This fascination has been fed and encouraged by popular media, generating a pseudo-understanding of the intricacies behind brain science. It may be premature to declare that all the public needs is more access to scientific literature in order to better understand the ethical problems facing the field, when in fact more exposure might lead to further obsessions and resulting confusion.

It appears that Farah has considered this problem in her next suggestion, which is aplomb to the scientific community regaining control of neuroscience. This is not to say, however, that advancements in neuroscience should be hidden from the public and all neuroethical considerations should be concealed. Instead, the scientific community must cultivate more effective tools to deal with the media’s portrayal of neuroscience. By taking ownership and control of their own scientific findings and by acting as the primary catalyst for the dissemination of information, researchers could hopefully shape the public discourse surrounding the neurosciences (Farah, 774). Contrast this environment with the current one, in which the media is a powerful influencer on public opinion – and not always in a positive manner.

It was not that long ago that “neuroethics was strictly discussed in the anticipatory sense,” with debates always focusing on potential problems that *could* arise or that *might* affect large numbers of individuals (Farah, 771). Now however, as evidenced by the amount of

neuroethics literature available and the widespread involvement of scholars from different fields, neuroethics “is no longer a future endeavor but rather a part of the here and now” (Farah, 771).

It is important to note that without neuroscience, neuroethics wouldn't exist. It seems safe to say, however, that neuroscience has asserted itself as a major player in the arms race of scientific advancement. Those that were referring to the 21st century as the age of neuroscience were certainly not mistaken. As a result of this prominence – and based on expectations that the field will continue to grow - the world has “reached a point where simply avoiding or discouraging the application of neuroscience in non-medical [clinical] problems would be neither feasible nor wise” (Farah, 771). Instead, it is clear that the applied uses of neuroscience (uses that are not rooted in clinical motivations or to serve a medical purpose in the traditional sense) must be embraced, and the new advancements must be seamlessly woven into our society. This is where neuroethics has come into play, and where it will continue to be a crucial component in discussions of scientific advancements of the future.

Whichever approach is favored, it is clear that neuroscience will continue to pervade society, and looking towards the future it is likely that further advancements will trigger more ethical issues. Neuroscience, like any thriving discipline, is not stagnant and many problems that arise will reflect the most current and pressing issues of the time. Thus far, the field of neuroethics has accomplished many goals, creating an ethical framework for the immediate future of neuroscience. The next step for neuroethicists will be to expand their discussions of ethical considerations and recapture the seriousness that neuroscience demands, thereby allowing for the birth of even more dynamic and relevant solutions. Undoubtedly, “ethics is already integrated into science in various ways, but more explicit integration definitely serves to elucidate implicit ethical judgments” (*Gray Matters*, 25).

Chapter Six – What is the Future?

Revisiting The Treatment/Enhancement Debate and the Wider Field of Neuroethics

Hugh Herr's story is an excellent example of the way technology is shaping not only clinical medicine, but also individual lives. With his prosthetics, Herr is able to continue rock climbing and has even become better adapted to change his body to meet the demanding needs of the sport. Herr himself has argued that he has not only returned to normalcy, but also surpassed it. For Herr, "normal" was having the ability to rock climb, hike, and participate in an adventurous lifestyle. After the amputation of his legs, it was unclear whether he would ever be able to put his body through those physical demands again, but the advanced technologies that are available in top-of-the-line prosthetics makes all of that and more possible for Herr.

Herr's story presents an interesting question - has society reached a point in which medicine is no longer solely used for the treatment of pathology (things like traditional diseases, ailments, and disabilities), but rather for the augmentation of normalcy (by making humans better, faster, and stronger)? If this is the case, is it necessarily a bad thing? Does it pose a threat to society in that it creates an environment of a "rat race," where individuals are pressured to use any available technology to improve themselves?

Perhaps evidenced by the issues of cognitive enhancement, the right to privacy and patient autonomy, and questions about the safety and efficacy of certain neurological treatments, the field of neuroscience is growing rapidly and with each advancement is moving closer to an approach that focuses on the enhancement of normalcy rather than the treatment of disease.

Where is the Dependence on Technology Leading Us: A Look at Popular Culture

Undoubtedly, the plans outlined by the BRAIN Initiative, the National Institute of Health, and the government are all excellent vehicles to further integrate neuroscience into society, which is a crucial component in the development of a firm application of neuroethics across both clinical and general communities. In order to fully cement and implement the ideas and suggestions proposed by neuroethicists, a sustained and continued discussion about neuroethics is imperative. One of these discussions must be the relationship between treatment and enhancement, with a focus on the technological imperative – just because we can, does that mean we should? Truthfully, there may not be an exact answer to this question at the present moment. As neuroethics continues to grow and blossom into a more concrete discipline, it is possible that it will serve as a source of answers to the questions about treatment and enhancement.

Herr perhaps represents one of the strongest arguments for the continued integration of technology into society, in order to make humans better, faster, and stronger than they ever have been before. His prosthetics are the epitome of revolutionary neurological technology, integrating brain-machine interface and serving to function as an organic extension of his body, thus allowing him to truly be better than his “normal” self. Advancements in brain imaging further support the idea that the wider use of technology is more beneficial than harmful, as high resolution images make it possible to detect and diagnose brain pathologies much earlier than before.

But what of the cases in which using technology becomes more of a burdened requirement and less of a benefit? Certainly the discussions of new psychosurgeries fall into this category, as some of them prove to do more harm than good. Along the same vein, consider the fictional case of Charlie Gordon, the main character in *Flowers for Algernon*. In the novel,

Charlie is a cognitively impaired young man who is elected for a surgery that will give him above average intelligence. Over a period of time following the surgery, Charlie does become intellectually enhanced and soon becomes an entirely different person. He is fired from his job because his employer no longer feels that Charlie needs his charity, he is able to pursue romantic relationships with women, and, most importantly, Charlie is able to develop insights into his own personality, struggles, and feelings. Many would argue that Charlie develops a stronger sense of agency and makes a movement towards personhood, assuming that prior to having a higher IQ he lacked some fundamental component of humanness. Over the course of the novel, Charlie becomes so intelligent that his knowledge surpasses that of the scientist that developed the procedure that made him smarter. Charlie begins to look at the residual complications of the surgery and discovers that the intelligence-heightening effects are only temporary. Charlie realizes that his intelligence will hit a peak and then gradually decline, leading to an eventual death.

In addition to *Flowers for Algernon*, consider the Borgs from the popular culture reference Star Trek. The Borgs represent a collection of races that have all been assimilated to a certain ideal, focused on a campaign to seek perfection and destroying all that they find inferior. In the Borg history, it is noted that as technology continued to improve (for the case of Star Trek, into the 24th and 25th centuries), a crucial component in Borg assimilation was the replacing of human, organic limbs with prostheses and other nano-technologies. Of course, we aren't living in the 24th century, but already prosthetics are being used as biological limb replacements, complete with the nano-technological component. A fundamental question in this situation is whether or not society will become so focused on "destroying that which is seen as inferior" that individuals will start pursuing prosthetic use at the cost of their otherwise healthy limbs. If this turns out to

be the case, what does that mean for the human race as a whole? Again, there is the problem of a people becoming entirely dependent on technology, and a question of the resulting effect on humanity.

Flowers for Algernon and the Star Trek Borgs are fictionalized – yet very powerful – ways to consider the direction that society is possibly heading. We have reached a point when medical interventions are no longer used solely for emergencies, but rather as a way to bring individuals up to – and have them surpass – what is considered to be a “normal” functioning level for humans. In Charlie Gordon’s case, this meant undergoing a surgery that altered his intelligence, but the same situation is easily imagined for surgeries that make people stronger or faster, give them better memories, or enable them to acquire and master any particular skill easily. This truly presents a question of whether or not technology, and for the discussion of neuroethics, neuroscience, should be used to perpetuate the idea of an above-normal, superhuman race.

The previous chapters have explored the current issues in neuroscience, looking at how the bioethical principles of beneficence, nonmalficence, social justice, and autonomy play a major role in public perceptions and scientific value. The most important charge for the future of neuroethics, however, will be that of answering the question of treating pathology versus augmenting normalcy, because that is where the future intersection of neuroscience and society lies. This goes beyond the applied bioethical principles and instead looks at the very morality of neuroscience as a discipline, and the wide reaching effects it can likely have in the coming years.

The rise of neuroethics has paralleled the advances in neuroscience, and the focus of neuroethicists has thus far been raising awareness about neuroscience in general non-scientific communities and maintaining expectations and producing guidelines for scientists and

researchers to follow. The next focus should be on monitoring wider social change, as it pertains to the use of neuroscience technology to manipulate and alter what has, up until now, been considered fundamentally human.

Reebok, a popular athletic company in the United States, has just released a new advertising campaign that focuses on this very topic; the campaign asks the question “what’s your level of human?” and explores different traits that people feel are imperative to the human condition. Among these things are compassion, empathy, courage, and a sense of humor, but also physical fitness and something called “grit,” the will and drive to improve and better oneself. The rest of the campaign emphasizes the importance of grit and the push for self-improvement, so that an individual, and the human race as a whole, can become the best versions possible.

While this campaign, of course, is fundamentally a means to sell athletic products, it reflects a wider shift that has recently occurred in society. By focusing on self-improvement, the Reebok ad demonstrates that as a society, we have reached a point in which nearly limitless improvement is possible – facilitated by the use of technology. This fact is highlighted in the current advancements in neuroscience – psychosurgery, cognitive enhancement, and brain imaging. What the Reebok ad doesn’t touch on, however, is if self-improvement can ever go too far. Is there a point in which society must say “no more,” and limit the integration of technology into people’s daily lives, outside of the traditional medical uses? At the core, this is the question that neuroethics must answer, maybe not right away, but certainly over the next ten years. Neuroethics is perhaps the key to defining the outer bounds of humanness, a limit that will either grow exponentially or will need to be aggressively restricted.

Concluding Thoughts and Questions

Hugh Herr has been extensively examined throughout this Capstone as an exemplary demonstration of the role that technology can have in not only treating disease, but also in enhancing the biological functions that are often considered normal. This question of the permissibility of human enhancement is related to neuroethics in that over the coming years, neuroethics will likely be the strongest regulatory force on human enhancement due to the fact that several advancements in technology focus on the maximization of the human brain.

Herr, who up until two months ago had never publically endorsed human augmentation, recently addressed the issue of human enhancement. At a widely-attended conference, Herr participated in a debate in which he publicly stated that he has “glimpsed into a world where, eventually, those with healthy or mildly injured limbs may prefer bionic limbs, where having bionic limbs would be seen as an advantage” (Kratochwill, 1). By using prosthetics and the wider resources available to the field of bionics, Herr imagines a time in which all disability will be eliminated. Herr also stated that after the elimination of disability, the next “ripple effect” would be that of human augmentation (Kratochwill, 1). Herr undoubtedly believes that this will be the end of all human suffering.

It is interesting to take Herr’s views on augmentation into consideration, although his comments have prompted extensive debates within the disability community. It is feared that with Herr’s vision of a disability-free future, there will come an aggressive elimination of an entire group of people, a threat that echoes past concerns of sterilization and other horrors forced onto individuals with disability in the past.

While prosthetics may not have a direct link to neuroscience, there are certainly several other corollaries that relate to the treatment/enhancement debate that are present in neuroethics, like concerns of social justice and resource allocation, acting in a patient's best interest, and respecting individual autonomy. If anything, the prediction posed by Herr demonstrates that with technology comes the question of a rat race – when will the reliance on technology become too much, and will it have changed society too much by the time it has?

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