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Cultivating Better Brains: Transhumanism and its Critics on the Ethics of Enhancement Via Brain-computer Interfacing

Matthew Devlin

The University of Western Ontario

Supervisor

Dr. Tim Blackmore

The University of Western Ontario

Graduate Program in Media Studies

A thesis submitted in partial fulfillment of the requirements for the degree in Master of Arts

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CULTIVATING BETTER BRAINS: TRANSHUMANISM AND ITS CRITICS ON THE
ETHICS OF COGNITIVE ENHANCEMENT VIA BRAIN-COMPUTER INTERFACING

(Thesis format: Monograph)

by

Matthew Devlin

Graduate Program in Media Studies

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts

The School of Graduate and Postdoctoral Studies
The University of Western Ontario
London, Ontario, Canada

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Abstract

Transhumanists contend that enhancing the human brain—a subfield of human enhancement called cognitive enhancement—is both a crucial and desirable pursuit, supporting the cultivation of a better world. The discussion thus far has almost entirely focused on cognitive enhancement through genetic engineering and pharmaceuticals, both of which fall within the realm of medicine and are thus subject to restrictive policies for both ethical development and distribution. This thesis argues that cognitive enhancement through brain-computer interfacing (BCI), despite being considered like any other form of cognitive enhancement, is developing outside of medical ethics, and is on track to avoid myriad legal and ethical regulations that other cognitive enhancements will ultimately face. Transhumanists and their opponents ignore the unique ethical dilemmas BCIs present, and are too enthralled in conceptual theories of the future to take notice of the ways BCIs are developing today, and fail to engage with any practical ethical deliberation.

Keywords

Transhumanism, Bioconservativism, Ethics, Human Enhancement, Technology, Brain-Computer Interfacing, Cognitive Enhancement

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Introduction

I entered into the whole idea of human enhancement about a year ago when I started watching Channel 4's critically acclaimed series *Black Mirror*. One particular episode of the show, called *The Entire History of You*, envisioned a near future where humans implanted tiny computers inside themselves and recorded everything they saw. People could replay video footage of their life at any time; share the video footage with others; relive in perfect detail any moment of their life. It got me thinking, "What if people actually started putting computers into their brains? What if this becomes a reality?" It seemed like complete science fiction at the time, but as I started looking into it, I found out it had already started. I became enthralled with the idea of enhancing human capabilities.

It would be nearly impossible to research human enhancement without stumbling into transhumanism, which is where I originally started this thesis. The idea that humans could use technology to become stronger, smarter, and live longer is very attractive—seductive even. If even 6 months ago someone asked me if I considered myself a transhumanist, I would have enthusiastically said "yes." Despite the way many people rolled their eyes at transhumanism, I took it quite seriously. Transhumanist arguments were a breath of fresh air to me, since I had spent some five years at that point in academia, always looking at all the *problems* of things. School had taught me any cultural product, technology, ideology, should be treated with caution, and the best way to get a good mark was to pick apart all of the downsides and negative aspects. I was relieved to find a group of scholars who fervently *supported* technology, and seemed to have sensible arguments and evidence to back up their beliefs. However, as time passed, I couldn't help but see the cracks in their arguments.

In this thesis I survey as much of the debate over enhancing human beings as possible, particularly focusing on what is generally referred to as cognitive enhancement: using artificial means to amplify, supplement, or otherwise augment the way human brains access and interpret information; communicate with other living beings or technologies; and utilize critical and analytical skills. Transhumanists argue that

cognitive enhancement has the potential to revolutionize human thought, and it is a noble pursuit—if humans have greater cognitive capacities, they have greater potential to innovate new technologies and ideas that can increase quality of life for the entirety of the human race. Bioconservatives disagree, as they believe those who enhance themselves are just as likely to use these technologies selfishly, which could worsen social, environmental, political, and economic matters. From their view, it is better to err on the side of caution and avoid human enhancement as much as possible. Other groups, many of which simply do not identify as openly with one ideology or another, chime into the debate. As I will show, what unifies most of these groups is that most arguments have considerable ethical implications, which largely go undiscussed.

I use several key terms consistently throughout this thesis. The term enhancement is used to broadly categorize any and all technologies that allow humans to extend their natural capacities.¹ Cognitive enhancement is then any technology that specifically relates to pushing the capacities of the human brain, and much like the word enhancement, it is a very broad term, but will generally refer to three primary technologies: genetic engineering, pharmaceuticals, and brain-computer interfaces (BCIs). I specifically deal with BCIs as a means of cognitive enhancement, and this term is used to refer to a number of both existing and theoretical devices. This includes devices that are implanted inside the brain, as well as external ones, but they share one common function: they allow the human brain to interact with and control external devices and systems solely through brain activity. These are described in greater detail in Chapter Two. Transhumanism is, as indicated by the title of this thesis, central to my arguments, and the most basic definition is that through the development and use of emerging technologies,² human minds and bodies can be deliberately augmented to improve quality of life in a number of ways. Transhumanism often is discussed in conjunction with ‘posthumanism,’ a far more contested word. Posthumanism refers to two different schools of thought, the first being that transhumanism will lead to a posthuman species,

¹ Even defining what constitutes a ‘natural’ capacity is an immense discussion, which both chapter one and three will at times wrestle with.

² Which includes but is not limited to genetic engineering, BCIs, life extension technologies, nanotechnologies, a variety of biotechnologies, and artificially intelligent machines.

which is distinctly different from humans as they exist today. It is unclear what a posthuman may look like, or how a posthuman may act, but it *is* clear that they will definitively be different. The second definition of posthumanism emphasizes an exploration of what might come after humanism. This second definition is far more philosophical, and not a major focus of this thesis. It is however important to note that the transhumanist vision of posthumanism is *not* an abandonment of humanism, but rather and *intensification* of humanism.

Chapter One outlines the current landscape of the debate and what has lead up to it, and will discuss the great complexity of the issue of enhancing human brains, regardless of the type of enhancement technology at issue. Chapter Two narrows the scope down to cognitive enhancement via brain-computer interfacing, an emerging field that allows human brains to control electronic devices directly, without using any other part of the body or requiring outside assistance. This chapter looks at the history of innovations in science and technology that led to current BCIs and how they are being used today. Despite sounding like science fiction, people have been experimenting with controlling various electronic devices and systems through both implanted and non-invasive technologies for some time now, and with great success. The chapter concludes by examining the aspirations of current BCI design, in order to open up to the future of BCI enhancement and the ethical considerations that arise. Chapter Three uncovers the ethical assumptions and arguments that the main groups engaged in debate over cognitive enhancement are making, and reveals the shortcomings in both transhumanist and bioconservative ethics. I will argue that both sides have made a major assumption, that BCI cognitive enhancements warrant the same ethical considerations as any other form of cognitive enhancement, namely genetic engineering and pharmaceutical use. A large portion of BCI development is within the realms of engineering and computer science, not medicine, and thus is excluded from the most serious and influential ethical evaluations. BCI enhancement is not considered either through legal or policy frameworks that might control such technology and avoid numerous detrimental outcomes from its misuse. Cognitive enhancement via BCI demands separate attention in order to receive proper ethical reflection, which is simply not happening anywhere, especially not amongst transhumanists and their opponents.

Despite having considerable reservations about transhumanism, I don't think transhumanism and pro-enhancement ideologies should be treated with knee-jerk hostility, which seems to be how many people react when I even say the word "transhumanism." I think transhumanists have interesting points to make, even if they are a bit too one-sided and overly hopeful. I don't think every author should be responsible for fully encapsulating all sides to a debate in their writing, as that's what debate is all about: people from different standpoints come together to hash out the issues. Transhumanism should not be taken as the definitive voice on cognitive enhancement, but rather as one legitimate side. All opinions and arguments in the entirety of the debate should be considered, which is what I spend much of this thesis doing. Human enhancement—and in particular cognitive enhancement—is a vastly complex issue, and deserves careful consideration. There are a multitude of groups involved in debating cognitive enhancement, from transhumanists and bioconservatives, to medical doctors, scientists, and philosophers. My issue is not that any one side is particularly weak or unfounded, but rather *all* sides are missing a crucial detail: brain-computer interfacing is quite different from other forms of cognitive enhancement, and it is quickly slipping through the cracks, avoiding major ethical evaluation and regulation, which I argue it so desperately needs. Transhumanists and bioconservatives are the loudest groups at debating cognitive enhancement, and so it's important to see how cognitive enhancement is being portrayed, and the types of issues being discussed. By exploring what's happening in the debate over enhancement, and looking to the types of brain-computer interfaces in use and in development, I hope to bring to light some of the glaring ethical problems with lumping brain-computer interfacing with other forms of cognitive enhancement.

1 Transhumanism and Cognitive Enhancement

In the broadest and most straightforward sense, to enhance human beings is to expand their capabilities—to enable them to do what normal human beings have hitherto not been able to. Understood this way, enhancement is ubiquitous in human history.

—Allen Buchanan

I think, ever since Darwin, we haven't had any basis for saying that there's any biological limit on what we could be, should be, or might want to become.

—Arthur Caplan

1.1 History of Transhumanism

The earliest transhumanist aspirations—of deliberately altering the human body and mind in the pursuit of transcending suffering, sickness and death, achieving altered states of consciousness, and even attaining ‘superpowers’—are rooted in ancient literature and religious texts.^{3,4} Even today, the basis of enhancement is a desire to improve upon one’s own life, as well as the lives and conditions of others, can be found in religion, as “every religion on the planet sees the improvement of the self and one’s children as a moral obligation.”⁵ Whether these religions approve of biomedical, genetic and electronic enhancements is an altogether different question, but the foundation of transhumanist thinking is a fundamental human desire to improve. Don Ihde points out that over time, and particularly after the Enlightenment, ‘superpowers’ like fast travel, the ability to change form, levitate or psychic powers, which were all once found in ancient literature, moved from being imagined as super-natural, organic or animal-like towards being based in technology, most notably in the form of speculative science fiction.⁶

³ Don Ihde, “On Which Human Are We Post?,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011). 125

⁴ James Hughes, *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future* (Cambridge, MA: Westview, 2004). 156

⁵ Arthur Caplan quoted in Simon Young, *Designer Evolution: A Transhumanist Manifesto* (Amherst, NY: Prometheus, 2006). 51

⁶ Ihde, “Of Which Human Are We Post?” 125

Humanism, as it still exists today, became cemented during the European Renaissance and the Enlightenment between the sixteenth and eighteenth centuries; a philosophy founded in encouraging “human beings to rely on empirical observations, reason and the scientific method, rather than religious tradition and authority.”⁷ Alongside the increased reliance on science came a revolution in agriculture during the mid-eighteenth century, which allowed large populations to overcome the effects of under-nutrition and to facilitate greater neurological development.⁸ As humans rapidly altered their bodies, minds and ways of living through industrialized farming and mass production of goods, traditional views of human evolution changed as well. In 1859 Darwin published *Origin of Species*, a text that confronted the view that human beings in their current form were a unique, biologically-fixed race by demonstrating that “humanity as it currently exists is one step along an evolutionary path of development.”⁹ The developed world began to understand that human beings had evolved from earlier species in an ongoing evolution.

As science and medicine flourished, the idea of extending human capabilities beyond therapy began to take root. Elizer Metchnikoff, a Russian scientist who received the Nobel Prize for Physiology and Medicine for identifying the function of white blood cells, proposed that removing a significant portion of the large intestine would greatly increase the duration of a person’s life. Metchnikoff proposed that science could not only heal the human body, but it could extend it beyond the natural boundaries of biology,¹⁰ arguably the first scientific suggestion resembling contemporary transhumanism. Unfortunately, Metchnikoff’s proposed intestinal removal was not as successful as hoped, beginning what would be a series of adverse developments in transhumanist thinking and practice.

⁷ Hughes, *Citizen Cyborg*. 157

⁸ Allen E. Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement* (New York: Oxford UP, 2011). 39

⁹ Max More, “The Philosophy of Transhumanism,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 10

¹⁰ Greg Klerkx, “The Transhumanists as Tribe,” in *Better Humans? The Politics of Human Enhancement and Life Extension*, ed. Paul Miller and James Wilsdon (London: Demos, 2006), 60

In the 1923, J.B.S. Haldane first imagined genetic enhancement with the publication of *Daedalus, Science and the Future* in which he saw science deliberately merging with evolutionary biology in order to control the future of humanity.¹¹ In 1927, Julian Huxley—Aldous Huxley’s brother—would be the first to use the term *transhumanism* when he wrote,

The human species can, if it wishes, transcend itself—not just sporadically, an individual here in one way, an individual there in another way, but in its entirety, as humanity. We need a new word for this new belief. Perhaps transhumanism will serve: man remaining man, but transcending himself, by realizing new possibilities of and for his human nature.¹²

Huxley envisioned a world where arts and science would merge to alleviate the ‘crisis of humanity’¹³ but his dream for the future was primarily concerned with biological boundaries and weaknesses within the confines of humanist thinking. His statement of ‘man remaining man’ would later summarize two sides of a debate on posthumanity: does ‘remaining man’ indicate retaining humanist values while biologically changing, or discarding humanism in favor of a variety of other philosophies, or something else entirely? These questions would later emerge in the mid 1970s amongst philosophers.¹⁴

In the 1920’s & 30s, scientists—the most famous of which were the ‘red’ scientists of Cambridge University—began to work on technologies that would allow us to deliberately alter the genetic foundations of human life, and more specifically, to remove undesirable traits in exchange for more beneficial ones¹⁵—a field of science that has infamously become known as eugenics. The academic eugenics movement of the early 1930’s quickly became tarnished by a different eugenics movement lead by the

¹¹ Nick Bostrom, “A History of Transhumanist Thought,” *Journal of Evolution and Technology* 14, no. 1 (April 2005). 5

¹² Huxley qtd. in Hughes, *Citizen Cyborg*. 158

¹³ Hava Tirosh-Samuelson, “Engaging Transhumanism,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 20

¹⁴ see Neil Badmington, ed. *Posthumanism*. Readers in Cultural Criticism. Hampshire: Palgrave, 2000. for a collection of foundational essays.

¹⁵ Tirosh-Samuelson, “Engaging Transhumanism.” 22

Nazi party during WWII, which effectively discredited eugenics.¹⁶ In addition, Julian Huxley's brother Aldous published *Brave New World*, which, coupled with the anti-genetic tampering mentality of the time, became a beacon for discouraging any serious development of human-enhancing technologies, genetic, biological, pharmaceutical or otherwise.¹⁷ This is not to say eugenics were discarded, as examples throughout the 20th century demonstrate State-imposed sterilization and selective breeding; rather, eugenics as a means of improving quality of life by preventing disease and biological weakness was seen by the public as something unnatural, dangerous, and altogether unwanted.

Thus the early incarnations of transhumanism were contained to science fiction until the mid 20th century, when a group of philosophers took up debating the end of humanism, and the possibility of the emergence of a new species—the posthuman. In 1973 Foucault published *The Order Of Things* in which he demonstrates that the very concept of 'Man,' an autonomous, rational being, only first emerged in 16th century Europe, and suggested that 'Man,' may very well be nearing an end.¹⁸ While futurists saw this as meaning the end of our biological constraints, philosophers took this to mean that the humanist philosophy might too be nearing an end.^{19,20} A debate opened concerning *posthumanism*, the concept that human beings could soon be replaced by biologically-enhanced, mechanized or otherwise non-human species, where scholars like Baudrillard and Lyotard discussed the possibility of the end of human life and the emergence of a new philosophy that may replace humanism. These philosophers were predominantly concerned with how thought itself could or should change in order to usher in a new-age philosophy, one that was admittedly difficult to imagine due to the

¹⁶ Ibid.

¹⁷ Francis Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (New York: Farrar, Straus and Giroux, 2002). 6-7 – Fukuyama argues *Brave New World* was a warning as to the likely outcome of tampering with human biology; in contrast, Kurzweil believes *Brave New World* was a warning of how not to approach human enhancement, rather than outright opposing it. Bostrom argues that *Brave New World* is a “tragedy of technology and social engineering being used to deliberately cripple moral and intellectual capacities—the exact opposite of the transhumanist proposal.”

¹⁸ Foucault, “The Order of Things: An Archaeology of the Human Sciences.” 387, cited in Ihde, “Of Which Human Are We Post?” 123

¹⁹ Cary Wolfe, *What Is Posthumanism?* (Minneapolis: University of Minnesota, 2010). xii

²⁰ Ihde, “Of Which Human Are We Post?” 123

fact that they believed posthumans would be intellectually superior to humans and thus more capable of forming such a philosophy. As a result, envisioning the posthuman future, one where our capacities for new thoughts and experiences are far beyond our current capacities, remains highly speculative.²¹

Among these philosophers was Donna Haraway, who in 1985 published *The Cyborg Manifesto*, a document that merged posthumanist thinking with science in order to alter the human body and mind simultaneously, thus creating the subset of posthumanism that would later be called transhumanism. Haraway's manifesto, which particularly looks at gender and sex in an age of mechanized bodies, expanded upon earlier work from Manfred Clynes and Nathan Kline. In 1960, Clynes and Kline proposed that for humans to best survive space travel, rather than altering the environment to suit human life, it might be better to alter the human body to suit the harsh environment of space.²² They imagined a merging of the human body with machine parts, and that the result would be called a cyborg: a cybernetic organism. Cybernetics dates back earlier to John von Neumann and Norbert Wiener, who suggested that technology look to the way the human body maintains equilibrium via negative feedback, and to base technologies upon the human body. Haraway took the concept of the cyborg, which until then had been a theoretical response to a future problem, and placed it within the realm of cultural philosophy. In the following decades, cyborgism would evolve into the contemporary debate on transhumanism, human enhancement technologies, and the blurring of human and machine.

Much of transhumanism is a response to scientific advancements, theories and forecasts from the late 20th century. In 1970, Minsky conceptualized an age where superintelligent machines roamed the earth, founding a subset of computer science geared towards achieving artificial intelligence.²³ In 1972, scientists began experimenting with

²¹ Nick Bostrom, "Why I Want to Be a Posthuman When I Grow Up," in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 32

²² Manfred E. Clynes and Nathan S. Kline, "Cyborgs and Space," in *The Cyborg Handbook*, ed. Chris Hables Gray (New York: Routledge, 1995), 29–34.

²³ More, "The Philosophy of Transhumanism." 11

what would become contemporary genetic engineering.²⁴ At the same time, computer science began to study possible ways the brain might be able to control external devices.²⁵ With the sudden surge of real-life technologies that promised to enhance human capacities came a generation of fictional representations of the cyborg; Steve Austin in the *Six Million Dollar Man* and Jaime Sommers in *Bionic Woman* put a positive outlook on the merging of human and machine, showing the cyborg as maintaining their humanity, morals and personality after enhancement.²⁶ Out of the emerging trends in scientific and technological development came bioethics, a body of ethical discussion concerning altering the human body through artificial means. U.S. President Jimmy Carter legitimized bioethics and the possibility for human enhancement in the late 1970s with the first executive-level bioethics commission, The President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavioral Research.²⁷ The 1970s were a turnaround for human enhancement technologies, legitimizing research and philosophical discussions as to their likelihood and social impacts, while the 1980s would problematize the situation. Due to pressure from anti-abortion lobbyists, Carter's Commission on bioethics was disbanded, and Presidents Reagan and Bush Sr. were unable—or simply refused—to form their own commissions.²⁸

In 1972, F.M. Esfanfiary (later known as FM-2030) began what some see as the second wave of transhumanism²⁹ by suggesting that transforming humans into posthumans by modifying both the body and then mind through artificial means could very well yield a myriad of positive effects.³⁰ In 1989, FM-2030 published *Are You Transhuman?*, a book that suggested that humans as we currently exist are already in a transitional period towards being posthuman, and that like our early hominid ancestors,

²⁴ Ramez Naam, *More Than Human: Embracing the Promise of Biological Enhancement* (New York: Broadway, 2005).13

²⁵ Anders Sandberg, "Cognition Enhancement: Upgrading the Brain," in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud Ter Meulen, and Guy Kahane (Oxford: Blackwell, 2011), 76

²⁶ Hughes, *Citizen Cyborg*. 100

²⁷ *Ibid.*, 61

²⁸ *Ibid.*

²⁹ Klerkx, "The Transhumanists as Tribe." 62

³⁰ More, "The Philosophy of Transhumanism." 4

we are generally unaware of our role in evolution.³¹ In the following year, Max More (who changed his name from O'Connor to More to demonstrate the transhumanist desire for continual improvement)³² founded Extropianism, a libertarian way of approaching human enhancement technologies that focused on individual rights, democracy, free-market consumer-based enhancements and the pursuit of continual improvement for the entirety of the human race. More went on to lead a series of Extropian conventions, called Extro, which heard from the likes of Moravec, Drexler, and Kurzweil, among a range of other philosophers, sociologists and computer scientists. Many of these early technology prophets, including Minsky, Ettinger and Hayles, have been foundational to transhumanist philosophies and practices, particularly in rationally predicting future technologies and their effects.³³ More's extropianism separated from the more general transhumanist movement by incorporating libertarian politics and anarcho-capitalist sentiment into their basic principles,³⁴ and was predominantly comprised of well-educated, wealthy men.³⁵ Transhumanism, as a collective of like-minded individuals rather than any formal organization, began as a much more radical set of beliefs compared to the more cautious attitudes of transhumanists today; this is not to say these individuals have disappeared, or that their views been excluded from the contemporary debate, but that for the most part the majority of those involved in human enhancement are more cautionary and in favor of the identifying the ambiguous nature of these technologies, rather than the strong faith in technological benefits that extropians once had.

After a 12-year absence of Presidentially commissioned bioethics discussion, President Clinton founded the Presidential Bioethics Advisory Commission in 1993, which was comprised of a broad range of academics, scientists, and business and industry leaders.³⁶ Human enhancement had begun to take a permanent foothold in political and

³¹ Hughes, *Citizen Cyborg*. 161

³² *Ibid.*, 165

³³ *Ibid.*, 163-164

³⁴ *Ibid.*, 165

³⁵ *Ibid.*, 72

³⁶ *Ibid.*, 62

cultural discussions. In 1997, Nick Bostrom founded the World Transhumanist Association—later renamed H+—going off many of the founding principles of extropianism. However, Bostrom saw extropianism as too radically libertarian and too readily ignoring the possibilities for enhancement technologies to do harm. In response, Bostrom proposed that to ensure the best use of technology and human enhancement is to examine as carefully as possible both the negatives and positives—as well as the ambiguous attributes in-between—and to enter transhumanism into public debate. Bostrom saw that democracy was crucial to properly using human enhancement, and that governments would need to acknowledge their legitimacy and to regulate their use, without impeding individual rights to one's own body. In 2000, More revised part of the extropian manifesto to be more closely tied to transhumanism, by denouncing radical free-market consumerism and unregulated innovation with regard to enhancement technologies, and instead suggested that some formal order be put in place to ensure equal access to enhancement technologies.³⁷ Despite growing discussion over enhancement, coupled with innovations in science and technology, N. Katherine Hayles wrote *How We Became Posthuman*, where she contends that transhumanism was a passing fad, and that the technologies discussed were nothing more than fantasy. With radical expansions in science, medicine, and computer science, particularly after to the decoding of the human genome in the early 2000's,³⁸ biotechnologies and speculative nanotechnologies not only became more plausible, but at a rate much sooner than early science fiction had speculated. As a result, there was an exponential increase in transhumanist thinking and literature in the 21st century, forcing Hayles to dismiss her earlier criticisms of transhumanism.³⁹

However, at the beginning of the 21st century, the growing body of transhumanists and human enhancement hopefuls faced strong opposition when the Bush administration made considerable staff cuts to the Office of Science and Technology Policy, which was

³⁷ Ibid., 168

³⁸ Klerkx, "The Transhumanists as Tribe." 65

³⁹ Katherine Hayles, "Wrestling With Transhumanism," in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 215

subsequently moved outside of the White House,⁴⁰ and replaced Clinton’s Bioethics Commission with Bush’s own President’s Council on Bioethics. Unlike Clinton’s diverse commission, Bush’s council was largely onesided, comprised entirely of radical conservatives. Bush appointed Leon Kass to head the council, “a political conservative with a twenty-five year history of opposing infertility treatments, cosmetic surgery, organ transplantation, and other technologies that, in his view, violate the natural order of things.”⁴¹ Kass built the committee primarily with known Christian conservative bioethicists, including Mary Ann Glendon and Gilbert Meilander, “and conservatives with little to no connection to academic bioethics, such as Robert George, Francis Fukuyama, James Q. Wilson and Charles Krauthammer,”⁴² whose first line of business was recommending that the use of embryos in stem cell research, as well as cloning, be banned and criminalized. In 2003, the council published *Beyond Therapy*, a foundational document for anti-enhancement advocates, which featured an article on the ‘wisdom of repugnance,’ more commonly referred to as the ‘yuck factor’, which states, “If a practice is scary or repugnant, that is sufficient grounds to ban it.”⁴³ As many transhumanists and those engaged in discussing the enhancement debate have noted, Kass’ ‘yuck factor’ was founded in vague, misleading rhetoric that proposed that federal laws and institutions judge emerging technologies based solely on knee-jerk reactions.⁴⁴ For the better part of the 2000s, Kass’ council was the most influential roadblock for transhumanists. With such strong opposition from the U.S. government, the stage for the current debates concerning enhancement was set.

1.2 Contemporary Transhumanism

Transhumanism as it exists today was first defined in 1990 when Max More wrote, “*Transhumanism* is a class of philosophies that seek to guide us towards a *posthuman*

⁴⁰ Hughes, *Citizen Cyborg*. 211

⁴¹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 3

⁴² Hughes, *Citizen Cyborg*. 63

⁴³ *Ibid.*

⁴⁴ *Ibid.*

condition.”⁴⁵ Transhumanism, however, has dual meanings, in that it can be seen as both transhuman-ism, and trans-humanism, the former being a broad categorization of philosophies and technologies that encompass enhancing human capacities and capabilities beyond their current limits, the latter ‘*transhumanism*’ is on the other hand much more contested. For some, transhumanism is a combining of humanist thinking with technological development in a conscious effort towards a posthuman state; this transhumanism definition relies on a simple humanism definition that “humans should exercise their powers of reason to control and improve their lives.”^{46,47}

However, what the posthuman era encompasses divides into two bodies of thought. On one hand, some philosophers see it as simply an era when enhanced bodies and minds have extended human capabilities to the point that they can no longer be categorized as the same species as those who are unenhanced.⁴⁸ On the other hand, some see the posthuman era as having more to do with discarding the problematic aspects of humanism. Moravec suggested a posthuman future where brains may be uploaded to nonbiological devices, which Hayles criticizes as being characteristically not posthuman, in that Moravec “is not abandoning the autonomous liberal subject but is expanding its prerogative into the realm of the posthuman.”⁴⁹ Wolfe points out that transhumanism is an intensification of humanism, while posthumanism opposes humanism⁵⁰; transhumanism carries forward humanist philosophy, while the vision of a posthuman world abandons it.⁵¹ Wolfe indicates that animal cruelty and inequality among humans

⁴⁵ Ibid., 165

⁴⁶ Ibid., 110

⁴⁷ Harold John Blackham, *Humanism*, 2nd ed. (London: Harvest Press, 1976) 13-20, Humanism states that human beings are to some extent autonomous individuals, that “we have the power to will something and to carry it out, that we are not puppets, not totally subject to influences without and within outside our control which determine what we are and what we do.” Early humanists, particularly those during the Enlightenment, saw that humans all had the capacity to take responsibility for their own actions, and disregarded any belief in fate, or that we are simply products of our environments. Humanism emphasized using reason and the scientific method in the pursuit of knowledge and truth.

⁴⁸ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 120-1

⁴⁹ Hayles, cited in Wolfe, *What Is Posthumanism?* xv

⁵⁰ Wolfe, *What Is Posthumanism?* xv

⁵¹ Pepperell, cited in Tirosh-Samuelson, “Engaging Transhumanism.” 27-8 who sees transhumanism as abandoning man-centered thinking

are in fact products of humanist thinking—that humanism proposes suppressing biological, instinctual and otherwise ‘animalistic’ urges in order to pursue reason, science and knowledge, and in doing so, allows for humans to justify treating other living beings, animal or human, as inferior.⁵² From Wolfe’s perspective, transhumanism only intensifies these justifications by suggesting human minds are capable of transcending their biological bodies, and that doing so would be an improvement on our present condition. It should be noted that Wolfe’s definition of transhumanism is not widely discussed among transhumanists, as his work is geared more towards the late 20th century discussion on posthumanism than it is applicable to the contemporary debate on emerging enhancements.

Early posthumanist philosophers, like Wolfe, Lyotard and Baudrillard, are rarely mentioned in the current enhancement debate. While their work may be foundational, current trends are much more geared towards how actual technologies, both ones that currently exist as well as ones that can reasonably be predicted to occur in the near future, will have an effect on society. Max More even goes as far to dismiss early technology futurists like Moravec, Minsky and Kurzweil as being irrelevant to the concerns of transhumanists today.⁵³ Whether More’s dismissal is representative of the transhumanist community at large is difficult to know, but it would seem that these theorists are often (mistakenly) seen as representative of transhumanism—Kurzweil outright rejects the label as a transhumanist, and transhumanists generally find him to be too technologically deterministic; he is however, often labeled as a transhumanist. Furthermore, while ‘cyborg’ was at one point a buzzword related to the enhancement debate, transhumanists “generally look down on the cyborg concept as primitive and unhelpful,”⁵⁴ suggesting that representations of cyborgs do not encapsulate the way the contemporary debate envisions enhancements—as primarily being ubiquitous, unobtrusive and conceivably impossible to detect.

⁵² Wolfe, *What Is Posthumanism?* – See chapters two and three for more detail

⁵³ Max More, “True Transhumanism: A Reply To Don Ihde,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 136

⁵⁴ More, “True Transhumanism: A Reply To Don Ihde.” 143

Instead, transhumanists see the ‘transhuman’ as being short for ‘transitional human.’ While some see humans as always being involved in evolutionary transition, transhumanists acknowledge that humanity stands for the first time at a point where we can collectively use emerging technologies to deliberately modify our biology, our bodies and our minds, in order to alleviate suffering—both current and future—and to better equip ourselves and our children to address societal and environmental issues.⁵⁵ Transhumanists acknowledge that natural evolution is faulted, in that “the human organism is not a finely balanced whole, because evolution does not create harmonious, ‘complete’ organisms; instead it produces tentative, changing, perishing, cobbled-together *ad hoc* solutions to transient design problems, with blithe disregard for human well-being.”⁵⁶ Consider the appendix: an organ that theoretically once served a purpose in the human body, but has over the course of natural evolution lost its function. However, it remains in the body, susceptible to disease—its only current ‘function’ is as a biological weakness in the human body. Despite those who would argue for intelligent design and leaving the natural path of evolution alone,⁵⁷ transhumanists believe that to embrace artificial modifications to the body is not only crucial to the future of humanity, but that it is even our obligation to pursue it. Transhumanists also believe in ‘morphological freedom,’ “the view that human enhancement technologies should be made widely available and that individuals should have broad discretion over which of these technologies to apply to themselves.”⁵⁸ Transhumanists also place a high degree of value on human ‘well-being’ and happiness as being fundamental to evaluating the value

⁵⁵ Chislenko, Sandberg et al., “The Transhumanist Declaration,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 55-6

⁵⁶ Buchanan, *Beyond Humanity?* 2

⁵⁷ Ihde, “Of Which Human Are We Post?” - Don Ihde addresses Intelligent Design at length, stating that while some believe the human body to be too complex to be a product of nature, and that there must be an intelligent designer, Ihde argues that very same reason demonstrates the opposite: that the vast complexity of the body, along with its evolutionary changes and adaptations to natural and artificial environments, demonstrates that there cannot be a designer, but rather a series of trial-and-error type modifications.

⁵⁸ Nick Bostrom, “In Defense of Posthuman Dignity,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 55

of human enhancements,⁵⁹ suggesting transhumanism believes in empowering autonomous individuals.

Not all of the discussion of human enhancement technologies is labeled ‘transhumanism’—in fact, many academics, scientists and business leaders simply prefer ‘human enhancement technology’ than any label that connotes a philosophical or political leaning. These authors⁶⁰ often look to enhancement technologies in relation to therapeutic technologies, the latter of which encompass any number of medical or electronic technologies that aim at restoring ‘normal levels’ of functionality to humans. Some instead divide ‘enhancement’ into ‘conventional enhancements,’ being methods for improving the human body and mind through education, information technologies, mental techniques, and common drugs like caffeine or nicotine, and ‘unconventional enhancements,’ such as implants, pharmaceuticals, genetic engineering, and brain-computer interfaces.⁶¹ Bostrom writes,

The boundary between these two categories, however, may increasingly blur. For instance, neurological health objectives such as maintaining full cognitive performance into old age, or remedying specific cognitive deficits such as concentration and memory problems, are likely to become increasingly hard to distinguish from enhancement objectives as the range of biomedical interventions expands.⁶²

For Bostrom, among others, the line between therapy and enhancement is slippery, and acknowledge that technologies intended to restore function are at times likely to be used to enhance capacities where no deficit exists.⁶³

⁵⁹ Julian Savulescu, Anders Sandberg, and Guy Kahane, “Well-being and Enhancement,” in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud Ter Meulen, and Guy Kahane (Oxford: Blackwell, 2011), 7

⁶⁰ Including Allen Buchanan, whose extensive work regarding enhancement technologies, philosophies, cultural and societal impacts, and politics, not once makes use of the word ‘transhuman’. Even when discussing prominent transhumanists, their work is taken for its value, not its label as transhumanist. Kurzweil also makes little use of the term when discussing prominent transhumanists.

⁶¹ Nick Bostrom and Rebecca Roache, “Smart Policy: Cognitive Enhancement and the Public Interest,” in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud Ter Meulen, and Guy Kahane (Oxford: Blackwell, 2011), 141

⁶² Ibid.

⁶³ Consider the use of ‘study drugs’ like Adderall among college and university students whose mental capacity for concentration is considered within the normative range.

Transhumanists largely debate at what point humans will be enhanced sufficiently enough to be considered posthumans.⁶⁴ For Buchanan, “Merely enhancing the human immune system, increasing average IQ by twenty points, and extending life by 50 years would not produce posthumans,”⁶⁵ because it is not sufficient a change to call us a new species. Moreover, he argues these changes must happen on a large-scale, in that if only a section of the population were to significantly enhance themselves, it could present a situation of ‘us’ versus ‘them,’ and thus a posthuman era had not emerged. Instead, Buchanan, alongside philosophers like Asher Siedel, imagines the posthuman era beginning in the distant future⁶⁶ in contrast to the transhumanists and futurists that see posthumans emerging within the 21st century.⁶⁷

1.3 Opposing Enhancement

Transhumanists undoubtedly have a number of opponents, both academic and political, but it is important to note that “the chief division in the literature on enhancement is not between ‘pro-enhancement’ and ‘anti-enhancement.’ It is between ‘anti-enhancement’ and ‘anti-anti-enhancement,’...by the ‘anti-anti-enhancement’ stance I mean the view that enhancement is sometimes permissible.”⁶⁸ The vast majority of transhumanists see enhancements as having potential dangers, and encourage exploring those potential dangers in order to best avoid them. Anyone who advocates for the use of enhancements regardless of potential risks would ultimately not be a transhumanist, but rather radically pro-enhancement.

Opposition to human enhancement technologies may have been around for some time, but it was Francis Fukuyama in 2004 that sparked the greatest objection to emerging technologies. Fukuyama published a paper in *Foreign Policy*, in which he

⁶⁴ Lisbeth Witthofft Nielsen, “Enhancement, Autonomy, and Authenticity,” in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud Ter Meulen, and Guy Kahane (Oxford: Blackwell, 2011), 21

⁶⁵ Buchanan, *Beyond Humanity?* 120

⁶⁶ Asher Siedel, *Immortal Passage: Philosophical Speculations on Posthuman Evolution* (Toronto: Lexington, 2010).

⁶⁷ Like Kurzweil, among nearly any Singularity. See pages 361-428 of *The Transhumanist Reader* for more.

⁶⁸ Buchanan, *Beyond Humanity?* 13

called transhumanism ‘the most dangerous idea in the world,’ a phrase that has since become prominent within the human enhancement debate. Fukuyama proposed that meddling in human biology, particularly through genetic engineering, would result in a significant loss of human dignity and meaning.⁶⁹ He expanded his arguments in *Our Posthuman Future*, which is among the most-cited anti-enhancement texts. While Fukuyama is a serious opponent to enhancement, it should be noted his objections are almost entirely targeted at genetic and biological enhancements, which make up only a portion of the larger body of enhancements, such as brain-computer interfaces, intelligent machines, pharmaceuticals and artificial body parts. His arguments have been used to attack a broad range of enhancements, associating them with negative outcomes and possibilities, most of which are affiliated with genetic tampering and biomedical technologies.

Taking Fukuyama’s protests to an extreme, Bill McKibben calls for “a halt on even the basic scientific research that might lead to techniques to enhance human abilities. In his book *Enough*, he writes, ‘We need to do an unlikely thing: we need to survey the world we now inhabit and proclaim it good. Good enough...Enough intelligence. Enough capability. Enough.’”⁷⁰ While McKibben’s proposal to stop developing even therapeutic technologies is rare among anti-enhancement advocates, his argument that our current situation is sufficient is common among not only those within the debate, but also the population at large.⁷¹ Bostrom and Ord suggest that many people are fearful of altering the human mind and body because of what they call a ‘status quo bias.’ They propose a ‘reversal test,’ where people are asked if instead of extending capacities, such as life extension, cognitive enhancement or otherwise, if we should work towards reducing these capacities. While it is obvious that reducing lifespan is irrational, opponents of enhancement fail to give any explanation as to why our current capacities

⁶⁹ Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*.

⁷⁰ Bill McKibben, cited in Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 4-5

⁷¹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 139 – Naam discusses global surveys of public approval of enhancement, with America being around 20% approval, while China is over 60%.

are ideal; when McKibben's proposal is applied directly to a specific type of enhancement, such as life extension, Bostrom and Ord note that those in opposition find it difficult if not impossible to explain why extending life by a single year would be detrimental.

Prominent transhumanist James Hughes states that opponents to enhancement “start from the assumption that new biotechnologies are being developed in unethical ways by a rapacious, patriarchal medical-industrial complex, and will have myriad unpleasant consequences for society, especially women, the poor and the powerless.”⁷² In comparison, transhumanists encourage that these ‘unpleasant consequences’ be flushed out through carefully analyzing current trends, examining existing inequalities that may be exacerbated by emerging technologies, and by making informed predictions for the future; anti-enhancement advocates assume these consequences are more than likely, regardless of intervention to prevent them. However, opposition comes from both the political left and right. On the right are primarily religious conservatives, like Fukuyama and Kass, who argue human enhancement violates basic human nature and disrespects ‘gifts’ that nature has bestowed upon us.⁷³ On the political left however are activists who, in reacting to corporate-controlled techno-utopianism,⁷⁴ argue against allowing corporations to control emerging enhancement technologies. Both libertarian-leaning left- and right-wing proponents have been accused of entirely avoiding any specific definition of ‘enhancement’ altogether as a way to generalize the opposition,⁷⁵ indicating a set critical issues in enhancement debates: a lack of consensus on definitions, unclear rhetoric from both sides, and misrepresentations of oppositional arguments.

⁷² Hughes, *Citizen Cyborg*. 62

⁷³ Kass cited in Bostrom, “In Defense of Posthuman Dignity.” 57—Bostrom responds, saying that while transhumanism may alter human nature, this is not necessarily a negative; nature’s ‘gifts’ include disease and environmental disasters, and that we should feel obligated to pursue anything that eases or erases those difficulties.

⁷⁴ Hughes, *Citizen Cyborg*. 129, points out that corporations often portrayed new consumer technologies as groundbreaking and changing the world for the better, while those same companies contributed to the development of military weapons. As a result, political progressives began to meet new technologies with suspicion, and have carried this over to emerging biotech, nanotech and the various technologies that make up transhumanism.

⁷⁵ Savulescu, Sandberg, and Kahane, “Well-being and Enhancement.” 4

One of the most problematic aspects of the human enhancement debate is miscommunication between opposing sides. For Buchanan, much of anti-enhancement arguments are flimsy and based in ‘murky rhetoric.’⁷⁶ He argues that allowing such arguments to be left uncontested could have disastrous effects in that it would allow populations to be influenced by faulty logic and partial representations of enhancement technologies, as well as of the transhumanist perspective.⁷⁷ For example, Miller and Wilsdon write, “All too easily, [transhumanists] slide from a discussion of what new technologies *may* make possible to an assumption that these changes *will* happen, without any appreciation of the subtleties of culture and values, or the unpredictable twists and turns of democracy.”⁷⁸ Ted Peter elaborates, arguing that deterministic transhumanists like Simon Young and Kurzweil—neither of which are recognized as transhumanists⁷⁹—overlook human inclination to use things selfishly and maliciously.⁸⁰ Russell Blackford, editor-in-chief of the *Journal of Technology and Evolution*, responds to Peters, “It is not intellectually useful to challenge a specific viewpoint within transhumanism or to synthesize some composite viewpoint out of the (perhaps conflicting) writings of a few prominent or not-so-prominent transhumanist thinkers, then attack this—and *then* claim to have refuted or discredited transhumanism itself.”⁸¹

As I’ve argued earlier, transhumanism explicitly states that one of its goal is to uncover both positive and negative impacts of enhancement technologies, in order to accurately present them to the public at large, and to have a truly democratic debate

⁷⁶ Refer back to Leon Kass’ ‘yuck factor’

⁷⁷ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 23

⁷⁸ Paul Miller and James Wilsdon, “Stronger, Longer, Smarter, Faster,” in *Better Humans? The Politics of Human Enhancement and Life Extension*, ed. Paul Miller and James Wilsdon (London: Demos, 2006), 21

⁷⁹ Russell Blackford, “Trite Truths About Technology: A Reply to Ted Peters,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 178, argues Simon Young’s book *Designer Evolution* “has no general acceptance within the transhumanist movement and really represents no more than its author’s personal views. The same applies to the ideas of Kurzweil.” Furthermore, Kurzweil himself rejects the title of transhumanist, not to mention his views are not generally accepted within the transhumanist community; it would appear he is only labeled as such by those who have only a basic understanding of transhumanism

⁸⁰ Ted Peters, “Transhumanism and the Posthuman Future: Will Technological Progress Get Us There?,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 148

⁸¹ Blackford, “Trite Truths About Technology: A Reply to Ted Peters.” 177

concerning their use and regulation. While some early writers like Kurzweil and Moravec may be deterministic, seeing these technologies as inevitable, they are not transhumanist authors: transhumanists reject the possibility of any one outcome being inevitable instead favoring an ongoing discussion regarding the ambiguous nature of technology. Greg Klerkx, also featured in Miller and Wilsdon's reader, writes that contemporary transhumanists "cannot see downsides to these developments, despite ample evidence that the products of modern science have been used at least as often for harm as for good,"⁸² which blatantly ignores some of the most basic principles of transhumanism. Broad generalizations like this hamper open and critical discourse regarding human enhancement.

Arthur Caplan points out another miscommunication among debaters when he refers to enhancement critics who claim that transhumanists 'seek perfection,'⁸³ when virtually no recognized transhumanist has ever claimed to 'seek perfection.' Max More shares his concern when he writes, "These critics cannot have actually read much transhumanist writing—certainly not anything written in the last decade,"⁸⁴ and while he may exaggerate how uninformed the opposition may be, he does point out that the various sides of the debate are not operating with an agreed upon set of terms, nor do all authors acknowledge the legitimacy of their opponents. Buchanan argues that some of the most outspoken critics of enhancement, including Kass, Fukuyama and Michael Sandel,

repeatedly make vast empirical generalizations about the psychology of those who pursue enhancement. They assert that to try to enhance is to strive for total mastery of the conditions of human existence... In this regard, the enhancement literature is one of the last academic strongholds of *a priori* psychology and sociology. One would think that one was living in the eighteenth century, when serious intellectuals still believed they could formulate interesting and controversial generalizations about human behavior or the working of human society from the armchair.⁸⁵

⁸² Klerkx, "The Transhumanists as Tribe." 66

⁸³ Arthur Caplan, "Is It Wrong to Try to Improve Human Nature?," in *Better Humans? The Politics of Human Enhancement and Life Extension*, ed. Paul Miller and James Wilsdon (London: Demos, 2006). 33-34

⁸⁴ More, "True Transhumanism: A Reply To Don Ihde." 141

⁸⁵ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 9

It would appear that not only Ted Peters but many in opposition of enhancement are guilty of targeting a specific aspect of what they perceive to be transhumanism, discrediting it, and then claiming to have discredited transhumanism as a whole. However, it is not just those in opposition of enhancement that have come under fire for misrepresenting the opposing side, as Miller and Wilsdon contend “Hughes occasionally slips back into the familiar mantras of technohype and determinism. And his call for a less polarized debate isn’t helped by him labeling all critics of enhancement ‘BioLuddites,’”⁸⁶ a term that other transhumanists⁸⁷ have since picked up on.

It is troublesome that within the human enhancement debate, both sides, or rather all sides, operate at times on false assumptions of their opponents, and that there is no cohesive set of definitions or terms being discussed. For example, Fukuyama’s book *Our Posthuman Future*, while often described as highly alarmist, is almost entirely focused on genetic engineering, yet its arguments are used as if they attack *all* types of enhancement equally. The result is a series of authors discrediting Fukuyama’s writing on genetic engineering, and then acting as if they’ve discredited all oppositions to human enhancement. This type of Straw Man argumentation occurs on practically all sides of the debate, and inhibits productive discussion.

Another major concern among enhancement critics is the concern that an enhanced human may find less value in things that current humans find beautiful or interesting.⁸⁸ Agar argues that enhanced humans may even find romantic relationships to be increasingly difficult to maintain, as an intellectually enhanced mind may find his or her partner’s interests to be less and less important than their own; furthermore, if both partners are equally enhanced, it is likely their interests will have become so specific and narrow that finding common ground may be next to impossible.⁸⁹ In response, Bostrom

⁸⁶ Miller and Wilsdon, “Stronger, Longer, Starter, Faster.” 23

⁸⁷ For example, Savulescu, Sandberg, and Kahane, “Well-being and Enhancement” use the term bioLuddite repeatedly.

⁸⁸ Nicholas Agar, in *Humanity’s End: Why We Should Reject Radical Enhancement* (Cambridge, MA: MIT, 2010), 142-3, argues we may find something like Bach’s B-minor Mass to be beautiful still, but our appreciation for it may diminish with cognitive enhancements.

⁸⁹ Agar, *Humanity’s End*. 186-7

writes “It is not clear why the ability to appreciate what is more complex or subtle should make it impossible to appreciate simpler things,”⁹⁰ and goes on to explain that enhanced cognitive capacities not only do not suggest a loss in one’s previous interests, but that the opposite may be true: enhanced minds may be more capable of appreciating a wider range of things that unenhanced minds can.

Regarding the loss of meaning in a posthuman age, Bill McKibben once again takes an extreme stance when he recollects a childhood friend, Kathy, who at the age of 15 died of complications from cystic fibrosis. He reminisces that Kathy was among the most kind and generous people he has ever known, arguing that the joy she felt from things many people take for granted was a result of her illness; for McKibben, suffering and vulnerability are necessary in order for positive human characteristics to flourish.⁹¹ Furthermore, Tirosh-Samuelson contends that a significant portion of all human culture could not have been possible without human suffering, and that future technologies that eliminate suffering may usher in a culture-less age.⁹² For transhumanists, “it seems obvious that the ethical goal for society should be to make life as fantastic for as many people as possible, not to valorize pain and suffering.”⁹³ Transhumanists believe that firstly, by enhancing our bodies to resist disease, to live longer, and to more rapidly heal, we can diminish the amount of suffering for both individuals as well as collectively. Furthermore, by enhancing our brains, namely in terms of our ability to recall memory, to stay alert for longer periods, to more easily understand and analyze information, we will be better equipped to address long-standing social issues through innovative social policy.

1.4 Cognitive Enhancement

Many speculate how enhancement technologies will act as an extension of the human mind, body, and identity. For example, More points out that “As we store more of our

⁹⁰ Bostrom, “Why I Want to Be a Posthuman When I Grow Up.” 47

⁹¹ McKibben cited in Agar, *Humanity’s End: Why We Should Reject Radical Enhancement*. 180

⁹² Tirosh-Samuelson, “Engaging Transhumanism.” 38-39

⁹³ Hughes, *Citizen Cyborg*. 44

memories externally and create avatars, it is also becoming increasingly apparent that the boundaries of the self are unclear and may not be limited to the location of a single body.”⁹⁴ While some speculate that future technologies may become internalized as part of an individual’s identity, Andy Clark argues in *Natural-born Cyborgs* that humans have always extended themselves through technology, including basic tools, language and even thought.⁹⁵ Clark argues that “human minds and bodies are essentially open to episodes of deep and transformative restructuring, in which new equipment (both physical and ‘mental’) can become quite literally incorporated into the thinking and acting systems that we identify as minds as persons,”⁹⁶ and explains that an object as simple as a hammer is, with regular use, internalized in the mind as an extension of the arm and a human’s capabilities. Similarly, McLuhan argued all media are extensions of human senses, and that even basic objects like books are an extension of the eye.⁹⁷ A common example of extension among transhumanist literature concerns the artist Stelarc, who uses sensors placed on his body to transfer signals to a mechanical arm. He describes that after years of using such a device, he no longer has to consciously think of each movement, and that he considers the mechanical arm an extension of his own body.⁹⁸ Similarly, Naam points out a man who suffered a severe stroke, losing all use of his body from the neck down. With a simple neural implant, he was able to learn to control a cursor on a computer screen, and after several months of use, claimed he saw the cursor as an extension of himself, rather than an external object he controlled.⁹⁹

It’s clear that “progress in computing and information technology has vastly increased our ability to collect, store, analyze, and communicate information,”¹⁰⁰ and that technology allows us to do things our natural bodies and minds cannot. However, Don Ihde points out that far too often transhumanists fall into what he calls the Idol of the

⁹⁴ More, “The Philosophy of Transhumanism.” 7

⁹⁵ This topic is explored more in-depth on page 27

⁹⁶ Andy Clark, “Re-Inventing Ourselves: The Plasticity of Embodiment,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 113

⁹⁷ Marshall McLuhan and Quintin Fiore, *The Medium Is The Massage* (New York: Bantam, 1967) 26-39.

⁹⁸ Clark, “Re-Inventing Ourselves: The Plasticity of Embodiment.” 116

⁹⁹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 173-4

¹⁰⁰ Bostrom and Roache, “Smart Policy: Cognitive Enhancement and the Public Interest.” 139

Cyborg—where we *wish* that an external (or internal) technology would become completely engrained into us and be completely transparent, but points out that with any technological enhancement, there is always a compromise. He argues that something a like prosthetic leg—while having great value at restoring function—is still not a completely transparent technology. Even a crowned tooth, while highly transparent and rarely thought about, will at times draw attention, either through being worn down, or simply the awareness that something in the body is artificial. Ihde claims no technology will ever be completely internalized, and that transhumanists are too concerned with merging machines with the human body. More responds, saying that transhumanism is not concerned with mechanizing the body,¹⁰¹ and while More is correct, I believe Ihde legitimately points to the perpetual awareness of compromise, one that does not allow identity to be fully extended to the body's mechanical parts.

Some worry that enhancing intelligence may have a detrimental effect on personal identity. Agar suggests that “the procedure that enhances your intellect will change the structure of your brain, leading to uncertainty about whether the person who emerges from the procedure is you.”¹⁰² Bostrom's response to the loss of personal identity indicates, as with other transhumanists, that there does not appear to be any logical reason why enhancing cognitive capacities would result in altering a person's personality, goals, skills, memories or otherwise.¹⁰³ However, Agar continues on to say that extending intelligence indefinitely, and repeatedly, will stop individuals from having ‘mature interests.’¹⁰⁴ Agar's concept of ‘mature interests’ is that as humans age, they typically settle into a more defined set of interests, things they appreciate, when compared to the more childish tendency to dramatically shift interests over a relatively short time. He claims that mature interests are crucial to building any meaningful connections between people, in that without them humans are likely to shift interests more frequently, as with continued intellectual expansion, and thus never be able to fully explore any one area.

¹⁰¹ More, “True Transhumanism: A Reply To Don Ihde.” 140

¹⁰² Agar, *Humanity's End: Why We Should Reject Radical Enhancement*. 183

¹⁰³ Bostrom, “Why I Want to Be a Posthuman When I Grow Up.” 41

¹⁰⁴ Agar, *Humanity's End: Why We Should Reject Radical Enhancement*. 186

The result would be people with broad but shallow understandings, and presumably the elimination of experts from the world. While Agar's concerns are noted, it seems unlikely that enhanced cognitive capacities would result in constant boredom.

My primary interest in transhumanist literature is the enhancement of intelligence, often referred to as cognitive enhancement (CE). Anders Sandberg champions the field of CE, defining it as “the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems.”¹⁰⁵ Compared to other core areas of transhumanism, namely life extension, genetic engineering, and ability-enhancing drugs, CE is at times seen as more crucial to developing more tolerant, peaceful, democratic and altogether happier societies.¹⁰⁶ Not only are cognitive enhancements understood as potentially beneficial to positively influencing existing desirable attributes of society—like our ability to communicate, understand and apply knowledge, among other things—but they also hold a promise of addressing existing crises. Buchanan writes, “To solve problems we have created—such as environmental pollution, overpopulation, and global warming—human beings may have to enhance cognitive capacities and perhaps their moral capacities as well,”¹⁰⁷ which relates back to the body of posthumanist philosophers who believe posthumans will be in a better position to correct outstanding inequalities and environmental issues that exist today.¹⁰⁸ CE combines the real possibility for enhancing our brains and intellectual capacities with the philosophical possibility to usher in a *posthumanist* era.

Others see cognitive enhancement as having already existed, in some sense, for quite some time. Buchanan contends that “whether cognitive gains are achieved by learning to read and write or implanting a microchip in the brain is irrelevant; the term ‘enhancement’ is equally applicable.”¹⁰⁹ He argues that the introduction of widespread literacy and numeracy should be considered a profound cognitive enhancement for mass

¹⁰⁵ Sandberg, “Cognition Enhancement: Upgrading the Brain.” 71

¹⁰⁶ See Posthuman authors on enhancing our ability to address social and environmental issues, like Siedel

¹⁰⁷ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 2

¹⁰⁸ Bostrom, “Why I Want to Be a Posthuman When I Grow Up.” 36

¹⁰⁹ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 24

populations.¹¹⁰ Similarly, Clark describes the process where humans create artificial learning environments, such as methods of education and instruction, which attempt to give newer generations a greater basis for knowledge and the application of analytical skills than previous generations. Those people who go on to develop greater methods, mental techniques and ways of remembering and applying knowledge, create a cycle of constant cognitive improvement with each new generation.¹¹¹ It would appear that a great number of innovations and technologies, both physical and mental, past and present, have radically extended the natural capacities of the human brain.¹¹²

Physical technologies like pen and paper, calculators and information technology allow humans to access and utilize information beyond the brains natural limits, the result being what Vernor Vinge referred to as Intelligence Amplification.¹¹³ In 1993 Vinge wrote that “the team of a PhD human and a good computer workstation (even an off-new workstation) could probably max any written intelligence test in existence,”¹¹⁴ which suggests that our understanding of intelligence may be limited, or open to change. To clarify, Kurzweil predicts that in an age where cognitive enhancements are ubiquitous—especially technological ones that link directly to the brain—that the very nature of education will change.¹¹⁵ This is to say that when accessing information via the Internet is so seamlessly integrated into how our brains function, it will become possible to reevaluate what ‘intelligence’ really is; in an age where every enhanced human has equal access to massive databases, being able to analyze and utilize that information will be increasingly important, and memorization will be unproductive.¹¹⁶ Kurzweil predicts that, much in the fashion of *The Matrix*, humans will be able to download both knowledge and

¹¹⁰ Ibid., 38

¹¹¹ Clark, “Re-Inventing Ourselves: The Plasticity of Embodiment.” 124

¹¹² Sandberg, “Cognition Enhancement: Upgrading the Brain.” 71

¹¹³ Vernor Vinge, “Technological Singularity,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 365–375.

¹¹⁴ Ibid.

¹¹⁵ Ray Kurzweil, *The Singularity Is Near: When Humans Transcend Biology* (New York: Viking, 2005). 337

¹¹⁶ Andy Clark, *Natural-born Cyborgs: Minds, Technologies, and the Future of Human Intelligence* (Oxford: Oxford UP, 2003) 67

skills directly into nonbiological portions of their brains.¹¹⁷ Sandberg suggests that neural implants will allow for “offloading irrelevant, repetitive, or boring tasks and enabling a person to concentrate on more complex challenges that relate in more interesting ways to her goals,”¹¹⁸ and suggests that may even result in humans having more *authentic* interests.

Ramez Naam optimistically notes that cognitive enhancements are likely to have a multitude of positive effects, as

people with better memories and quicker minds will earn more money and produce more for others. Any technique that increases the human ability to learn, to think, or to communicate is going to produce economic returns. It will increase our ability to solve problems, to make scientific breakthroughs, and to build better products. Scientists who learn more quickly will be better able to stay abreast of developments in their field. Doctors and nurses who can stay alert longer will make fewer errors in treating patients.¹¹⁹

But there is much debate over what types of cognitive enhancements will be available, and how they may be used. While my interests lie with neural implants, many discuss cognitive enhancement via pharmaceuticals; however, many of the proposed effects and outcomes of using such drugs are at times equally as applicable to implanted devices.

Buchanan states that while brain-computer interfaces, in particular implanted computers, may very well be possible, he acknowledges that enhancement through drugs is more likely to occur on a large-scale before brain-implants, due to the lower cost of production, and less obtrusive methods,¹²⁰ and the slippery slope between drugs produced for treatment and restoring function and those used for enhancing capacities.¹²¹ Savulescu and Sandberg indicate that already many drugs designed for treatment are used for enhancement, and point out that “there is some doubt whether it is even possible to draw

¹¹⁷ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 337

¹¹⁸ Sandberg, “Cognition Enhancement: Upgrading the Brain.” 82

¹¹⁹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 56

¹²⁰ *Ibid.*, 176

¹²¹ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 28

a consistent and useful distinction between treatment and enhancement.”¹²² As briefly discussed earlier, the line between therapy and enhancement, particularly in terms of drugs, is likely to be increasingly hard to distinguish.

Hughes points out that after the initial rise of cognitive drugs, the next step will be connecting human brains directly to computers,¹²³ quite possibly through implanting devices directly into the brain. Nanotechnology specialist J. Storrs Hall writes that “nanocomputers represent enough power in little enough space that it would make sense to implant them in your head to extend your sensorium, augment your memory, sharpen your reasoning.”¹²⁴ While much transhumanist literature considers the possibilities of nanocomputers, it is important to note that neurally implanted devices do not necessarily require being built on an atomic scale; microcomputers are altogether more likely to be used first, and just as likely to present the same level of cognitive enhancement. That being said, nanocomputers are much more widely discussed, and contribute a great deal to the discussion of brain-computer interfaces and neural implants.

Kurzweil, in his ever deterministic way of writing, insists that once we begin to implant intelligent machines into our brains, our biological intelligence will be dominated by our artificial intelligence; as our brains are “effectively of fixed capacity,”¹²⁵ the computing power of machine intelligence is exponential. Kurzweil argues that intelligent machines will follow a similar trend to other artificial intelligences, and thus double in power every year. This might suggest that implanted mechanical artificial intelligence will overwhelm our original biological brains, a scenario Kurzweil seems unconcerned with. Ihde points out that this type of scenario—one that involves the fear of machines replacing humans—is a longstanding *myth*; technologies have never replaced humans, even if innovations in machine automation have initially reduced the number of workers for example, but rather new technologies only change the “nature of the task” by

¹²² Savulescu, Sandberg, and Kahane, “Well-being and Enhancement.” 5

¹²³ Hughes, *Citizen Cyborg*. 39

¹²⁴ J. Storrs Hall, “Nanocomputers,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 183

¹²⁵ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 28

tightening the relation between humans and machines.¹²⁶¹²⁷ Ihde sees the possibility of humans being entirely replaced by machines as an impossible outcome, rooted in the appeal of doomsday-type fiction.¹²⁸ Andy Clark, Chair of Logic and Metaphysics at the University of Edinburgh, anticipates that when neural implants or brain-computer interfaces become intelligent, “when our technologies actively, automatically, and continually tailor themselves to us just as we do to them—then the line between tool and user becomes flimsy indeed.”¹²⁹

Hughes predicts that neural implants will profoundly augment human lives, writing that “we will have unimaginable access to and control over our currently unconscious reactions to the world, our ingrained defense to hierarchy, our addictions and self-destructive behaviors, and the ways we are manipulated by advertising, charismatic authority and social approval.”¹³⁰ While much of what Hughes foresees may be in the more distant future, the development of connecting the brain directly to devices is relatively new; arguably science has really only begun to understand how the brain works since the beginning of the 21st century,¹³¹ and already a great deal of work has been accomplished.¹³² “While we are still far from understanding higher-level thinking, we are beginning to figure out how the individual components work and how they are hooked up,”¹³³ which, for someone like Kurzweil, is the first step in reverse-engineering the brain. If we can understand how the different parts of the brain process information, store

¹²⁶ Ihde, “Of Which Human Are We Post?” 133

¹²⁷ Harry Braverman, for one, disagrees, as he argues that automation and new technologies have historically not only decreased the number of workers necessary for production, but at times completely remove human labour. See Harry Braverman, “The Degradation of Work in the Twentieth Century,” *Monthly Review* 41, no. 5 (October 1989) for more, as this issue is far too big for this thesis to address adequately.

¹²⁸ Max More quoted in Hughes, *Citizen Cyborg*. - argues that end-of-the-world concepts appeal to Western cultures

¹²⁹ Clark, *Natural-born Cyborgs*. 7

¹³⁰ Hughes, *Citizen Cyborg*. 200

¹³¹ Nick Bostrom, “Welcome to a World of Exponential Change,” in *Better Humans? The Politics of Human Enhancement and Life Extension*, ed. Paul Miller and James Wilsdon (London: Demos, 2006), 43

¹³² See Chapter 2 of this thesis for accounts of current implanted technologies

¹³³ Bostrom, “Welcome to a World of Exponential Change.” 46

and access memory, we—in theory—can build artificial intelligence based on our own brains.¹³⁴

Predicting how—not to mention when—neural implants will significantly augment human brains concerns a wide range of authors. In 2003, the National Science Foundation (NSF) published a series of papers concerning the future merging of nanotechnology, biotechnology, information technology and cognitive science (NBIC), giving legitimacy to the growing body of transhumanist and futurist literature. The NSF reports stated that in the near future, new technologies would be routinely implanted directly into the human brain, likely used to access the World Wide Web, and communicate directly with other implanted humans. Such technologies were predicted to be widely available by 2030.¹³⁵ The NSF’s report concluded “With proper attention to ethical and societal needs, converging technologies could achieve tremendous improvement in human abilities, societal outcomes, the nation’s productivity, and the quality of life.”¹³⁶

Transhumanist Alex Chislenko predicts neural communication implants are likely to contribute to breaking down global barriers by augmenting language; intelligent translators will ease communication between people using different languages, and neural implants will make such connections effortless.¹³⁷ Having humans more easily communicate and access information suggests a synergistic effect that Eric Drexler refers to as ‘collective intelligence,’ where the more people are able to connect through technology, the more powerful the knowledge-base becomes.¹³⁸ Ben Goertzel and Stephan Bugaj, combining the idea of collective intelligence with the possibility for artificial intelligence, suggests that a ‘global brain’ may emerge, a system that

¹³⁴ Ibid., 43

¹³⁵ Hughes, *Citizen Cyborg*. 40

¹³⁶ Mihail C. Roco and William Sims Bainbridge, *Converging Technologies for Improving Human Performance* (Dordrecht, The Netherlands: National Science Foundation, 2003).

¹³⁷ Alexander Chislenko, “Intelligent Information Filters and the Future of Humanity,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 140

¹³⁸ Drexler quoted in Sandberg, “Cognition Enhancement: Upgrading the Brain.” 78

encompasses all artificial and human intelligence, with practically limitless capabilities.¹³⁹

Don Ihde warns against relying too heavily on prediction, what he refers to as worshipping the Idol of Prediction.¹⁴⁰ He argues futurists too readily believe in prediction, and that they are likely to slip from thinking something might happen to the conviction that it will happen. Ihde makes reference to David Nye, who in 2006 discussed a list of over 1,500 predictions made by science fiction writers, futurists and scientists between 1890 and 1940, of which less than one-third came to fruition.¹⁴¹ In response, Max More points out that many predictions made in the past few decades, especially those by Kurzweil and Moravec, two authors Ihde is most concerned with refuting, have indeed come true.^{142,143} One account for the failure for earlier predictions to come true is that as technology has advanced, our ability to analyze trends has become increasingly accurate. As such, forecasting future technologies has become increasingly important for businesses, many of which rely on Moore's Law when developing timelines for new products.

As our ability to predict became more precise, speculative science fiction also changed. Vinge notes that while early science fiction used to envision intelligent machines existing hundreds if not thousands of years in the future, contemporary science fiction sees these outcomes as happening before the 22nd century.¹⁴⁴ This is partly due to an increased interest in the possibility of a technological singularity, a time when the exponential growth of technology—and of intelligent machines—becomes so rapid it becomes nearly impossible to assume what would happen next. At the point where

¹³⁹ Ben Goertzel and Stephan Vladimir Bugaj, *The Path to Posthumanity* (Bethesda, MD: Academica Press, 2006). 30

¹⁴⁰ Ihde, "Of Which Human Are We Post?" 131

¹⁴¹ David E. Nye, *Technology Matters* (Cambridge, Mass.: MIT Press, 2006) 36

¹⁴² More, "True Transhumanism: A Reply To Don Ihde." 144.

¹⁴³ Bill Gates, quoted in Agar, *Humanity's End: Why We Should Reject Radical Enhancement*. 36, said Kurzweil is "the best person at predicting the future of artificial intelligence." While Kurzweil is often overly dramatic and technologically deterministic, his list of accurate predictions is impressive, having forecasted the expansion of the Internet, a multitude of military technologies, and the emergence of computer displays built into glasses (Google Glass).

¹⁴⁴ Vinge, "Technological Singularity." 367

machine intelligence is greater than our own, it is possible that artificial minds may be better at imagining and creating new technologies, and thus our unenhanced human minds would be unable to perceive where technology might lead. What's important about this shift in science fiction is that, for N. Katherine Hayles, science fiction is critical to transhumanism, in that much of transhumanist discussion decontextualizes what is really at stake in favor of broad, generalized philosophies and social policies. For Hayles, science fiction *recontextualizes* transhumanism with detailed depictions of society and technology in the future, and allows for a more comprehensive debate over the possible outcomes emerging technologies may contribute to.¹⁴⁵ Furthermore, transhumanists such as Bostrom have been accused of focalism—too much attention paid to the possible ways enhancement technologies might be beneficial at the present, an optimism that extends into his predictions for the future, causing him to overlook the way problems may also develop alongside the benefits.¹⁴⁶ For this reason, forecasting via science fiction—which often explores dystopic, negative, or at least ambiguous visions of the future—is central to transhumanism.¹⁴⁷

Kurzweil, one of the most prominent of the current technological futurists, and certainly one of the most vocal, predicts that by 2019 neural implants will be relatively common,¹⁴⁸ and that, just as Bostrom predicts, by 2020 we can reasonably assume that hardware will be as fast and powerful as the human brain in its computational capacities¹⁴⁹; the problem of developing software that is capable of the complex analytical skills of the human brain is an altogether different one.¹⁵⁰ Kurzweil sees the trend of neural implants continuing, and that by 2030 there will be networks of intelligent nanobots that communicate directly with our brains, allowing us to access memories,

¹⁴⁵ Hayles, "Wrestling With Transhumanism."

¹⁴⁶ Agar, *Humanity's End: Why We Should Reject Radical Enhancement*. 147-148

¹⁴⁷ It should be noted that much of transhumanist forecasting does not explicitly indicate any formal research method, as it is often philosophical, and hypothetical at times. In comparison, authors like Kurzweil and Minsky employ more rigorous research methods, which contributes to their work being more prolific in comparison to say, Bostrom or Hughes.

¹⁴⁸ Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Viking, 1999). 234

¹⁴⁹ Bostrom, "Welcome to a World of Exponential Change." 42

¹⁵⁰ *Ibid.*, 41

communicate, and access information¹⁵¹; by 2099, neural implants will be so powerful and ubiquitous in everyday life, that unenhanced humans will be unable to communicate on any meaningful level with the rest of the enhanced population.¹⁵²

1.5 Exponential Change & The Singularity

Many transhumanist authors find addressing the Singularity, regardless of their support of it, as necessary, especially when attempting to predict future technologies and their impacts.¹⁵³ Vernor Vinge writes that a technological singularity is likely to occur by rapid technological growth leading to the emergence of true AI,¹⁵⁴ via biological changes that radically increase our own intellect, or “computer/human interfaces may become so intimate that users may reasonably be considered superhumanly intelligent.”¹⁵⁵

While Vinge may have been the first to suggest a technological singularity,¹⁵⁶ it has been Ray Kurzweil who has so adamantly warned of its importance and inevitability. Kurzweil focuses on the Singularity that “will allow us to overcome age-old human problems and vastly amplify human creativity. We will preserve and enhance the intelligence that evolution has bestowed on us while overcoming the profound limitations of biological evolution,” before carefully noting that “the Singularity will also amplify the ability to act on our destructive inclinations, so its full story has not yet been written.”¹⁵⁷ Basing his vision of the Singularity on computing trends of the past, Kurzweil sees an exponential growth in the power and speed of computers. For some, this

¹⁵¹ Hughes, *Citizen Cyborg*. 41

¹⁵² Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence*. 234

¹⁵³ See the entire section of *The Transhumanist Reader* on the Singularity

¹⁵⁴ This is in itself the topic for another thesis, and there is simply not enough time or space to devote to properly defining true or ‘strong’ AI. Note that many authors debate whether true AI is even possible, while Bostrom suggests that it is theoretically possible to make hardware as powerful as the brain, creating software to go with it may never come to fruition (see Bostrom 41). Furthermore, John Horgan, and he isn’t alone on this, believes Kurzweil underestimates the complexity of the human brain (cited in Agar 43). Agar indicates that Kurzweil’s understanding of AI relies on neurological atomism, that understanding each part will lead us to replicate the brain, while neurological holism suggests that the whole is greater than the sum of its parts (see Agar 48)

¹⁵⁵ Vinge, “Technological Singularity.” 365

¹⁵⁶ Vinge first coined the term ‘technological singularity’ in 1993, but the idea stems much further back, dating back to sciencefiction in the first half of the 20th century.

¹⁵⁷ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 21

implies that technology will begin to advance so quickly that humans will be unable to adapt to innovations before even newer ones have arrived—that is, unless we enhance our own cognitive capacities to keep up.¹⁵⁸ The concern that humans will be unable to adapt quickly enough to new technology is however a longstanding fear, stemming back to Alvin and Heidi Toffler’s 1970 book *Future Shock*, in which they proposed that as technology exponentially increased, more and more people would suffer from “shattering stress and disorientation that we induce on individuals by subjecting them to too much change in too short a time,”¹⁵⁹ a prediction that Hughes notes has since failed to have as dramatic an impact as once thought.

Despite Kurzweil’s insistence that the Singularity is inevitable,¹⁶⁰ other futurists are less convinced. While Vinge once saw the Singularity as unavoidable,¹⁶¹ he has since amended himself, arguing it is likely but not guaranteed.¹⁶² Extropians, who lean towards the more libertarian and deterministic side of transhumanism, argue that individuals must actively pursue enhancements in order to prosper through the Singularity;¹⁶³ but even among extropians there is doubt that a Singularity may ever occur.¹⁶⁴ Instead, trends in computing, while exponential, show that new technologies routinely follow an ‘s’ curve—where they have slow starts, followed by rapid and exponential growth, before slowing down as they become more widespread—a trend many technological innovations have followed for some time.¹⁶⁵ Some see that while technology grows faster and more powerful, these growths occur at different rates among different industries and fields of development, where despite Moore’s Law, other aspects in technological growth move at

¹⁵⁸ Goertzel and Bugaj, *The Path to Posthumanity*. 17

¹⁵⁹ Toffler cited in Hughes, *Citizen Cyborg*. 58

¹⁶⁰ See Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 123 – He argues that even if his estimates of the computational power of the human brain are off by a factor of one billion, this would only delay the Singularity by a couple decades. Kurzweil’s logic makes evident that the Singularity must and will occur.

¹⁶¹ Vinge, “Technological Singularity.” 369

¹⁶² Various, “A Critical Discussion of Vinge’s Singularity Concept,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013). 399

¹⁶³ Hughes, *Citizen Cyborg*. 173

¹⁶⁴ *Ibid.*, 172, Cites a survey, where one of five extropians did not believe a singularity would occur.

¹⁶⁵ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 43-4

much slower rates.¹⁶⁶ Grassie argues that there are six key aspects holding back a Singularity from occurring, including the fallacy of exponential growth, meaning that most examples of exponential growth in other areas throughout history have either slowed or reached a point of implosion.¹⁶⁷ Grassie also notes that there are basic physical limits to computing, a point Hall drives home when he describes current nanotech simulations show that even basic nanobots have extremely high heat outputs, with some being theoretically equivalent to a small explosion.^{168,169}

Although Vinge argues a technological Singularity is likely, he suggests that it is ultimately determined by the work of humans,¹⁷⁰ and thus, the rate that humans produce technological precursors to the Singularity may be controlled. Bostrom points out that there is often a time gap between conceiving a new technology and its actual production, which may remain relatively constant, impeding the rate that new technologies can occur¹⁷¹; Sandberg notes that economic factors like high costs of production may hinder exponential growth, as well as the fact that requiring increasingly specialized skills and knowledge to develop various technologies will reduce the number of people working on technological development.¹⁷² Computer scientists suspect that artificial intelligence—not to mention enhanced humans capable of faster discoveries and higher productivity—may rapidly increase the speed of production.¹⁷³ In fact, Hughes, in agreement with Vinge, states that humans need to begin enhancing and augmenting their intelligence in

¹⁶⁶ Ibid., 72, Kurzweil admits that aspects of computing ultimately reach a point where exponential growth is no longer possible, but chooses not to expand on this point.

¹⁶⁷ William Grassie, “Millennialism at the Singularity: Reflections on the Limits of Ray Kurzweil’s Exponential Logic,” in *H ±: Transhumanism and Its Critics*, ed. Gregory R. Hansell and William Grassie (Philadelphia: Metanexus Institute, 2011), 254-6

¹⁶⁸ Hall, “Nanocomputers.” 185

¹⁶⁹ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 134 – Acknowledges the physical limits of computing in regards to heat dissipation, but only offers that “this will require some careful packaging” as a solution.

¹⁷⁰ Vinge, “Technological Singularity.” 369-70

¹⁷¹ Bostrom, “Welcome to a World of Exponential Change.” 47

¹⁷² Sandberg’s section in “A Critical Discussion of Vinger’s Singularity Concept,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013). 415

¹⁷³ Goertzel and Bugaj, *The Path to Posthumanity*. 410 – See for more on Seed AI, that basic AI may be able to make greater AI, which in turn create greater AI and so forth, an idea championed by Eliezer Yudowsky.

order to stay one step ahead of the machines,¹⁷⁴ suggesting that while Kurzweil may be correct in predicting machine intelligence will surpass human intelligence in 2045, it is likely human intelligence will in one way or another have been enhanced beyond our current state.

Going back to the miscommunication between authors in the human enhancement debate, Kurzweil—without ever mentioning transhumanism—describes Max More’s belief in the Singularity concept; More however, views the Singularity as “a classic religious, Christian-style, end-of-the-world concept that appeals to people in Western cultures deeply. It’s also mostly nonsense... The Singularity concept has all the earmarks of an idea that can lead to cultishness, and passivity,” before perceptively noting that, “There’s a tremendous amount of hard work to be done, and intellectual masturbation about a supposed Singularity is not going to get us anywhere.”¹⁷⁵ Moreover, Goertzel and Bugaj write, “it is worth noting, however, that most aspects of posthumanity do not necessarily require a Singularity as described, requiring only a linear, still transformative, rate of change.”¹⁷⁶

1.6 Posthuman Society

As cognitive enhancements become more and more a reality, the burning questions in the minds of many transhumanists are Who will have access to enhancements? How will cognitive enhancement research and development be funded? and How much might commercially available cognitive enhancements cost? Transhumanism, while largely made up of academic work, is after all part of an emerging industry, and as such, transhumanist research into future technologies receive substantial funding from the National Science Foundation.¹⁷⁷ While there are activists such as Jeremy Rifkin, whose work is geared towards uniting religious conservatives with anti-technology liberals by asserting emerging enhancements will “only serve the nefarious ends of their corporate

¹⁷⁴ Hughes, *Citizen Cyborg*. 172

¹⁷⁵ More quoted in Hughes, *Citizen Cyborg*. 173

¹⁷⁶ Goertzel and Bugaj, *The Path to Posthumanity*. 15

¹⁷⁷ Tirosh-Samuelson, “Engaging Transhumanism.” 24

manufacturers,”¹⁷⁸ it is also true that many transhumanist authors are employed in helping produce actual enhancement technologies.¹⁷⁹ Whether enhancements will be part of a corporate consumer culture is primarily determined by social and political policies.

At present, it is clear not everyone is in support of cognitive enhancements,¹⁸⁰ but as they become increasingly available, either through pharmaceuticals or implanted devices, “it is possible that social support for people who refuse to take advantage of enhancements will diminish.”¹⁸¹ But this would require CE to firstly become available to a large portion of the population. One of the most important issues in making enhancements widely available is “to consider whether future cognitive enhancement would be expensive (like good schools) or cheap (like caffeine).”¹⁸² As with any product, after initial development costs, an economy of scale emerges, making the possibility for widespread use greater; current cognitive enhancements, like drugs, while having large startup costs, are relatively cheap to manufacture.¹⁸³ Many see that the possibility for rapidly decreasing costs for enhancements. When coupled with large societal demand for enhancements, and careful policy enactments that enable affordable enhancing, the rich-poor divide in access to enhancements could be virtually erased.^{184,185}

One thing to consider when evaluating the economic benefit of cognitive enhancements is in considering network effects. Firstly, Savulescu and Sandberg note that forgetfulness and its network effects cost hundreds of millions a year—in Britain

¹⁷⁸ Rifkin quoted in Hughes, *Citizen Cyborg*. 65

¹⁷⁹ For example, Max More is CEO of Alcor Life Extension, Kurzweil is director of engineering at Google working on intelligent voice-recognition systems, and Ben Goertzel is CEO of Novamente, an software development firm working on artificial intelligence

¹⁸⁰ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 58 – Naam outlines a survey that indicates different countries vary greatly in their approval of human enhancement.

¹⁸¹ Sandberg, “Cognition Enhancement: Upgrading the Brain.” 84

¹⁸² Anders Sandberg and Julian Savulescu, “The Social and Economic Impacts of Cognitive Enhancement,” in *Enhancing Human Capacities*, ed. Julian Savulescu, Ruud Ter Meulen, and Guy Kahane (Oxford: Blackwell, 2011), 93

¹⁸³ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 62

¹⁸⁴ Kurzweil, *The Singularity Is Near: When Humans Transcend Biology*. 469

¹⁸⁵ Hughes, *Citizen Cyborg*. 52

alone.¹⁸⁶ They contend that widespread cognitive enhancements—particularly ones that enhance memory and recollection—will result in a substantial reduction of losses—including deaths resulting from carelessness, or medical errors. Secondly, while some believe that enhanced humans will gain a competitive advantage over unenhanced humans, one that will force a new social divide, Buchanan notes that the opposite might be true; some cognitive enhancements will not only have networked effects for others who are not enhanced, such as greater policies and ways of approaching inequality, but that it is wrong to think of enhancements as a zero-sum situation.¹⁸⁷ Instead, it's plausible that cognitive enhancements will actually benefit both individuals and groups as more people become enhanced, as it will allow greater collaboration. Furthermore, studies indicate that higher intelligence levels often correlate with higher wages, less debt, and contribute more to their country's economy,¹⁸⁸ indicating that a society that openly embraces and actively pursues making cognitive enhancement affordable and widely available will most likely see an increase in productivity and economic gains. Such a society would thus be at a better vantage point to provide care for those in need.¹⁸⁹

Despite the growing disparity between rich and poor, access to technology—and the benefits and negatives it allows—is increasingly common: “in real terms, the poor of the world are closing the gap with the rich—in life expectancy, in education, in access to technology.”¹⁹⁰ For example, in the mid-1990s there was major concern regarding the digital divide—who had access to computers and the Internet and who did not—which has since reduced dramatically due to rapidly falling prices for basic technologies.¹⁹¹ However, other parts of the world have remained steady in their lack of access to technology, partly because of weak public institutions, poor education, economics and

¹⁸⁶ Sandberg and Savulescu, “The Social and Economic Impacts of Cognitive Enhancement.” 95

¹⁸⁷ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 38

¹⁸⁸ Sandberg and Savulescu, “The Social and Economic Impacts of Cognitive Enhancement.” 96-97

¹⁸⁹ Whether enhancements will be corporately-owned or publicly funded is a much larger discussion, one that this thesis cannot adequately encompass.

¹⁹⁰ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 75

¹⁹¹ Sandberg and Savulescu, “The Social and Economic Impacts of Cognitive Enhancement.” 99

infrastructure to support newer technologies.¹⁹² This would indicate that with emerging enhancements, it is crucial that federal policies be put in place to ensure the greatest access to cognitive enhancements.^{193,194}

1.7 Public Policy & Regulation

At this point in the human enhancement debate, Buchanan insists that “what is needed is policy proposals for coping with the challenges of enhancement that are definite enough to be of some practical use, not an endless iteration of the pros and cons of enhancement.”¹⁹⁵ At present, academic research regarding cognitive enhancement is predominantly restricted to recognized medical pathologies, meaning funding is only allocated if researchers can prove their work is primarily used for therapeutic and restorative uses. The result is “researchers find it difficult—even impossible—to secure funding to study potential cognitive enhancers,”¹⁹⁶ which causes several bad outcomes. First, it forces researchers to look to what is one of the greatest sources of funding for enhancement: military contracts. While military funding contributes a great deal financially, it forces enhancement projects to keep military interests first and foremost, and pushes enhancement out of the realm of transhumanism and into something potentially used for warfare, something transhumanists generally disapprove of.¹⁹⁷ For over ten years the Defense Advanced Research Projects Agency (DARPA) has investigated brain-computer interfaces that will allow soldiers to communicate directly to one another, and to control devices by thought.¹⁹⁸

¹⁹² Ibid.

¹⁹³ Bostrom in “Welcome to a World of Exponential Change.” 48 notes that policy makers need to fund more emerging technologies, and may find that funding things that enhance our intellect will result in us being better poised to solve other pressing issues like global warming. Bostrom suggests even reducing funding to global warming in order to pursue enhancements. Buchanan (2) notes that something like global warming may only be solved if humans enhance their cognitive capacities.

¹⁹⁴ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 75 – proposes that governments, if the market does not bring prices down fast enough, should be prepared to step in to ensure access

¹⁹⁵ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 244

¹⁹⁶ Bostrom and Roache, “Smart Policy: Cognitive Enhancement and the Public Interest.” 143

¹⁹⁷ Bostrom, “In Defense of Posthuman Dignity,” 56, argues that transhumanists actively fight against military abuse of enhancements that may endanger lives

¹⁹⁸ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 178

Secondly, societies that refuse to acknowledge that therapeutic technologies will undoubtedly be used for enhancement, which is already occurring, will be unable to effectively regulate or establish safety guidelines.¹⁹⁹ As the line between therapy and enhancement quickly blurs, the result is twofold: cognitive enhancements that piggy-back on innovations geared towards treatment are likely to receive more funding than if they were strictly proposed as enhancements, while reducing or even eliminating the “opportunity for democratic, scientifically informed decisions about its comparative worth.”²⁰⁰ Central to transhumanism are democratic decisions on how enhancements are used and regulated: such choices are only possible by informing the public of the complexity of the issues. Any society that allows enhancements to become widespread either by abusing therapy technologies, black market enhancement, or forcing citizens to seek enhancement operations in other countries will be unable to control enhancement use, and are more susceptible to a plethora of negative outcomes.²⁰¹

Just as Buchanan insists human enhancement discussions must become part of a larger body of politics and society-wide information campaigns, Hughes, Miller and Wilsdon also believe that the debate must be moved outside of the confines of the transhumanist sphere.²⁰² As technological advances may become exponentially faster, it is crucial that cognitive enhancement be acknowledged by policy makers and governments on a global scale, with Buchanan suggesting a global institute be formed in order to promote global justice and equality that is specific to dealing with enhancement issues.²⁰³ It is important to note that “when transhumanists refer to ‘technology’ as a primary means of effecting changes to the human condition, this should be understood broadly to include the design of organizations, economies, polities, and the use of

¹⁹⁹ Ibid., 40

²⁰⁰ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. 17

²⁰¹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 6

²⁰² Miller and Wilsdon, “Stronger, Longer, Starter, Faster.” 23

²⁰³ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*. – Buchanan dedicates an entire chapter to a detailed policy proposal on forming and operating a Global Institution for Justice through Innovation (GIJI). See pages 243-279.

psychological methods and tools.”²⁰⁴ Transhumanists insist that new policies must go hand-in-hand with technological innovation.

The Action Group of Erosion Technology and Concentration (ETC) argues that society should follow a ‘precautionary principle,’ which states “no technology should be used until its risks are fully assessed.”²⁰⁵ While transhumanists strongly believe in risk assessment prior to allowing any enhancement to be used or commercialized, Hughes points out “What exactly are all the risks of any technology fully assessed, and what do you do in the meantime?”²⁰⁶ The obvious problem here is that emerging technologies such as cognitive enhancements may rapidly become available—legally or otherwise—and push towards a rushed political debate concerning their use, if not skipping political debate altogether.

Fukuyama, among most anti-enhancement critics, argues that there needs to be a clear line between technologies for therapy, and technologies for enhancement. He writes, “The original purpose of medicine is, after all, to heal the sick, not to turn healthy people into gods.”²⁰⁷ Agar contends we have two options: to make radical enhancements mandatory for all citizens, or enact a complete ban (which he is much more in favor of).²⁰⁸ However, banning cognitive enhancements is an incredibly complex issue, as even Fukuyama notes that a ban in one country will only push development into another area of the world.²⁰⁹ Countries that ban cognitive enhancement research and technologies will also force their citizens to seek enhancement elsewhere, causing only the wealthiest to have access. Naam expands on the complexity of a complete ban, “A ban would make enhancement procedures more expensive by creating a black market with an artificially high price, further separating the rich and poor. It would add risk for those who sought enhancement, by removing any possibility of safety regulations. Furthermore, a ban

²⁰⁴ More, “The Philosophy of Transhumanism.” 4

²⁰⁵ Hughes, *Citizen Cyborg*. 118

²⁰⁶ *Ibid.*

²⁰⁷ Fukuyama, *Our Posthuman Future*. 208

²⁰⁸ Agar, *Humanity’s End: Why We Should Reject Radical Enhancement*. 173-4

²⁰⁹ Fukuyama, *Our Posthuman Future*. 11

would hinder scientific progress, as long-term studies on the effects of these technologies would be impossible.”²¹⁰ Both transhumanists and anti-enhancement advocates see a complete ban as unlikely.

Nicolas Agar proposes that only *moderate* enhancements be permissible, which would include any enhancement that allows all humans to achieve higher capacities that other humans have already achieved, such as genetically engineering all children to be as smart as Einstein and as good at tennis as Roger Federer.²¹¹ Agar’s argument however comes apart when we consider that if future generations are enhanced enough so that each and every person is say, as intelligent as Einstein, then it is likely they will soon make discoveries beyond what Einstein was capable of, and in doing so, will push the boundaries of what humans have already achieved. Enhanced humans would see it permissible to enhance subsequent generation to their new current capacities, and over time continually push that boundary further and further.

Sandberg suggests that enhancements should be widely available, as individuals should have the right to modify their own bodies.²¹² He sees that previous methods of body modification and control—through tattooing, abortion, birth control, among others—have liberated individuals from state control and allowed for better expression of personal identity and needs.²¹³ At the same time, Sandberg, along with Savulescu, believes that initial enhancements should be made available on a need-basis, in order to ensure social classes do not dramatically separate.²¹⁴ There is considerable concern that enhancements—particularly cognitive enhancements—will exacerbate social inequality, and rightfully so. James Hughes advocates for a particular strain of transhumanism called *democratic transhumanism*, where establishing social structures and policies that protect individual rights and ensuring universal access are crucial to society and the world at

²¹⁰ Naam, *More Than Human*. 6

²¹¹ Agar, *Humanity’s End: Why We Should Reject Radical Enhancement*. 17

²¹² Anders Sandberg, “Morphological Freedom — Why We Not Just Want It, But Need It,” in *The Transhumanist Reader*, ed. Max More and Natasha Vita-More (John Wiley & Sons, 2013), 56-57

²¹³ *Ibid.*

²¹⁴ Sandberg and Savulescu, “The Social and Economic Impacts of Cognitive Enhancement.”

large in the coming years.²¹⁵ Caplan points out that the core issue is not that our minds and bodies may become enhanced, augmented, or even be recognized as a new species, but rather that there are social and political structures that perpetuate inequalities between races, genders and economic classes.²¹⁶ Emerging technologies cannot be used to the benefit of society if such strong inequalities are allowed to exist. Transhumanists believe education, public debate, and political change are necessary—and soon—before enhancements have the opportunity to worsen existing issues.²¹⁷

However, before any real policy or regulations can be effectively drafted and enacted, there needs to be serious ethical deliberation. Human enhancement technologies are radically different from each other, both in the way they are used, as well as how they are developed. The debate thus far has considered cognitive enhancement to be a single category of human enhancement, often focusing entirely on genetic engineering and pharmaceuticals. The problem is that various types of cognitive enhancements raise different ethical considerations, and consequently lead to different forms of policy and regulation. So far I've shown that those involved in the debate over cognitive enhancement argue from a multitude of viewpoints, challenging the political, economic and social implications of these emerging technologies. For the most part they deal with how these technologies will be developed; how they will be distributed amongst members of society; and how those enhanced humans will interact with each other as well as unenhanced citizens—all of these arguments, whether stated explicitly or not, deal with ethical principle. Many touch on how these technologies can be used to avoid worsening existing inequalities, particularly those between economic classes, which is fundamentally an issue of distributive justice. Others focus on how these technologies may be used to create the greatest outcome for as many people as possible, which is clearly utilitarian. Lastly, some argue human enhancement violates the natural world and the natural order of things, threatens human nature and human dignity—these are all deontological positions. As I've shown, major positions focus on any number of

²¹⁵ Hughes, *Citizen Cyborg*. 41

²¹⁶ Caplan, "Is It Wrong to Try to Improve Human Nature?" 36

²¹⁷ Bostrom, "In Defense of Posthuman Dignity." 59

philosophical, sociological, economical, statistical or political issues at hand, with the overall direction of the debate moving towards bringing these disciplines together in order to inform policy and to help shape and regulate emerging HETs. However, at this point, the debate requires some narrowing, as it is difficult—if not impossible—to attempt to regulate such broad technologies as genetic engineering, artificial limbs and organs, and brain-computer interfaces as if they were all the same. Each technology requires its own evaluation and discussion. Therefore, before I can explore the ethical questions and considerations of cognitive enhancement through BCIs, I have to illustrate what specific technologies exist today, how they are used, how they are developed, and the types of BCIs in development for use in the near future.

2 Brain Computer Interfacing

You know in the year 2000 we'll all be on speed dial. You'll just have to think of a person, and they'll be talking to you. It'll be like whoa, getting a call here.

—Cosmo Kramer. *Seinfeld*

2.1 Introduction

Transhumanists use the term ‘cognitive enhancement’ as a way of generally referring to a variety of technologies used to enhance brain function—from pharmaceuticals that increase focus to futuristic intelligent brain implants. This thesis is particularly interested in technologies that facilitate interaction between the brain and electronic devices, a field broadly known as brain-computer interfacing. These technologies are blanketed by the more general term ‘neuroprosthetics,’ which refers to any technology that interacts with the nervous system, such as cochlear or retinal implants. These devices can help facilitate communication by receiving external stimulation and relaying it to the brain, but brain-computer interfaces (BCIs) specifically offer non-muscular communication output that the user can control.²¹⁸ The term BCI encompasses both surgically implanted devices, as well as non-invasive technologies that record brain activity.

BCIs are currently one of the most significant areas of research that are considered part of cognitive enhancement, as they offer not only an alternative to traditional communication methods, but they also suggest the possibility of enhancing it; allowing humans to speed up communication,²¹⁹ extend communication beyond the body’s physical limitations,²²⁰ and seamlessly merge information systems with the human mind.

²¹⁸ Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 3

²¹⁹ Circumventing the body in order to communicate, and relying on the brain communicating directly with other people and devices

²²⁰ Such as how far one can hear, see or shout

Furthermore, experiments in BCI research continually add to the growing body of knowledge as to how the brain functions, both in terms of its individual parts as well as the system as a whole.

2.2 History of BCIs

The first experiments with recording human brain function—and the beginning of brain-computer interfacing—began in 1924, when Hans Berger, a German scientist, recorded electrical brain activity through the human scalp.²²¹ His method involved placing electrode receivers on the scalp, a technology called electroencephalography (EEG), which is widely used today. Unfortunately, not only was the technology of the time far too crude to accurately measure the signals, but the understanding of the brain's functions and particularly electrical signals produced by the brain was in its infancy. Because neuroscience had barely scratched the surface of understanding how different parts of the brain functioned and interacted with each other, initial research into rudimentary brain-computer interfacing was slow and limited.

In the 1950s, Jose Delgado, a physiologist at Yale University, began implanting electrodes into the brains of live animals in an effort to understand brain function. His work, published in *Physical Control of the Mind* in 1969, described the process of stimulating electrodes within the brain using a type of radio receiver called a stimoceiver, and recording the types of electrical outputs during various exercises with the animals. Delgado had studied the electrical output in the brain of a bull during aggression, discovering which section was responsible for the behaviour. One of his most prolific experiments involved Delgado himself using a red sheet to taunt the bull—already implanted with an electrode in the brain and stimoceiver in the skull. The bull rushed Delgado, who activated a transmitter device that activated the stimoceiver to send an electrical pulse to the part of the brain most active during aggression. In response, the

²²¹ Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 1

bull halted immediately, and retreated.²²² Delgado's work extended to implanting similar devices in primates in order to understand brain activity, where "he found that he could electronically control sleep, appetite, sexual arousal, aggression, and even social behavior."²²³ Delgado's work greatly contributed to understanding how parts of the brain functioned and interacted, and led to what is now known as Deep Brain Stimulation (DBS), which implants devices into the brains of patients with a variety of mental illnesses in order to electrically stimulate damaged areas. Although even current DBS systems only allow input into the brain and not output to external devices, this type of technology indicates that implantable devices can be used to alter human behaviour in a variety of ways, which is a form of cognitive enhancement.

The first functioning BCI implant came about in 1964 when Dr. Grey Walter implanted a small electrode to the motor areas of a voluntary patient's brain during an unrelated surgery.²²⁴ Afterwards, Walter gave the patient control of a slideshow, where whenever the patient wished to move the slide forward, he would press a button, and Walter would record changes in his brain activity. Walter identified a specific electrical signal that was produced anytime the patient advanced the slide, so he deactivated the patient's button, and instead hooked up the slideshow to advance whenever the patient thought about pressing the button. However, Walter found that the BCI system was faster than the patient—the BCI registered the patient's thought faster than the body, and so the slide would move before the patient actually pressed the button. This resulted in a jarring effect on the patient, as the slide would move just slightly before they pressed the button each time, so Walter had to delay the reaction of the BCI to meet the patient's expected reaction time to when the slide should advance.

²²² Jose M.R. Delgado, *Physical Control of the Mind: Toward a Psychocivilized Society* (Toronto: Fitzhenry & Whiteside Limited, 1969), 168-70

²²³ Ramez Naam, *More Than Human: Embracing the Promise of Biological Enhancement* (New York: Broadway, 2005), 193

²²⁴ Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller, "Brain-Computer Interfaces: A Gentle Introduction," in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 2

The term BCI was coined by Jacques J. Vidal, a professor at UCLA's Brain Computer Interface lab, who in 1976 produced a functioning BCI for basic communication. The device he and his team built allowed a user to control a cursor through a two-dimensional maze,²²⁵ indicating that brain activity could be processed to allow people to control external objects and software. The 1970s also saw advances in BCI research to augment both sight and hearing. The first camera-brain interface was an electrode implanted into a blind patient's visual cortex, and allowed them to 'see' flashes of light.²²⁶ In 1979, the first auditory brainstem implant was used, which allowed patients with cochlear damage to bypass the ear entirely, and receive audio from a device partially implanted on the side of their head.²²⁷ However, these early predecessors to the cochlear implant used widely today²²⁸ had very poor speech perception, but did allow patients to more easily read lips.

BCI research increased dramatically in the mid-1980s, as advances in science—particularly understanding of brain functions—alongside the development of faster, more powerful, and cheaper computers have driven the merging of computer science with medicine in order to meet the needs of people with disabilities.²²⁹ BCI research centered around working with patients with advanced forms of neuromuscular disorders like amyotrophic lateral sclerosis (ALS, or Lou Gehrig's Disease), who in later stages of the disease become 'locked-in,' meaning they are unable to communicate or move in any way. The goal of much of the research at the turn of the century—and continuing on today—was concerned with restoring communication functions to improve quality of life.

²²⁵ Ibrahim Arafat, "Brain-Computer Interface: Past, Present & Future" (presented at the International BCI Conference, Austria: academia.edu, 2011). 3

²²⁶ Ryszard Tadeusiewicz, Pawel Rotter, and Mark N. Gasson, "Restoring Function: Application Exemplars of Medical ICT Implants," in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 50

²²⁷ Iver A. Langmoen and Jon Berg-Johnsen, "The Brain-Computer Interface," *World Neurosurgery* 78, no. 6 (December 2012): 573

²²⁸ 188,000 people use cochlear implants as of 2009, cited in Frederic Gilbert, "Nano-bionic Devices for the Purpose of Cognitive Enhancement: Toward a Preliminary Ethical Framework," in *Cognitive Enhancement: An Interdisciplinary Perspective*, ed. Andreas G. Franke and Elisabeth Hildt, Trends in Augmentation of Human Performance 1 (Dordrecht: Springer, 2013)

²²⁹ Jonathan R. Wolpaw et al., "Brain-Computer Interfaces for Communication and Control," *Clinical Neurophysiology* 113 (2002): 767

In 1999, “Birbaumer and colleagues reported the first two locked-in patients using a BCI to communicate messages,”²³⁰ which allowed them to use an EEG-based BCI to slowly select letters from an array. One of these two patients was able to use the BCI without assistance, and began to write letters to friends and family.

At the University of Berkeley, researchers working on camera-brain interfaces implanted a small chip into a cat’s thalamus, which is the area of the brain the processes visual signals.²³¹ In 1999, they recorded electrical output from the electrode in short bursts, which they used to reconstruct low quality images of what the cat saw. Due to the physical limits of the implant—mainly the low number of electrodes and data transfer rate—the images were very small, but are “recognizable versions of the scenes played out before the cat’s eyes.”²³²

In 1999, the First International Meeting of Brain Computer Interfacing took place in New York, bringing together a wide range of experts from a diverse group of disciplines, including neuroscience, biology, computer science and business.²³³ At this time, “there were only one or two dozen labs doing serious BCI research. However, BCI research developed quickly after that... There are at least 100 BCI research groups active today [2010], and this number is growing.”²³⁴ Due to the ease of designing and testing BCIs that do not require a surgical procedure, a large portion of BCI research focuses on non-invasive systems.

²³⁰ Femke Nijboer and Ursula Broermann, “Brain-Computer Interfaces for Communication and Control in Locked-in Patients,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 189

²³¹ Robert Sanders, “Reconstructed Movie Showing Animal View of World Proves Scientists Have a Good Understanding of How the Brain Processes Visual Information,” *Berkeley.edu*, October 15, 1999.

²³² *Ibid.*

²³³ Arafat, “Brain-Computer Interface: Past, Present & Future.” 1

²³⁴ Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 2

2.3 Non-invasive BCIs

There are generally two broad categories of brain computer interfaces: non-invasive (technologies that typically record brain activity through sensors placed on the scalp) and invasive (technologies that are surgically implanted). At present, surgically implanted BCIs are not only generally more expensive, but also carry far greater risks to the patient's health. A significant portion of current BCI research concerns non-invasive technologies, which in many ways provide the building blocks for future implants; by experimenting with recording various types of brain activity, the collective body of knowledge as to how various parts of the brain interact with each other grows,²³⁵ which in turn nurtures research into the development of devices that replace or supplement specific capabilities of the brain (memory, reasoning, empathy, etc.).

There are three leading types of non-invasive neuroimaging technologies used in current BCI research: electroencephalography (EEG), which records electrical charges that take place during brain activity and is the most widely used; magnetoencephalography (MEG), which examines magnetic fields created from the electrical output of the brain; and functional magnetic resonance imaging (fMRI), which measures small changes in blood oxygenation that occur during brain activity.²³⁶ However, both MEG and fMRI are more expensive than EEG, which is relatively cheap in comparison.²³⁷ MEG requires a magnetically shielded room to prevent external magnetic waves—however minute—from interfering with the machine, making MEG both expensive to build, as well as impractical for mobile applications. Similarly, fMRI machines are large and cumbersome, making them poor candidates for popularizing

²³⁵ Jonathan R. Wolpaw et al., "Brain-Computer Interfaces for Communication and Control," *Clinical Neurophysiology* 113 (2002): 767

²³⁶ *Ibid.*, 768

²³⁷ Graimann, Allison, and Pfurtscheller, "Brain-Computer Interfaces: A Gentle Introduction." 6

BCIs. EEG technologies, however, are easily portable and lightweight,²³⁸ and are “the most practical modality—if we want to bring BCI technology to a large population.”²³⁹

EEG-powered BCIs generally have the same setup: a cap that consists of electrode sensors that is placed on the patient’s scalp, usually with a layer of conductive gel in between. The cap is connected to an amplifier, which then connects to a computer. The basic hardware setup plus a wide variety of software applications make the device flexible and open to further development. A two-day BCI workshop called Brainihack was held at Google’s Tel Aviv campus in November 2013, where teams of developers, neuroscientists and artists competed to rapidly develop BCI software using standard EEG-cap type hardware.

The most basic BCI software system is the P300, which works by presenting the user with an array of options (such as letters or numbers) which randomly flash on screen. As the user focuses on the object they wish to select, the BCI hardware registers spikes in brain activity that occur when the user sees their object highlighted. As a result, the BCI software records these spikes and aligns them with what object was highlighted at the moment of heightened brain activity. While the P300 can be slow to use for communication purposes, users typically adjust to the device within just a few minutes.²⁴⁰

The majority of EEG-based BCIs to date have been used for medical purposes, specifically to restore lost communicative capacities due to spinal cord or brain injury, or degenerative disease. Among the most common causes for lost communication are abilities “Amyotrophic lateral sclerosis (ALS), brainstem stroke, brain or spinal cord injury, cerebral palsy, muscular dystrophies, and multiple sclerosis,” which in 2002 collectively “affected nearly two million people in the United States alone, and far more

²³⁸ Ibid.

²³⁹ Robert Leeb and Jose Del R. Millan, “Brain-Computer Interfaces and User Experience Evaluation,” in *Towards Practical Brain-Computer Interfaces: Bridging the Gap from Research to Real-World Applications*, ed. Brendan Allison et al. (New York: Springer, 2012), 108

²⁴⁰ Graimann, Allison, and Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction.” 11

around the world.”²⁴¹ Patients with ALS are among the most common users of BCIs, as it is a neurodegenerative disease that progressively paralyzes muscle groups throughout the body, but most often leaves mental function intact.²⁴² As the disease progresses, patients eventually become referred to as ‘locked-in,’ as they lose all ability to control and move their body, but the brain remains active. ALS patients most commonly use P300-based BCI systems: they choose one letter at a time from a grid displayed on a computer screen.

One of the most troubling aspects of ALS is that as patients get progressively worse, many consider their quality of life to be very low, since they are increasingly unable to interact with the outside world, and find expressing themselves extremely difficult.²⁴³ As a result, some ALS patients refuse to receive artificial nutrition and ventilation to keep themselves alive. Current BCI technologies not only provide an opportunity to restore a basic level of communication, but the rapid speed of technological advancement and expanding interest in BCI technologies in general—not to mention increasing grants and budget allocations from a variety of institutions going to BCI research—indicate that future BCIs will provide better, more affordable, and more mobile systems that may even fully restore communication for ALS patients.

German pharmacist Ursula Broerman developed ALS in 2003, rendering her unable to work. Broerman began receiving artificial ventilation and nutrition in order to stay alive. She is almost entirely unable to move, yet using an EEG-based BCI, continues to communicate with her family and friends; she even published academic work, writing about her experience using a BCI. When asked why she chose to be artificially respirated, and communicate using a painstakingly-slow BCI, she replied, “Life is always beautiful, exciting and valuable.”²⁴⁴

²⁴¹ Wolpaw et al., “Brain-Computer Interfaces for Communication and Control.” 768

²⁴² Femke Nijboer and Ursula Broermann, “Brain-Computer Interfaces for Communication and Control in Locked-in Patients,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 186

²⁴³ *Ibid.*, 187

²⁴⁴ *Ibid.*, 191

EEG-based BCIs have also been used in a variety of non-medical applications. Using a P300-based software, Bayliss and Ballard had users control appliances in a 3D virtual smart home. Flashing spheres would appear randomly over various devices in the simulation (a TV or a light for example), and the user would focus on the appliance they wanted to turn on or off. The system recorded at which points electrical output from brain activity was strongest in order to analyze which virtual appliance the user was focusing on. In 2012, a group the University of Twente in The Netherlands developed simple a video game called Mind The Sheep!, which presented the player with a top-down perspective of a field with ten sheep and three dogs. The user would focus on which dog they wanted to move while simultaneously using a mouse to select where they wanted that dog to move. When the mouse button was released, the system would analyze which dog they were focusing on, and move it to the location they selected, with the goal of herding the sheep into a pen. These game-type BCIs, despite having incredibly simple and even mundane gameplay, indicate that BCI research has extended beyond restoring human functions, and has begun enhancing them. BCIs let healthy users control external activities and keep their hands free to complete other complex tasks.

Despite the prevalence of EEG technology in BCI research and development, there are currently significant technological limitations. EEG sensors on the scalp are susceptible to forms of bioelectrical activity created by body movements, where even electrical output from eye movements or blinks cannot be distinguished from electrical activity in the brain, causing the output data to be easily skewed.²⁴⁵ The frequency range is also very narrow, meaning that the types of activities possible with EEG-based BCIs are limited; moving a cursor on a 1-dimensional plane is exponentially easier than in a 3D space due to the limited number of different thought patterns that are discernable through EEG. EEG-based BCIs have traditionally suffered from very low information transfer rates,²⁴⁶ which limits the complexity of BCI software and possible applications. In 2002, Wolpaw et al. commented that, “many possible applications of BCI technology,

²⁴⁵ Graimann, Allison, and Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction.” 6

²⁴⁶ Wolpaw et al., “Brain-Computer Interfaces for Communication and Control.” 767

such as neuroprosthesis control, may require higher information transfer rates,²⁴⁷—at the time, BCI-controlled prosthetic limbs had yet to be used with any success. Since then, several prominent cases of BCI-controlled prosthetics have garnered significant acclaim. However, these devices and software applications suffer from low accuracy rates, with 70% accuracy being considered acceptable, “which is rather low compared to traditional input technologies.”²⁴⁸ This means that users typically struggle to control prosthetics and external devices using EEG technologies, in comparison to implanted BCIs, which have had much greater accuracy and ease of use.²⁴⁹

Despite EEG signals that are “very weak, noisy and non-stationary, there is an entire research area in signal processing and classification aiming to derive a stable control signal from the complex brain activity that enables reliable BCI control,”²⁵⁰ creating increasingly inexpensive, commonplace EEG-based BCIs. In 2009, Mattel commercially released an EEG-based BCI toy called Mindflex, which had users control a ball through an obstacle course.²⁵¹ Users pressed buttons on the machine to guide the ball around, while the BCI allowed them to raise or lower it. Despite EEG-based BCIs becoming more commonplace, they are still limited in the complexity of the tasks they can enable. Current EEG-based BCIs are incapable of performing “complex tasks like rapid online chatting, grasping a bottle with a robotic arm, or playing some computer games,”²⁵² compared to implanted devices, which are far more precise.

2.4 Implanted BCIs

Implanted BCIs typically consist of an array of electrodes surgically implanted under the skull, on top of the cortex. EEG-type BCIs consist of electrodes placed on the scalp, and are difficult to place at the exact same positions each time they are applied, which make it

²⁴⁷ Ibid.

²⁴⁸ Melissa Quek et al., “Designing Future BCIs: Beyond the Bit Rate,” in *Towards Practical Brain-Computer Interfaces: Bridging the Gap from Research to Real-World Applications*, ed. Brendan Allison et al. (New York: Springer, 2012), 174

²⁴⁹ Ibid.

²⁵⁰ Ibid., 175

²⁵¹ Scott Stein, “Moving Objects With Mattel’s Brainwave-reading Mindflex,” *CNET*, June 26, 2009.

²⁵² Graimann, Allison, and Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction.” 16

“difficult to record from the same neurons every time or to leave the electrode in place for more than a few months at a time.”²⁵³ Implanted electrodes on the other hand are fixed in place, some of which are “impregnated with neurotrophic factors, which encourage neurons to grow into and around the electrode, anchoring it in place and allowing it to [transmit] for a much longer time.”²⁵⁴ Because of their greater stability and closer proximity to the brain itself, implanted BCIs offer “excellent signal quality, very good spatial resolutions, and a higher frequency range,”²⁵⁵ which allows for greater accuracy in BCI usage, and more complex applications.²⁵⁶

It should be noted that transhumanists, among others, often classify implanted computers and BCI-type devices within the realm of nanocomputing. Nanocomputing refers to a growing field of research that aims to make devices on an atomic scale, by precisely assembling objects using single atoms as building blocks. Contemporary BCI implants—as well as the types of complex BCIs many groups aspire to make—do not necessarily need to be made on a nano-scale. Microcomputing, which is not only less costly but far easier to design and build, is far more likely to become commonplace among implantable BCIs before nanocomputing. Implantable BCI research is, for the most part, developing independently of nanocomputing.

2.4.1 BrainGate

Apart from the high costs and intrusiveness of implanting devices into the brain, not to mention the risks of meddling with the brain’s natural functioning, there are also concerns about the long-term effects of leaving a device inside the brain. There appears to be some inconsistencies within the BCI community, as in 2010 leading BCI research team lead by Bernhard Graimann wrote, “It is unclear whether both ECoG and

²⁵³ Kerri Smith, “Brain Implant Allows Mute Man To Speak,” *Nature News*, November 21, 2008.

²⁵⁴ *Ibid.*

²⁵⁵ Graimann, Allison, and Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction.” 8

²⁵⁶ Johnathan R. Wolpaw and Chadwick B. Boulay, “Brain Signals for Brain-Computer Interfaces,” in *Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction*, ed. Bernhard Graimann, Brendan Allison, and Gert Pfurtscheller (New York: Springer, 2010), 37

intracortical recordings can provide safe and stable recordings over years.”²⁵⁷ While it is true that many brain implants to date “have eventually failed because of moisture or other perils of the internal environment,”²⁵⁸ a device called BrainGate has had great success, and drawn much attention.²⁵⁹ BrainGate, a combination system of software and hardware that can “directly sense electrical signals produced by neurons in the brain that control movement,”²⁶⁰ seems to have proven implantable devices can safely be left underneath the skull. In November 2013 the BrainGate team announced one of their patients had used the same implant for over 1,000 days without any sign of harm or impairment.²⁶¹

BrainGate was launched in 2002 under the supervision of Dr. John Donoghue and Dr. Arto Nurmikko from Brown University, in conjunction with bio-tech company Cyberkinetics,²⁶² and later joined by researchers from Stanford University, where its development and testing took place at Providence VA Medical Center and Massachusetts General Hospital. In 2005, the first BrainGate device was implanted in Matt Nagle, a tetraplegic, who used the device to successfully control an artificial hand via cables running from the implant—a grid of 96 electrodes implanted in the motor cortex. This marked the first time an implanted device within the brain had allowed control of an artificial limb.²⁶³ A similar system was used in Berlin later that year.²⁶⁴ The BrainGate team is currently working towards “developing and testing a novel broadband wireless, rechargeable, fully implantable version of the brainsensor,”²⁶⁵ as the original BrainGate

²⁵⁷ Graimann, Allison, and Pfurtscheller, “Brain-Computer Interfaces: A Gentle Introduction.” 8

²⁵⁸ “BrainGate Is Still Working 1,000 Days After Implantation,” *Neurogadget*, March 25, 2011.

²⁵⁹ The BrainGate team was awarded the Breakthrough Research And Innovation in Neurotechnology (BRAIN) prize in November 2013, which consists of a \$1million grant. The prize was part of the First International BrainTech Israel Conference.

²⁶⁰ BrainGate Is Still Working 1,000 Days After Implantation.”

²⁶¹ Ibid.

²⁶² Arafat, “Brain-Computer Interface: Past, Present & Future.”

²⁶³ Mark N. Gasson, “Human ICT Implants: From Restorative Application to Human Enhancement,” in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 15

²⁶⁴ Christian Kandlbauer also received an artificial limb, controlled via brain implant. He later became the first person with a mind-controlled prosthesis to obtain a driver’s license in 2009, but unfortunately died in an auto collision in 2010. It is unclear whether the prosthesis contributed to the collision.

²⁶⁵ “BrainGate Team Wins \$1 Million B.R.A.I.N. Prize at BrainTech Israel 2013,” *Neurogadget*, October 15, 2013.

required cables which connected to the implanted chip via an adapter on the scalp. The new BrainGate2, a 4x4mm silicon electrode array, is in pilot clinical studies with animal subjects at Massachusetts General Hospital. Cyberkinetics hopes to make the BrainGate BCI commercially available, indicating that it may be possible for healthy people to have access to implantable BCIs that augment and extend their abilities, allowing them to control external systems via thought.

2.5 DARPA BCI Initiatives

The Defense Advanced Research Projects Administration (DARPA), a research and development arm of the United States Department of Defense, has had a significant presence in the BCI community. In 2008 they began testing the Cognitive Technology Threat Warning System (CT2WS).²⁶⁶ “Basically, a soldier wears an electroencephalogram (EEG) cap that monitors his brain signals as he watches the feed from a 120-megapixel, tripod-mounted, electro-optical video camera with a 120-degree field of view.”²⁶⁷ The system’s basic function is to couple the speed of the computer with the analytical skills of the human mind. The brain perceives tiny changes in movement within the soldier’s field of vision, most of which is not consciously registered. The system uses these tiny electrical pulses of brain activity to highlight portions of the video, in order to draw the full attention of the soldier to a particular area. The goal is to allow soldiers to scan their surroundings, while a computer system analyzes when motion or a potential threat is unconsciously perceived, and to draw attention to that spot. In testing, the CT2WS on its own identified 810 false alarms per hour—things such as birds or swaying branches. To the system, these were perceived as potential threats. “When a human wearing the EEG cap was introduced, the number of false alarms dropped to only 5 per hour, out of a total of 2,304 target events per hour, and a 91 percent successful target recognition rate.”²⁶⁸ The human mind is able to recognize the difference between

²⁶⁶ Bruce Kasanoff, “DARPA’s New ‘Brain-Computer Interface’ Makes You a Pattern Recognition Machine,” *Digital Trends*, October 1, 2012.

²⁶⁷ *Ibid.*

²⁶⁸ *Ibid.*

environmental factors that a computer cannot, but the CT2WS system speeds up how fast a human can recognize actual threats.

Another project of DARPA's, titled Restorative Encoding Memory Integration Neural Device (REMIND), which has received \$16.8 million in funding since 2008,²⁶⁹ is described as "trying to make a biometric model of the hippocampus, in order to produce a neural prosthesis to aid memory."²⁷⁰ The greatest obstacle for the project is uncovering how the brain stores and codes memories. The project work is primarily conducted by the University of Southern California, in partnership with Wake Forest University and the University of Kentucky, and aims to "develop a neural prosthesis for a replacement of memory function lost due to central brain region damage or disease."²⁷¹ The research focuses on areas of the hippocampus used for long-term memory retention in healthy patients, in order to build a microchip that can replace portions of the hippocampus entirely by redirecting information that would normally be destined for the hippocampus to an implant instead. The idea is for healthy minds to be augmented in order to more accurately store memories, as well as recall them in greater detail.

In the same vein as DARPA's typical naming conventions, REPAIR (Reorganization and Plasticity to Accelerate Injury Recovery) looks to discover how the brain analyzes and organizes information.²⁷² The project, lead by teams at Stanford University and Brown University, has a two-year budget of \$14.9 million,²⁷³ and has three primary objectives: "restore impaired sensory function," advance the ability to communicate directly through BCIs, and to control external devices and systems.

²⁶⁹ "DARPA Awards \$2.3million Grant to Restore Lost Memory Function," *USC Viterbi*, n.d., viterbi.usc.edu/news/news/2012/another-grant-for.htm.

²⁷⁰ Geoffrey Ling, "Restorative Encoding Memory Integration Neural Device (REMIND)" (DARPA, n.d.), http://www.darpa.mil/Our_Work/DSO/Programs/

²⁷¹ Walid V. Soussou and Theodore W. Berger, "Cognitive and Emotional Neuroprostheses," in *Brain-Computer Interfaces: An International Assessment of Research and Development Trends*, ed. Theodore W. Berger (New York: Springer, 2008). 113

²⁷² Geoffrey Ling, "Reorganization and Plasticity to Accelerate Injury Recovery (REPAIR)" (DARPA, n.d.), http://www.darpa.mil/Our_Work/DSO/Programs/

²⁷³ Jeremy Hsu, "DARPA's Brain Implants Would Help Replace Mental Function in Wounded Warfighters," *Popular Science*, July 5, 2010, www.popsci.com/technology/article/2010-05/darpas-brain-implants-would-help-replace-mental-function-wounded-warfighters.

DARPA's most ambitious and overtly militaristic project is Silent Talk, a research initiative aiming to allow soldiers to communicate—to both each other and external computer systems—solely via thought. Silent Talk is funded under DARPA's Brain Machine Interfaces Program, which “is providing tens of millions of dollars to MIT, Duke and other universities.”²⁷⁴ DARPA's interest in “giving U.S. soldiers the ability to control tanks, fly planes, and share information purely by thought,” dates back to at least 2005,²⁷⁵ but only officially received funding in 2009 with a \$4 million initial investment.²⁷⁶ Silent Talk currently has three objectives: “First, try to map a person's EEG patterns to his or her individual words. Then, see if those patterns are generalizable—if everyone has similar patterns. Last, construct a fieldable pre-prototype that would decode the signal and transmit over a limited range.”²⁷⁷ The intention is to accelerate reaction times, and to allow soldiers to “control more complex systems than their hands can currently manage.”²⁷⁸ As a project funded and managed by the United States military, the implications for future war are troublesome.²⁷⁹

In June of 2013, DARPA expanded its BCI research with funding to four projects geared more towards commercial production of BCIs than purely academic or military-oriented. The first newly funded by DARPA is a 3D-printed electrode designed by S12, a BCI research group based in Boston. Cognionics is a company developing portable EEG equipment that monitors bioelectric signals from the brain via a portable, low-cost, Bluetooth-powered system. Design Interactive, another firm now funded by DARPA, is working on a DIY EEG headset using existing, off-the-shelf parts. DARPA is also funding OpenBCI, which is an opensource platform to develop EEG-based BCIs. This easily allows institutions, independent agencies and even hobbyists to develop their own BCI applications. “There are a lot of reasons DARPA wants to crowdsource brainwave

²⁷⁴ Hughes, *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future*. 40

²⁷⁵ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 178

²⁷⁶ Arafat, “Brain-Computer Interface: Past, Present & Future.”

²⁷⁷ Ibid.

²⁷⁸ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 178

²⁷⁹ Due to the length of this thesis, I cannot adequately address concerns about warfare and military ownership of emerging technologies.

research. The data can be used to refine soldier training, treat post-traumatic stress disorder, study the effects of torture, triage medical diagnoses on the battlefield, harness the human subconscious.”²⁸⁰

In 2003, DARPA funded a research project at Duke University, led by Miguel Nicolelis and John Chapin. The team implanted electrodes into the brains of rhesus monkeys to study their neural activity. The monkeys were given a joystick that controlled an external robotic arm, which the monkeys quickly figured out how to use. Nicolelis and Chapin found patterns emerged when the monkeys used the joystick in different ways, allowing them to “predict how the robot arm would move in response to the activity in the monkey’s motor cortex. In trial after trial, their predictions matched what really happened.”²⁸¹ Nicolelis and Chapin had effectively discovered what regions of the brain were responsible for specific movements. They then disconnected the joystick, and instead let their BCI software move the robotic arm based on what the monkeys *thought*, before they even used the inactive joystick. With a slight delay in the BCI, the monkeys would use the joystick, and the robotic arm would move accordingly. In later studies, the monkeys learnt to control the robotic arm without using the joystick at all, indicating that the brain was no longer sending signals to the monkey’s arm to move the joystick, and that the monkey had “incorporated an external device as a natural extension of the body.”²⁸² Nicolelis has since gone on to give monkeys control of a virtual avatar that allows for multiple limbs to move independently of each other; the research indicates that groups of neurons control movement rather than single neurons as previously believed.²⁸³

These samples of DARPA’s many BCI projects showcase the diverse ways in which this technology is developing. While many of these projects have stated goals of repairing cognitive capacities for the wounded, it is easy to see how they extend themselves to enhancing those same capacities. Indeed much of the research done on

²⁸⁰ Adrienne Jeffries, “Can DARPA Spark a DIY Brain-scanning Movement?,” *The Verge*, September 22, 2013.

²⁸¹ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 179

²⁸² *Ibid.*, 180

²⁸³ “Monkeys in Nicolelis Lab Control Both Arms On a Virtual Avatar Using Just Their Brain Activity,” *Neurogadget*, November 13, 2012.

BCIs lends itself to enhancing communication for military purposes, with a clear possibility for future civilian applications. DARPA—as with many of the other research teams I have showcased—are beginning to look to BCIs enhancement not as a science fictional idea of the distant future, but rather as a reality not too far off from today. Many research outfits outline a distinct plan for moving BCI research increasingly towards enhancing human cognition.

2.6 Aspirations of Current Research

At present, it is implausible to implant BCI-type devices into healthy human brains simply to experiment with ways in which to enhance communication—the safety risks are too great to undertake without any serious medical necessity.²⁸⁴ Thus nearly all implanted BCIs are confined to therapeutic purposes. However, transhumanist Ramez Naam notes, “The urge to help and heal will propel the design of more sophisticated implants and safer surgical procedures to implant them. It will teach us more about how the brain works, and it will gradually introduce the idea of brain implants to the general public. This will blunt the shock that will come when people begin using these implants to enhance themselves rather than cure disease.”²⁸⁵ As medical research into BCIs continues, along with myriad research into neuroscience done across the world, the body of knowledge as to how the brain functions increases. With increased knowledge of how parts of the brain work together, BCI research and development becomes more advanced, increasingly the likelihood that BCIs may become commonplace as an enhancement. And it is not only transhumanists who see the plausibility in BCI enhancement: the Natural Science Foundations reported in 2002 that in the coming decades, the convergence of nanotechnology with neuroscience and communication technologies may make BCIs affordable and widespread.²⁸⁶ They envision implanted BCIs being used to access the

²⁸⁴ Naam, *More Than Human: Embracing the Promise of Biological Enhancement*. 176

²⁸⁵ *Ibid.*, 176-177

²⁸⁶ Mihail C. Roco and William Sims Bainbridge, *Converging Technologies for Improving Human Performance* (Dordrecht, The Netherlands: National Science Foundation, 2003).

Internet and communicate with others, and some believe this may even be possible by 2030.²⁸⁷

Retinal implants like the Dobbelle Vision System²⁸⁸ and Second Sight²⁸⁹ bypass the damaged or injured human eye to transmit visual data received through small cameras directly onto the visual cortex. The effect is that blind humans have been able to regain some level of vision, with some even able to drive.²⁹⁰ Technologies such as these demonstrate that digital information can be sent directly into and processed by the human brain. This would suggest that *other* visual data can be streamed into the brain as well, such as video or images from remote locations, so long as it is received by the implant and transmitted to the visual cortex. Similarly, cochlear implants bypass the eardrum entirely by receiving sound, turning it to digital information, and transmitting it directly into the cochlear nerve. These two technologies together—retinal and cochlear implants—suggest that digital information may be used to augment healthy humans and their senses. External data received from the Internet may be transmitted directly into the cochlea and visual cortex, and allow humans to superimpose other information over their existing perceptions.²⁹¹

Aside from these hypothetical future BCIs, many researchers today express interest in refining and improving upon existing BCIs. It is clear that research will continue to improve upon existing devices, making the possibility for cognitive enhancement increasingly a reality. However, while much of BCI research takes place in medical contexts, there is considerable growth in BCI development by independent groups of engineers and computer scientists. These groups have yet to look to implanted

²⁸⁷ Hughes, *Citizen Cyborg*. 40

²⁸⁸ Ryszard Tadeusiewicz, Pawel Rotter, and Mark N. Gasson, “Restoring Function: Application Exemplars of Medical ICT Implants,” in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 50

²⁸⁹ “Second Sight,” last modified 2014, <http://2-sight.eu/en/home-en>.

²⁹⁰ Hughes, *Citizen Cyborg*. 17

²⁹¹ Bert-Jaap Koops and Ronald Leenes, “Cheating With Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes,” in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 115

BCIs, but their work on non-invasive systems is impressive, as many developers can construct primitive games and applications in a matter of days.²⁹² While researchers working with therapeutic and medical BCIs are subject to ethical review in both the design and development process, as well as with human subjects and distributing these technologies to patients, those who develop BCIs within the realm of engineering and computer science—namely those working on BCI-based consumer products and applications—are not subject to those same ethical evaluations.

So far I've shown that there is a considerable amount of discussion about cognitive enhancement, through a variety of technologies. I've showcased BCIs as both therapeutic tool and an enhancement device. At this point, I will turn to look at the ethics involved with BCIs, both in theory, in development, and in distribution. Many BCIs are developing without ethics playing any major part for designers or businesspersons. As the following chapter will show, those engaged in talking about the ethics of such enhancements are missing this fundamental issue: BCIs are not the same as other forms of cognitive enhancement, and demand attention sooner rather than later to prevent the multitude of negative outcomes both transhumanists and their opponents debate.

²⁹² “Brainihack: An All About BCI Hackathon Held at Google Tel Aviv Campus,” *Neurogadget*, October 18, 2013.

3 Ethics of BCI Enhancement

Besides, we have our stability to think of. We don't want to change. Every change is a menace to stability. That's another reason why we're so chary of applying new inventions. Every discovery in pure science is potentially subversive; even science must sometimes be treated as a possible enemy. Yes, even science.

—Aldous Huxley. *Brave New World*

Today's problems cannot be solved if we still think the way we thought when we created them.

—Albert Einstein

3.1 Introduction

Human enhancement has been part of ethical discussions for some time, but there is a lack of consensus as to where within ethics it falls. When talking about cognitive enhancement, many insist on using emerging bioethical frameworks; bioethics is relatively new field that gained prominence in the 1970s, which argues traditional ethics required a reworking to address how technology and science alter human bodies and environments.²⁹³ When using bioethical frameworks, cognitive enhancement debates tend to look to the *medical* applications of cognitive enhancement: pharmaceutical drugs and genetic manipulation. The problem here is that cognitive enhancement is a rather broad category, and BCI-type enhancements are at times mentioned within bioethical discussion, but hardly—if ever—discussed in detail. The assumption is that cognitive enhancements will arise from medical advances made for therapeutic purposes and then applied to already healthy minds. Because of this assumption, BCI cognitive enhancements that are developed outside of medicine and healthcare are ignored in the ethical discussion around biomedical cognitive enhancements, leaving them to develop

²⁹³ Ben Mepham, *Bioethics: An Introduction for the Biosciences*, 2nd ed. (New York: Oxford, 2008). 5

unregulated by private companies. Moreover, transhumanists point out that cognitive enhancements, and the type of ethical concerns they create, “are not readily addressed in terms of the traditional bioethical principles of autonomy, beneficence, and justice; they raise fundamental questions about our self-understanding as individuals and human beings, the meaning of human dignity, the nature of human community and society, and the purposes of medicine.”²⁹⁴

Despite disagreements as to whether traditional ethical frameworks are sufficient to address emerging cognitive enhancements, the majority of ethical analyses of cognitive enhancement do tend to fall within two primary frameworks: utilitarianism, and deontological ethics. Transhumanists and proenhancement advocates favor utilitarian ethics as a way of justifying human enhancement for the betterment of humanity, while bioconservatives and critics of enhancement tend to utilize deontological arguments, mainly that humans have a responsibility to refuse enhancements if they at all threaten what it means to be human. However, as I will argue, both of these frameworks fail to realize that BCI enhancements do not belong in the same category as medical cognitive enhancements like pharmaceuticals, as they develop largely through independent groups of engineers, computer scientists, and businesspersons. They are at present altogether bypassing the rigorous ethical evaluations that accompany any and all medical technologies, and are subsequently avoiding regulation. Both sides of the debate willingly acknowledge cognitive enhancements require ethical evaluation and regulation, but fail to realize BCIs are not all developed within the medical community, and thus require immediate attention in order to ensure proper policies can be enacted. BCI enhancements, while often mentioned, are utterly absent in ethical discussion. Furthermore, these ethical debates are too often focused on vague assumptions about either human nature or what is best for humanity, and fail to have very much to say with regards to the actual ethical development and use of cognitive enhancers in any practical sense.

²⁹⁴ S. Matthew Liao, Julian Savulescu, and David Wasserman, “The Ethics of Enhancement,” *Journal of Applied Philosophy* 25, no. 3 (2008). 159

3.2 Transhumanist Ethics

The ethics of human enhancement, for the overwhelming majority of transhumanist authors, utilizes at least one of the four primary tenets of utilitarianism: consequentialism; the maximization principle; the theory of value; and the scope of morality. Taking these tenets one at a time, transhumanists primarily focus on consequentialism, an ethical framework that puts full emphasis on the outcome of actions and decisions, rather than the motivations or intentions of said actions.²⁹⁵ From this standpoint, transhumanists see human enhancement technologies (HET) as a means to achieving a better, happier, more stable society than what currently exists, with an emphasis on eradicating—or at least diminishing—various societal inequalities, including but not limited to racial and gendered prejudices, and the immensely uneven distribution of wealth. For transhumanists, “the good of scientific research and technological development is in their proven ability to facilitate wealthier, healthier, longer and happier lives.”²⁹⁶ Take for example the changes in average life expectancy in the last 100 years: in 1900, average life expectancy in America was 47 years, and by 2002 that number had increased to 77. While this fact can be—and often is—misconstrued to suggest that Americans are altogether living longer lives, the change in life expectancy has much more to do with a radical reduction in infant and child deaths. Prenatal care and education, medicine and technology, and public healthcare systems have become accessible to a far greater number of citizens in America.²⁹⁷ These types of technological innovations—from a transhumanist perspective—indicate that technological advances that initially increase health and happiness for the wealthy and upper class society, *can* and *do* eventually become widespread, and transhumanists believe emerging technologies will follow similar trends. While some transhumanists propose that the consequentialist endpoint would be a posthuman era, other transhumanists and pro-enhancement advocates more

²⁹⁵ Thomas F. Budinger and Miriam D. Budinger, *Ethics of Emerging Technologies: Scientific Facts and Moral Challenges* (New Jersey: John Wiley & Sons, 2006). 17

²⁹⁶ Charles T. Rubin, “What Is the Good of Transhumanism?,” in *Medical Enhancement and Posthumanity*, ed. Bert Gordijn and Ruth Chadwick, vol. 2, *The International Library of Ethics, Law and Technology* (Springer, 2008), 140

²⁹⁷ James Hughes, *Citizen Cyborg: Why Democratic Societies Must Respond to the Redesigned Human of the Future* (Cambridge, MA: Westview, 2004). 23

simply suggest that technology will be crucial to fostering a better world. Regardless, transhumanist utilitarian ethics generally have the same conclusions: the best course of action with regard to cognitive enhancements is to actively pursue developing and distributing them in order to improve quality of life. Hughes strongly insists that emerging technologies, in conjunction with ethical attentiveness to public policy and economic structures, are key to improving the world and quality of life, as he writes, “Democracy and technology have and will increase human intelligence, and increasing human intelligence will encourage liberty, democracy and the innovation of new technology.”²⁹⁸

For David Pearce, cofounder of the World Transhumanist Association, the facilitation of technological development and the pursuit of human enhancement presents an incredible utilitarian opportunity, in that “ethically it is imperative that the sort of unspeakable suffering characteristic of the last few hundred million years on earth should never recur elsewhere.”²⁹⁹ For Pearce, HETs are crucial to reducing suffering on a global level, particularly in regards to the potential for cognitive enhancements to allow humans to construct altogether new ways of cultivating a better world. Furthermore, Pearce argues that pursuing human enhancement is a moral obligation, not only for humans, but to also “reconstruct the natural order entirely so that any other beings capable of suffering will likewise be happy.”³⁰⁰ If more intelligent minds can create better social and political systems in order to benefit the greatest number of people, then pushing resources towards BCI cognitive enhancement development is, for transhumanists, ethically sound. For Pearce, human enhancement is a key component in achieving a utilitarian outcome: the actual types of enhancements and how they are applied and distributed, is secondary to the intended outcome.

More radically proenhancement advocates—including some transhumanists like Ramez Naam—argue that “if enhancing out bodies does not hurt anyone (other than

²⁹⁸ Ibid., 42

²⁹⁹ David Pearce, “The Hedonistic Imperative,” 1998, <http://www.hedweb.com/hedethic/hedon4.htm>.

³⁰⁰ Rubin, “What Is the Good of Transhumanism?” 141

possibly ourselves), then why should we be prevented from doing so?”³⁰¹ A key component of transhumanism—included in a number of transhumanist texts^{302,303}—is the concept of morphological freedom, the right for individuals to choose which enhancements to apply to themselves, an argument closely tied to the ethical principle of autonomy. Transhumanists insist that individuals should have complete authority over which—if any—enhancements they apply to themselves and their children, with an emphasis that no enhancements should be imposed by the state. They see the ability to choose what is best for oneself as critical to cultivating a better world, but some types of cognitive enhancements may threaten the sense of autonomy that they are supposed to support. Consider a BCI that aids an individual in accessing and sorting through massive amounts of data, just as a word processor or database does. If that system were implemented into a human brain, it might enable an individual to better evaluate and act out various situations in their lives; at the same time, “If an enhancement, such as mood-altering drugs or neural implants, interferes with or alters our deliberative process, then it is an open question whether or not we are truly acting freely while under the influence of enhancement.”³⁰⁴ For bioconservative Leon Kass, the concept of having a BCI enhancement severely threatens an individual’s autonomy, as he likens connecting a computer directly to the human brain to having a ‘little demon’ inside your mind that makes decisions for you.³⁰⁵ While his stance may be dramatic and overtly religious in tone, the general problem of that BCIs may have impact on our ability to reason and analyze data and situations in a way that is detrimental to our sense of self-determination. Some worry that “if we imagine a world of cyborgs wirelessly connected to each other via the Internet, it is clear we may need to rethink concepts of what constitutes autonomy

³⁰¹ Fritz Allhoff, Patrick Lin, and Jesse Steinberg, “Ethics of Human Enhancement: An Executive Summary,” *Sci Eng Ethics* 17 (January 22, 2010). 205

³⁰² Bostrom, “In Defense of Posthuman Dignity.”

³⁰³ Sandberg, “Morphological Freedom — Why We Not Just Want It, But Need It.”

³⁰⁴ Allhoff, Lin, and Steinberg, “Ethics of Human Enhancement: An Executive Summary.” 206

³⁰⁵ Leon Kass quoted in Michael L. Spezio, “Brain and Machine: Minding the Transhuman Future,” *Dialog: A Journal of Theology* 44, no. 4 (2005): 377

of an individual, as the boundaries of individual body and mind seem to blur in such a world.”³⁰⁶

While transhumanist arguments clearly insist on the highest level of autonomy possible when choosing enhancements, simultaneously ignore myriad networked effects from individuals enhancing their minds through BCIs, namely, the possibility for new social hierarchies to emerge, or existing ones to worsen. Even hypothetical cognitive enhancements, such as pharmaceuticals and BCIs, offer stronger cognitive capacities, but in different ways that are not necessarily equal. Those who have access to more efficient enhancements may very well still have an advantage over enhanced minds using ‘lesser’ cognitive enhancements. Transhumanist literature addresses this issue in several ways, and varies between authors: there is no clear consensus even amongst transhumanists as to how to address this problem or if it needs addressing at all. The first, and most radically libertarian position, argues that the maximization principle of utilitarianism does not require equality as an outcome, but rather equality of *opportunity*: that all citizens have equal opportunity to access enhancements, regardless if they are publicly funded or paid for out of pocket to private developers.³⁰⁷ The argument stresses that there have always been natural inequalities amongst humans of virtually every culture, and that there is a distinction between injustice (such as distributing BCI enhancements solely to already privileged people) and *misfortune*.³⁰⁸ This argument insists that even in pursuing a better world for all humans, it is not necessary to completely make all humans equal, but rather only to increase quality of life and access to healthcare for everyone.

Some transhumanist ethics investigate the way enhancements of any kind, including BCIs, utilize a commutative justice framework, “which calls for fairness in

³⁰⁶ Bert-Jaap Koops and Ronald Leenes, “Cheating With Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes,” in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 125

³⁰⁷ Buchanan, for one, takes a Rawlsian approach to justice in ethics by suggesting enhancements are acceptable if they are reasonably available to everyone within society, despite a lack of concrete definition of what ‘reasonably available’ might mean.

³⁰⁸ Robert Dingwall, “Shaping The Future of Humankind: Three Commentaries on The Ethics of Enhancement,” *Health Economics, Policy and Law* 3 (2008). 102

competition.”³⁰⁹ These types of ethics examine the ways enhancement technologies will affect situations where the value of the enhancement is positional rather than intrinsic:

The main issue here is distributive justice. In the enhancement debate, this is typically associated with the question whether the enhancement at issue is an intrinsic or positional good: does it confer an intrinsic benefit (for example, a longer or healthier life) or a benefit only in comparison to non-enhanced people (such as enhanced height)?³¹⁰

However, this comparison between intrinsic and positional good is often ambiguous, especially in terms of BCI enhancements. A BCI that allows a user to access information quicker is intrinsic in some sense (freeing up an individual to multitask more easily or access medical help quicker in an emergency), and is also a positional good in another sense (setting new standards for productivity that unenhanced individuals cannot compete with). As a result, this type of commutative justice framework can only be useful when applied to specific BCIs, rather than any broad categorization of cognitive enhancement.

The transhumanist take on the maximization principle of utilitarianism creates contradiction as to how the greatest result can be achieved: on one hand, transhumanists advocate giving enhancements to the worst off in society first (distributive justice), before attempting to then as evenly as possible raise all members of society to new levels of cognitive capacities. With BCIs however, this type of distributive justice is impractical due to high costs of devices and surgery to implant them. As many suggest, it will take a considerable amount of time and effort to make BCI implants sophisticated enough—not to mention safe—to implant in healthy brains. However, when and if they are reasonable to implant as a form of enhancement, initial access will likely be severely limited by the high costs of surgery and the BCI hardware itself.³¹¹ As a result, the first BCI enhancements beyond therapeutic uses are most likely to go to those who can afford them—not to mention that existing BCIs for ALS patients are already too costly for

³⁰⁹ William Cheshire, “Just Enhancement,” *Ethics & Medicine: An International Journal of Bioethics* 26, no. 1 (February 2010): 7

³¹⁰ Koops and Leenes, “Cheating With Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes.” 127

³¹¹ Joelle Proust, “Cognitive Enhancement, Bioethics and Human Evolution,” *International Journal of Bioethics* 22 (March 2011): 163

insurance companies to cover, so they too are distributed based on who can afford them. In contrast to distributing BCIs—along with other types of cognitive enhancements—to those who need them the most in order to function, transhumanists also believe that enhanced minds—not necessarily posthuman but with at least a distinctly larger cognitive capacity—will be at a better vantage point to address current societal and global issues (climate change, poverty, warfare, to name a few).³¹² This would suggest giving BCI enhancements to humans who already possess high cognitive capacities in the hopes that they will then be able to use those cognitive abilities to best benefit all of humanity. These two ethical stances rely on two competing forms of justice ethics, where resources are allocated based on need, or on potential merit. Transhumanists seem to be advocating for both simultaneously.

The issue comes down to how limited resources are to be allocated, either by providing for the disadvantaged at present, or to invest in posthuman minds for the hope of a better future. Within the Transhumanist FAQ, they pose the ethical question “Shouldn’t we concentrate on current problems such as improving the situation of the poor, rather than putting efforts into planning for the ‘far’ future?”³¹³ to which they answer, “We should do both.” Unfortunately, this answer entirely avoids the basic ethical principle of how limited resources should be distributed amongst citizens, and demonstrates a major weakness in the ethics of transhumanists. Many transhumanists seem to forget—or willfully ignore—that we do not live in a post-scarcity world, and that pursuing all options simultaneously is impractical, and violates basic ethical principles.

Transhumanist utilitarianism seems to forget that the resources required to fund, develop, and distribute enhancements are already limited. If BCI enhancements were to develop from within the realm of healthcare—as much of current BCI research is already doing,

It would place further demands on medical resources, including time on physicians’ and nurses’ calendars, diagnostic efforts to assess cognitive symptoms, the time needed for informed consent discussions, testing to

³¹² Seidel, *Immortal Passage: Philosophical Speculations on Posthuman Evolution*.

³¹³ Alexander Chislenko et al., “The Transhumanist FAQ,” 1998, <http://humanityplus.org/philosophy/transhumanist-faq>.

monitor side effects, and medical treatment for adverse effects when they occur. Since medical resources are finite, and in some quarters scarce, their just distribution should first ensure that the medical needs of the sick are met before enlarging the healthcare industry routinely to accommodate enhancement requests from the healthy.³¹⁴

It is clear that even in highly developed parts of the world, access to healthcare and medicine is nowhere near perfect, and all societies face problems of distributing limited resources such as access to doctors and physicians, healthcare facilities, and even access to information and communication technologies like cellphones and the Internet. For some, the prospect of allocating medical resources towards enhancement rather than therapy is unethical to begin with.³¹⁵ From this position, a transhumanist utilitarian framework would suggest that the greatest outcome would be to utilize existing resources to first address existing illnesses and impairments, before developing technologies with the sole purpose of enhancing the healthy.

Several transhumanists take the position that distributing cognitive enhancements to the worst off in society—those who might require them in order to have the same cognitive capacities as ‘healthy’ individuals—is the best ethical course of action to pursue. This type of distributive justice stems from Rawls’ “Justice as Fairness” principle, which Julian Savulescu uses to argue that, “enhancement increases justice rather than injustice.”³¹⁶ This stance proposes that “The state has an obligation to...ensure that pre-existing inequalities are not worsened and that harm is not done by the use of ineffective or dangerous technologies,”³¹⁷ and that access to cognitive enhancements are either made available to everyone, or available to no one. It is the responsibility of the state to regulate access, and to ensure cognitive enhancements are affordable to all citizens. In rebuttal, Wagner points out that Savulescu’s take on

³¹⁴ Cheshire, “Just Enhancement.” 8

³¹⁵ Arianna Ferrari, Christopher Coenen, and Armin Grunwald, “Visions and Ethics in Current Discourse on Human Enhancement,” *Nanoethics* 6 (September 20, 2012): 225

³¹⁶ Greta Wagner, “Leveling the Playing Field: Fairness in the Cognitive Enhancement Debate,” in *Cognitive Enhancement: An Interdisciplinary Perspective*, ed. Andreas G. Franke and Elisabeth Hildt, Trends in Augmentation of Human Performance 1 (Dordrecht: Springer, 2013), 224

³¹⁷ Dingwall, “Shaping The Future of Humankind: Three Commentaries on The Ethics of Enhancement.”

Rawlsian justice ignores “the problem that, probably, the worst off in society would not be the only ones to benefit from an efficient enhancement.”³¹⁸ The argument here is that any attempt to regulate HETs in order to first enhance the worst off in society and level the playing field prior to enhancing humans beyond their current normative levels may fail, as others will enhance themselves at the same time, thus maintaining the level of inequality but simply elevating it for both sides.

It seems evident how unlikely it is that only the worst off would try to gain access to cognitive enhancements. In terms of BCI enhancements, a Rawlsian approach can only make sense when applied to specific BCIs: any P300-type device (outlined in chapter two) would hardly increase productivity for healthy individuals—it would more likely hinder productivity. If however BCIs become much more efficient, and allow users to type messages as fast as thought itself, then it’s likely healthy individuals would seek these enhancements just as much as locked-in ALS patients might, so distributing them based on need becomes increasingly difficult as BCIs become increasingly more sophisticated. The problem of fair distribution becomes even more complex when determining who would benefit the most from a BCI enhancement, especially when healthy-minded people may be able to increase their cognition far greater than someone with an existing impairment.

For Peter Singer, the ethical distribution of healthcare should be based on examining who would receive the largest incremental change in quality of life, a utilitarian framework fitting with transhumanism. Using this type of framework, a BCI enhancement may appear to give a larger cognitive boost to a healthy person compared to a disabled person.³¹⁹ Imagine normative cognitive capacities could be measured and assigned a numeric value, which for our purposes we will say is 100. If a disabled person were to have a cognitive value of 80 in comparison, and there was an available BCI enhancement that could push that number to 100, then the incremental value is 20—if that same device boosted a healthy individual from 100 to 130, it would, under this type

³¹⁸ Wagner, “Leveling the Playing Field: Fairness in the Cognitive Enhancement Debate.” 224

³¹⁹ Cheshire, “Just Enhancement.” 9

of framework, be distributed to the healthy individual solely as an enhancement rather than as a therapeutic tool for those with greater need, simply because the utilitarian outcome is greatest.³²⁰ This perspective looks at who could make the most out of any given cognitive enhancement, rather than who needs it to function at a normative level, and thus may privilege the healthy prior to healing the sick. Utilitarian frameworks that emphasize enhancement distribution based on the greatest outcome at a societal level often ignore outcomes for individuals and the disadvantaged. Habermas critiques utilitarian approaches to human enhancement for disregarding what constitutes a good life for an individual, “provided the outcome is equally just for all, [transhumanists] have no concern for the behaviors that it produces.”³²¹ In this light, things that seem to encourage equal opportunity for all do not take into account the values of varying cultures and subcultures, and insist upon a singular view of what a “benefit” or “enhancement” means. Take for example cochlear implants, a therapeutic device intended to correct the inequalities between deaf and healthy individuals. In a utilitarian perspective, cochlear implants provide equal opportunity to hear, given that improving hearing will actually be considered a benefit to those it is provided to. Sweirta and Rip point out that “The promise of allowing the deaf to hear again was contested by the deaf community, with its own culture, and now officially recognized language,”³²² which demonstrates that what was considered a utilitarian benefit in theory was—at least partially—rejected in practice, because cultural values had not been taken into account. Similarly, a BCI made and distributed with the utilitarian goal of providing equal cognitive capacities to individuals deemed “lesser” than normative levels may in fact be rejected by those it was intended for. Transhumanists often assume that enhancements

³²⁰ This is not to suggest that cognitive enhancements will necessarily provide greater cognitive boosts to already healthy individuals, but that particular BCIs *may* be evaluated as such.

³²¹ Habermas qtd. in Dingwall, “Shaping The Future of Humankind: Three Commentaries on The Ethics of Enhancement.” 98 – Habermas writes extensively on human enhancement through genetic engineering in his Book *The Future of Human Nature*, focusing primarily on how genetic engineering threatens human agency.

³²² Tsjalling Swierstra and Arie Rip, “NEST-ethics: Patterns of Moral Argumentation About New and Emerging Science and Technology,” in *Readings in the Philosophy of Technology*, ed. David M. Kaplan, 2nd ed. (Maryland: Rowman & Littlefield, 2009), 218

made to “level the playing field” will be interpreted *as enhancements*, and that individuals will *want* to enhance themselves.

Particularly troubling about using a distributive justice framework for cognitive enhancement is how exactly the “worst off” may be determined. There is a severe lack of discussion as to who may decide who are cognitively inferior’ and what criteria may be used to evaluate individuals. This part of using a distributive justice approach exemplifies the idea that transhumanism is an intensification of humanism,³²³ namely, of a sort of hierarchical thinking stemming from the Enlightenment, in that it privileges science and the idea of progress above all else, and in this case, passing judgment on what humans ought to be.

Some fear that BCI enhancements will give enhanced minds competitive advantages over non-enhanced minds, with a common example of individuals accessing data via the Internet without others around them being aware of it, in exam situations or any kind of business negotiation, which may give them an advantage over others. If in fact BCI enhancements were to become commonplace—or at least common amongst those who could initially afford them—the integrity of competitive situations like university exams would be compromised, as students would be able to connect to the Internet or other devices to access information and easily cheat. Without strong regulation as to who has access to BCIs—particularly inconspicuous implanted ones—and where they can be used, these cognitive enhancements challenge the value of memorizing information for educational purposes: the data will always be easily accessible to enhanced users.³²⁴

Central to the ethics of cognitive enhancement, and enhancement in general, is the issue of how these technologies may create new norms and standards unenhanced minds cannot compete. The problem raises concern for how cognitive enhancements may eventually coerce those who refuse enhancement towards adapting these technologies in

³²³ Wolfe, *What Is Posthumanism?*. xv

³²⁴ The issues of how cognitive enhancements challenge notions and traditions of education is a substantial topic on its own, and cannot adequately be explored here.

order to have equal opportunity with regards to career options.³²⁵ If an enhancement were to become relatively commonplace among a given industry, and become a standard for a new level of productivity, it would impede an individual's freedom to choose what enhancements to apply to his or herself—if they chose to enhance themselves at all. Transhumanists insist individuals be given full authority over what enhancements they choose, but fail to address how individuals may be pressured to use those same enhancements. Wagner points out that Savulescu willfully ignores problems of coercion,³²⁶ which never seems to appear in any great detail in transhumanist literature, or at least with substantive ethical consideration. However, transhumanists often point to the ways previous technologies or techniques (such as literacy) initially enhanced the few, and indeed gave them a temporary advantage over those without equal access. Written texts, as well as instruction on how to read well, were originally only accessible to typically wealthy individuals, and took a considerable amount of time to become commonplace.³²⁷ Using literacy and written texts as an example, transhumanists draw a parallel to emerging technologies: just because they may privilege the few at first, and worsen existing inequalities between classes, it is not a reason to reject pursuing these technologies entirely. While some bioconservatives suggest abandoning human enhancement altogether, and working towards a global ban, transhumanists see this as unethical, as “The right thing to do is to make as many better as we can, not to make no-one better.”³²⁸ If an opportunity for enhancement is available, transhumanists see it as an ethical responsibility to pursue it in some way.

Some transhumanists concede that despite efforts to distribute enhancements to the worst off first, the wealthiest begin enhancing themselves early on, giving them a competitive edge. Many transhumanists suggest that even if cognitive enhancements

³²⁵ Roland Kipke, “What Is Cognitive Enhancement and Is It Justified to Point Out This Kind of Enhancement Within the Ethical Discussion?,” in *Cognitive Enhancement: An Interdisciplinary Perspective*, ed. Andreas G. Franke and Elisabeth Hildt, Trends in Augmentation of Human Performance 1 (Dordrecht: Springer, 2013), 153

³²⁶ Wagner, “Leveling the Playing Field: Fairness in the Cognitive Enhancement Debate.” 224

³²⁷ Sandberg, “Cognition Enhancement: Upgrading the Brain.” 84

³²⁸ Roger Brownsword, “Regulating Human Enhancement: Things Can Only Get Better?” *Law, Innovation and Technology* 1 (July 2009): 135

initially become commonplace amongst the wealthy, they are likely to ‘trickle-down’ over time and that this ‘transition period’ is not a serious problem: “Transhumanists acknowledge this effect as a short-term issue; early adopters of new possibilities will pay a high price for them, but they also point to the powerful tendency for technology prices to go down over time.”³²⁹ While this may be true with many commercial products, Buchanan points out that this assumption is particularly dangerous, as “Even if valuable innovations tend to become widely available over time, they may do so too slowly.”³³⁰ BCI enhancements may give a tremendous advantage to those who can access them, allowing inequalities amongst social classes to worsen dramatically before these same technologies become more easily accessible. Additionally, because of the invasiveness of BCI enhancements and the high cost of development and implementation, they may very well *never* trickle-down to all members of society.

What may be the most significant problem with transhumanist ethics—and wholly incorporated throughout transhumanists ideology—is the confidence placed in technologies to construct a better world, without identifying specific ways technology will lead towards it, contribute to it, and without what some consider to be a sufficient amount of scientific facts to support this outcome. From this perspective, some liken transhumanism to religion,³³¹ which even some prolific transhumanists like Bostrom admit the similarity: the better, more prosperous posthuman era that transhumanists propose is, in many ways, similar to concepts of the afterlife, in that it is a *belief* in a future that cannot be fully imagined or comprehended by humans as we exist now. Transhumanists do believe that as science and technology progress, their predictions for what enhancement technologies will arise, and what social impacts they will have if used carefully and with careful ethical and regulatory considerations, will prove their hypothesis of a posthuman era.³³² The very basis of their ethical arguments that the world will be better place is founded in not being able to determine how exactly to get

³²⁹ Rubin, “What Is the Good of Transhumanism?” 150

³³⁰ Allen E. Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement* (New York: Oxford UP, 2011). 243

³³¹ Rubin, “What Is the Good of Transhumanism?” 153

³³² *Ibid.*

there, and what in what ways it will be better, since posthumans will, according to transhumanists, innovate technologies and social structures inconceivable to our unenhanced minds today.

3.3 Bioconservative ethics

Critics of transhumanist ethics, often referred to as bioconservatives or bioluddites, approach human enhancement technologies from both utilitarian and deontological frameworks, with the most conservative writers focusing on deontological arguments, trying to determine "...to what extent human implants violate moral rules or principles, such as human dignity, bodily integrity, autonomy and self-determination or non-discrimination."³³³ For these authors, the value of an ethical decision is in the moral intentions of an action, rather than its consequences.³³⁴ From this stance, transhumanism's critics argue that to enhance the brain beyond its natural capacities would risk damaging human nature, and with it, altering our very ability to uphold morality. Furthermore, they suggest that cognitive enhancements will worsen socioeconomic inequalities, and increase competitiveness in society in such a way that violates moral codes of fairness.

Early deontological ethics, particularly those of Immanuel Kant, relied on religious foundations in determining concepts of right and wrong as being defined by what was "commanded or forbidden by God."³³⁵ These ethics turned to ideas of natural law and human reason as a means to engage ethical dilemmas. However, in contemporary ethical debates, such as those centered around cognitive enhancements, these religious-type deontological ethics tend to be easily dismissed, as "these concepts are too general and too distant for consistent use in formulating methods for approaching ethical problems in various culture and everyday situations."³³⁶ As a result, the majority of

³³³ Mireille Hildebrandt and Bernhard Anrig, "Ethical Implications of ICT Implants," in *Human ICT Implants: Technical, Legal and Ethical Considerations*, ed. Mark N. Gasson, Eleni Kosta, and Diana M. Bowman, vol. 23, Information Technology and Law (The Hague: T.M.C. Asser, 2012), 136

³³⁴ Budinger and Budinger, *Ethics of Emerging Technologies: Scientific Facts and Moral Challenges*. 20

³³⁵ Ibid.

³³⁶ Ibid.

bioconservative ethicists tend to reach out to more contemporary ethical frameworks, such as Hans Jonas' technological ethics.

Jonas' ethics are highly precautionary, as he believes that exploring myriad negative outcomes is far more crucial than offering the possibility for more ideal outcomes, as "We are not unsure about evil when it comes our way, but of the good we become sure only via the experience of its opposite."³³⁷ He argues that the purpose of ethics should be confronting the ways an outcome of an ethical problem may worsen existing problems, or create altogether new ones. For Jonas, proposing that an emerging technology may allow for a particular result, say in the example of BCI enhancements, that humans will be able to increase productivity and extend cognitive capacities, may be likened to hitting a bull's eye on a target. He writes that the wager of using a new technology is not a matter of whether it will produce the ideal outcome or not, 'a simple hit or miss scenario; rather, a hit is only one possible option, while there exist a multitude of ways to miss.'³³⁸ Thus for Jonas, it is imperative to seriously consider as many negative consequences *first*, and then wager those against the possibility for success.

More important to the transhumanist debate is Jonas' take on ethical actions based on speculative future scenarios, which he sees as being unethical in itself. He writes that traditional ethics, "was of the here and now of occasion as they arise between men, of the recurrent, typical situations of private and public life."³³⁹ Putting his patriarchal language aside, Jonas' ethics of technology starts from the argument that ethics needs to look more to the future than it traditionally has done. He however qualifies that argument to pay particular attention to current developments in science and technology in order to discern trends and extrapolate them to predict possible future outcomes.³⁴⁰ This qualification would suggest speculation on future conditions is crucial to ethical evaluation today. However, Jonas also argues, "if the future conditions upon which ethics reflects were purely speculative in any radical sense, the ethical advice that might follow from such

³³⁷ Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. 27

³³⁸ *Ibid.*, 31

³³⁹ *Ibid.*, 5

³⁴⁰ *Ibid.*, 26

reflection could not lead to anything of consequence.”³⁴¹ Here it seems Jonas’ ethics of technology lends itself to both transhumanists and bioconservatives: he argues speculation on the future of technology is critical to ethical evaluations at the present and near future, but also insists that pure speculative scenarios for the future do not contribute to ethical discussions today. He admits “the impossibility to predict future inventions, which would amount to preinventing them,”³⁴² while also suggesting extrapolating technology trends may supply a reliable foundation for ethical debate. From this point, it appears transhumanists and pro-enhancement advocates such as Kurzweil may be supported by Jonas’ ethical stance, while simultaneously contributing to bioconservative arguments that ethics should focus on current problems rather than distance future possibilities. It would seem both sides reduce Jonas’ arguments to what best supports their own arguments, while ignoring aspects that demonstrate the vast complexity of the ethical issues at hand.

Fukuyama takes a similar stance when he proposes that the posthuman future may very well be disastrous to not only society, but to individuals as well. While transhumanists fervently debate Fukuyama’s arguments, he does examine human enhancement from both utilitarian and deontological points of view. Fukuyama’s primary concern about enhancement—from a utilitarian stance—is that enhancement technologies are likely to become commercialized, and not state-subsidized or publicly funded. For him, this would prevent the poor from accessing enhancements,³⁴³ and contribute to greater inequalities amongst humans. Fukuyama’s main concern with enhancement is “the politics of groups who argue on their behalf,”³⁴⁴ raising an altogether different concern.³⁴⁵ The bioconservative take on utilitarianism wagers that with existing methods

³⁴¹ Ferrari, Coenen, and Grunwald, “Visions and Ethics in Current Discourse on Human Enhancement.” 218-219

³⁴² Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. 28

³⁴³ Fukuyama is primarily concerned with genetic engineering, but his concerns are equally applicable to all forms of technological enhancement.

³⁴⁴ Andy Miah, “A Critical History of Posthumanism,” in *Medical Enhancement and Posthumanity*, ed. Bert Gordijn and Ruth Chadwick, vol. 2, *The International Library of Ethics, Law and Technology* (Springer, 2008), 74

³⁴⁵ The political issues of HET development and control is far too large and complex to adequately address in this thesis. However, James Wilsdon’s reader, *Better Humans? The Politics of Human Enhancement and*

of developing and distributing these technologies, injustices and inequalities will worsen on a very large scale. Thus, these writers aim to enforce a greater distinction between therapy and enhancement—a line that transhumanists argue will only increasingly blur—in order to best heal the sick with the limited resources available.³⁴⁶ Proust points out using cognitive enhancements for therapeutic uses, such as giving them to “subjects confined in a paralyzed body, or deprived of a perception,”³⁴⁷ is unanimously seen as ethically acceptable amongst bioconservatives. The problem primarily lies in the slippery slope of what constitutes enhancement.

Fukuyama approaches enhancement with a deep concern that the transhumanist push towards a posthuman future may likely be “a future state of affairs in which the traditional human might no longer be valued.”³⁴⁸ Fukuyama’s fear of the posthuman future—which transhumanists fully embrace—is that by changing the minds of humans, we may inadvertently diminish the value of things humans currently hold dear, namely human achievement and respect for one another. Some suggest that posthumans may regard unenhanced humans as being less able to judge right and wrong, and to make decisions that affect themselves and each other, and that that superiority may lead posthumans to suggest that unenhanced minds should have “fewer participation rights in the polity as their genetic superiors.”³⁴⁹ The argument that human enhancement may damage, impede, or in some way negatively affect what it means to be human on a connotative level is common amongst bioconservatives, and is one of the strongest arguments in opposition to transhumanism.³⁵⁰ This stance insists that human nature is

Life Extension provides a general overview of how transhumanism engages with political ideologies. Further reading on the subject moves towards authors who address specific technologies and the corporations that own them, with a majority of writing focusing on emerging biotechnologies like genetic manipulation due to its commercial appeal to engineer smarter, healthier children for wealthy parents.

³⁴⁶ Cheshire, “Just Enhancement.” 8

³⁴⁷ Proust, “Cognitive Enhancement, Bioethics and Human Evolution.” 163

³⁴⁸ Miah, “A Critical History of Posthumanism.” 72

³⁴⁹ Dingwall, “Shaping The Future of Humankind: Three Commentaries on The Ethics of Enhancement.” 101

³⁵⁰ Allhoff, Lin, and Steinberg, “Ethics of Human Enhancement: An Executive Summary.” 207

crucial to not only giving value to human life and the things that humans give meaning to, but that it may also be a key element in determining morality.³⁵¹

Tampering with human minds, through any cognitive enhancement, may hamper our ability to ethically evaluate situations as we do now; augmented minds may disregard aspects of what humans today hold to be meaningful, ranging from interpersonal relationships to the sentimental value of objects, which to bioconservatives, is an extremely undesirable future. Jonas' ethics of technology really come to light here, as he writes, "Never must the existence of the essence of man as a whole be made a stake in the hazards of action."³⁵² While transhumanists welcome an era where humans have evolved to more intelligent, stronger beings with extended lifespans, bioconservatives stress that the possibility in altering human nature in a negative way, however unintentional it may be, is too strong an ethical risk to take. However, debates on what constitutes human nature, whether BCI enhancements threaten human nature at all and if so how, and what value human nature arguments have in regards cognitive enhancement, are central to ethical discussions on HET.

Buchanan's definition of human nature tends to be amongst the most widely accepted and well defined, which he describes as "a set of dispositions that all (or at least most) humans have and that shape behavior across a wide range of human activities, regardless of cultural contest, throughout human history."³⁵³ For nearly all proponents in the debate on cognitive enhancement, human nature is, despite attempts to define and encapsulate it, unclear and amorphous. Jonas admits "the essentially unfathomable nature of man,"³⁵⁴ which either side of the debate use to their advantage: while transhumanists attempt to discredit arguments made on the basis of human nature (described in greater detail later on), bioconservatives use the ambiguity of human nature as a reason to be

³⁵¹ Allen Buchanan, "Human Nature and Enhancement," *Bioethics* 23, no. 3 (2009): 143 – Buchanan writes that moral philosophers such as Hume argue that morality may be a result of human nature, and goes on to add that the biology of our bodies and minds may be in some unknown way tied to our ability to be moral, if that morality was the result of an evolutionary need. Thus, to tamper with human biology may inexplicably damage our ability to be moral.

³⁵² Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. 37

³⁵³ Allen Buchanan, "Human Nature and Enhancement," *Bioethics* 23, no. 3 (2009): 142

³⁵⁴ Jonas, *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. 28

cautious with enhancement. Fukuyama argues that “a fixed, if inarticulate, conceptualization of the human is crucial to the organization of society, and this is why debates about posthumans are so controversial.”³⁵⁵ If we cannot define what human nature is, then we cannot be certain how cognitive enhancements may affect it, thus, the deontological ethical recommendation is to err on the side of caution rather than risk irrevocably damaging our very nature. If cognitive enhancements threaten an individual’s ability to act morally and autonomously, then they violate deontological principles.

BCI enhancements complicate this discussion, as most authors tend to focus on enhancements that alter human minds through biological or chemical means; BCI enhancements are seemingly less overt in their threat to altering human biology, which some see as foundational to human nature.³⁵⁶ They do, on the other hand, propose a greater challenge to individual autonomy as they may supplement human memory, analytical abilities and capacity for reason by coupling human capacities with mechanical ones. Thus, it is not altogether impossible to alter human nature, but, the case can be made that technologies have *always* altered human nature in this way: Andy Clark points out the concept of neural plasticity, that the human brain is able to adapt and in a sense rewire itself in response to changes in behavior and even injury.³⁵⁷ When parts of the brain are damaged, other sections may become more active over time to supplement and make up for lost cognitive abilities. Clark uses this phenomenon to put forth the idea of ‘technological scaffolding,’ which “refers to the dynamic coupling between feedback gained from tool use, and cognitive enhancement.”³⁵⁸ For Clark, humans have always extended their natural cognitive capacities through external technologies, such as maps, books and computers, which have “enhanced our natural ability to remember, understand, and reason.”³⁵⁹ This raises two major points with regards to BCI enhancements, the first of which is that because the brain has always adapted to external technologies, it might be said that it is *human nature* for the brain to rely on and adapt to external objects.

³⁵⁵ Miah, “A Critical History of Posthumanism.” 74

³⁵⁶ Buchanan, “Human Nature and Enhancement.”

³⁵⁷ Clark, “Re-Inventing Ourselves: The Plasticity of Embodiment.”

³⁵⁸ Proust, “Cognitive Enhancement, Bioethics and Human Evolution.” 169

³⁵⁹ Ibid.

Secondly, Clark's argument would suggest that inserting external devices into the body is merely a superficial change, and that accessing the Internet through a mobile phone or an implanted BCI device are nearly identical in the result they produce. From this stance, BCIs hold no particular importance over any other technology already in widespread use that extends human cognitive capacities.³⁶⁰

Buchanan offers a cogent rebuttal to bioconservative concerns over damaging human nature by pointing to a glaring limitation to the argument, namely, that bioconservatives believe human nature to be inherently *good*. Buchanan writes, "One thing that most religious conceptions, folk conceptions, and evolutionary conceptions have in common is that they do not restrict human nature to good characteristics,"³⁶¹ which for him, bioconservatives selectively ignore. They insist that human nature is foundational to our ability to uphold morality and to pursue what is good, and to alter or risk that nature would be unethical. David Pearce points out that, "Warfare, rape, famine, pestilence, infanticide and child-abuse have existed since time immemorial. They are quite 'natural,' whether from a historical, cross-cultural or sociological perspective,"³⁶² indicating that human nature encompasses the capacity to harm other humans, animals, and environment. From this stance, transhumanists disregard the argument that protecting and preserving the natural capacity for moral behaviour in humans is ethically sound by suggesting that preserving human nature not only protects *good* things, like capacity for empathy and love, but also preserves *bad* things like the capacity for greed and cruelty. Instead, transhumanists argue that from a deontological position, the better course of action is to adapt human nature in order to foster *humaneness*, rather than preserve what has historically been 'natural.'³⁶³ Bostrom writes, "One might say that if 'human' is what we are, then 'humane' is what we, as humans, wish we were. Human nature is not a bad place to start that journey, but we can't fulfill that potential if we reject any progress past

³⁶⁰ Ibid., 170

³⁶¹ Buchanan, "Human Nature and Enhancement." 142

³⁶² David Pearce, "The Hedonistic Imperative," 1998, <http://www.hedweb.com/hedethic/hedon4.htm>.

³⁶³ Alexander Chislenko et al., "The Transhumanist FAQ," 1998, <http://humanityplus.org/philosophy/transhumanist-faq>.

the starting point.”³⁶⁴ This leads the debate on human nature away from the risk of altering or damaging human nature *in general*, and instead towards looking at what characteristics of traits associated with human nature are worth preserving or encouraging, and which are detrimental or negative. Buchanan reasons that arguments concerning human nature “tend to obscure rather than illuminate the debate over the ethics of enhancement, and can be eliminated in favor of more cogent considerations,”³⁶⁵ which indicates that general deontological ethics should be contextualized and narrowed down to specifics, which Buchanan exemplifies by writing,

It is conceivable that an enhancement of some human capacity would damage some human capacity we rightly value, for example, our capacity for empathizing with others. If this damage occurred, then our capacity to achieve the good, to live well, might be seriously compromised, but not because the capacity for empathy is a part of our nature; rather, because the capacity for empathy is either itself an important component of our good or instrumental for other goods, or both.³⁶⁶

Furthermore, as Budinger and Budinger point out, ethical arguments that emerging technologies violate some aspect of human nature have become outdated, as “in modern societies throughout the world, these same concepts [of human nature and natural law] seldom lead to similar conclusions by individuals dealing with ethical dilemmas. This is because the concepts are too general and too distant for consistent use.”³⁶⁷ They critique the use of deontological ethics by indicating that the principles of deontology are founded in upholding tradition, rather than seeking innovative responses to new challenges. As cognitive enhancements pose questions about the boundaries of individual minds and bodies, as well as what constitutes human nature, deontological principles offer little in terms of practical ethical solutions.

In a majority of literature on cognitive enhancements—whether via BCI, pharmaceuticals or a number of other methods—there is no clear consensus as to *how*

³⁶⁴ Ibid.

³⁶⁵ Buchanan, “Human Nature and Enhancement.” 141

³⁶⁶ Ibid., 145

³⁶⁷ Budinger and Budinger, *Ethics of Emerging Technologies: Scientific Facts and Moral Challenges*. 20

these technologies may have an impact on an individual's moral capacity; this should be obvious, either from the inability to perfectly predict the future impact of yet-to-be-developed technologies, or from the transhumanist perspective that we cannot possibly know how smarter beings will act due to our own cognitive limitations. What is clear however, is that there will be some sort of impact, either positive or negative or more generally ambiguous, as virtually no arguments are made that cognitive enhancements will have zero impact on human behavior. Thus, the debate turns toward ways in which cognitive enhancements may be steered towards greater outcomes, in order to prevent the dystopic predictions that many bioconservatives fear, and that transhumanists wish to avoid. The transhumanist proposal for guiding the use of cognitive enhancements for the betterment of all humans is to simultaneously pursue *moral* enhancements, a mainly theoretical conception of technologies that stimulate stronger moral characteristics, such as empathy and compassion. When discussing the ethical development and use of cognitive enhancements of any kind, Liao, Savulescu and Wasserman conclude that "Cognitive enhancement may be lethal unless is it accompanied by the substantial moral enhancement of human beings,"³⁶⁸ insisting that cognitive enhancements be coupled with moral enhancement to ensure those who first access cognitive enhancements will be more likely to use them in compassionate, humanitarian ways. While they admit that moral enhancement as it currently stands is, "possible in principle, but practically remote,"³⁶⁹ there have been experiments that demonstrate moral enhancement may be achievable. Using transcranial magnetic stimulation (TMS), a method of generating small electrical currents in the brain through an external device, Young et. al. conducted a series of tests where subjects were asked to make ethical judgments on a variety of scenarios. They found that, "TMS applied to the right temporoparietal junction caused subjects to focus more on the outcome of the act than the intention of the actor when judging permissibility of the act. This was the case even when the agent's intent was to harm another person, so

³⁶⁸ Liao, Savulescu, and Wasserman, "The Ethics of Enhancement." 160

³⁶⁹ Ibid.

long as the outcome of the agent’s action was innocuous.”³⁷⁰ This experiment demonstrates that the moral capacities of humans are susceptible to technological influence, and thus moral enhancement may be possible.

However, moral enhancement technologies are far from feasible and are mostly speculative—thus from an ethical stance they need hardly be considered a serious problem for the present. This moves the debate of cognitive enhancement ethics away from theoretical situations and toward ways ethics can be used to achieve *actual results*, namely by informing policy. Debate over how existing and emerging BCI technologies may be used in conjunction with moral enhancements is useless if those moral enhancements cannot be developed simultaneously. BCIs exist now, while moral enhancements do not—thus the debate needs to shift focus to how policy can regulate BCIs and other cognitive enhancements until, at the very least, realistic forms of moral enhancement are available. Even still, moral enhancement may never be possible, thus ethics needs to readily engage with how BCI enhancements can be put to benefit those who most need them, and to avoid exacerbating inequalities.

3.4 Applied Ethics

There is a major downfall in transhumanist literature: a severe lack of practical ethics. It is clear that a multitude of problems may stem from allowing the smartest humans to become extraordinarily intelligent by coupling their brains to BCI enhancements—anything from giving them competitive advantages in business to extending their memory beyond normal expectations and in doing so, setting even higher standards that unenhanced individuals cannot contend with. The exact ways these BCIs may worsen existing inequalities is vague, and encompasses a variety of hypothetical situations. As I’ve shown so far, strictly hypothetical scenarios for the future are not entirely the best way the approach ethical dilemmas that exist today: simply put, we cannot focus on purely conceptual understandings of BCIs—and particularly idealistic futures of

³⁷⁰ Young et. al. referenced in Roy Hamilton, Samuel Messing, and Anjan Chatterjee, “Rethinking the Thinking Cap: Ethics of Neural Enhancement Using Noninvasive Brain Stimulation,” *Neurology* 76 (2011): 189

affordable, safe and reliable BCIs available to all humans—when there exist countless tangible problems that need addressing today and in the near future.

BCI development is speeding up as technology—in terms of both the hardware and software—while simultaneously experiencing growth in the number of groups and individuals pursuing BCI research. BCIs, both for military and medical use, are quickly becoming a reality. However, outside of the research done towards therapeutic BCIs, such as the ones used for ALS patients, a considerable number of devices and software systems are developing outside of the realm of medicine. At present, they are predominantly non-invasive BCI systems, such as systems that use EEG-caps. These devices are complex and cumbersome, but are clearly becoming more sophisticated and affordable.³⁷¹ As the hardware becomes smaller and more accurate, the devices themselves become less obtrusive and obvious, and are more likely to be desired by the general public; people are far more likely to use a tiny Bluetooth earpiece to use their cellphone hands-free than they are to wear a large headset, even if that headset is considerably cheaper. If a BCI were to be as easy to use as a Bluetooth earpiece, it seems obvious portions of the population would want them. Private companies stand to gain enormous profits from mass producing BCIs, especially when considering the World Economic Forum named BCIs as one of the top emerging technologies in 2014.³⁷² BCIs are undoubtedly developing to enhance those who can afford them, in one way or another.

The problem with BCI development, as it is currently happening, is that BCIs are sidestepping ethics, policy and law to a considerable extent. While many debate the ethics of cognitive enhancement, BCIs are wrongfully lumped in with other forms of cognitive enhancement, namely genetic engineering and pharmaceuticals. These three primary technologies for cognitive enhancement are discussed in two ways by both transhumanists and bioconservatives: first, that cognitive enhancement proposes ethical challenges regardless of the method by which that enhancement is achieved. The

³⁷¹ Consider the BCI-based toy MindFlex made by Mattel, outlined in chapter two.

³⁷² Noubar Afeyan, “Top 10 Emerging Technologies for 2014,” *World Economic Forum*, February 26, 2014, <http://forumblog.org/2014/02/top-ten-emerging-technologies-2014/>.

outcome is broadly labeled as enhancement, as thus some argue should be treated as one subsection of human enhancement in general. But the methods and technologies producing cognitive enhancement vary radically, both in how they are to be used, distributed, and developed. The second way these three cognitive enhancement technologies are discussed is that genetic engineering and pharmaceutical enhancement pose serious risks to human biology of humans and especially the brain—BCIs are an afterthought, thrown into numerous texts about cognitive enhancement with only a brief mention. There exist only a small number of texts that deal with the ethics of BCI enhancements directly, much of which only broadly survey the technologies and their speculative future uses.

The most troubling aspect of lumping BCI enhancements with genetic engineering and pharmaceutical interventions is that these technologies develop in different sectors: genetics and pharmaceuticals are developed by medical doctors, geneticists, biologists and chemists, all of which fall into the realm of medicine. As a result, they are subject to rigorous testing for their safety and efficacy, and are evaluated and regulated by federal governments. While this system may not be perfect, it does still take considerable action in controlling technologies that may be abused by certain individuals and groups. They are also subject to ethical evaluation, both in how they are developed as well as how they may be distributed. These ethical deliberations influence policy and law, and help prevent radical disparities between individuals from worsening; one cannot simply pick up a bottle of Adderall and enhance themselves beyond normative levels without a prescription. This type of regulation is engrained into all medical innovations. Such controls are precisely what do not govern BCIs, in that some BCIs are developed for medicinal purposes, many are not. They are created by engineers, computer scientists, and designers, and so long as they do not require surgery or alter human biology in any direct way, they avoid medical ethical evaluation and regulation altogether.

As I've shown, BCIs pose serious risks to both individuals and society at large, and demand ethical discussion. Transhumanists, as forerunners advocating for human enhancement, often group BCIs with all other forms of cognitive enhancement,

particularly when it comes to the ethical questions they raise. There are however rare moments when BCIs are treated as separate from other forms of cognitive enhancement. Unfortunately, the types of ethical questions raised are confined to how posthumans may use them, and to specific scenarios like a waiter accessing information about dinner guests without notice.³⁷³ The ethical discussions amongst transhumanists is not where it needs to be, nor is it heading in that direction, as the purpose of ethics is to inform policy and law. There is absolutely no attempt by transhumanists to approach BCIs from a practical standpoint, and to propose any sort of regulatory policy. Transhumanists are amongst the most informed on the philosophy of cognitive enhancement, and occupy a tremendous vantage point from which to influence policy makers and BCI development before it gets out of hand. Yet they make no attempt to do so. The imagined situations BCIs may produce in the future has no apparent impact on the development or regulation of BCIs as they develop today.

The only proposal for policy and regulation—for really any kind of enhancement—comes from Allen Buchanan who while he isn't a transhumanist, is prominent in the human enhancement debate. He argues that HETs are undoubtedly coming, and will in many ways worsen current injustices. These technologies, if left unchallenged, will provide the wealthiest with further opportunities to manipulate others and amass more resources for themselves. He thoroughly deliberates over the ethics of human enhancement (although only briefly about BCIs) and concludes that what is necessary for the debate now is to move towards practical application, namely, to enacting regulatory policy.

His proposal is to build an international committee, not unlike the United Nations, that will focus entirely on evaluating and regulating any form of human enhancement. He sees that the bioconservative argument to ban enhancements is implausible, in that a ban in one country simply persuades development to happen elsewhere, and so long as humans want to develop these technologies, they will find a place that allows them to do

³⁷³ Koops and Leenes, "Cheating With Implants: Implications of the Hidden Information Advantage of Bionic Ears and Eyes." 120

so. Instead, he argues that this ethical committee, which he names the Global Institute for Justice in Innovation (GIJI), would oversee all developments no matter what country and state they are in. While I applaud his proposal, I believe it shares some of the same pitfalls of attempting a global ban in that it would firstly require all nations to consent to a single regulatory institution. This alone is a daunting task, but without global compliance, the GIJI may amount a body that hopes to police sovereign nations that disagree about particular HETs. Furthermore, this type of institution, by including the opinions and ideologies of all the world's nations, may severely slow down the development of HETs. It would appear to be very similar to the bioconservative argument for the precautionary principle, in that no technology should be used until all of its potential risks and benefits are understood. Such a ban will not work as there is no way of fully predicting how technologies may be used. Buchanan's proposal, while on the right path towards ethical discussion and regulation, is massive in scale, and without significant political support may never come to fruition.

One of the roadblocks to serious ethical debates over the different types of cognitive enhancements is transhumanism itself, and the reputation it has built. Transhumanists are in many ways technocratic, ignorant of numerous probable negative outcomes, and even contradictory; while they advocate emerging technologies will lessen inequality, many prominent transhumanists have considerable financial stakes in corporations whose research either directly or indirectly lends itself to human enhancement, such as Max More's life extension company Alcor. The success of HETs will make certain transhumanists—as well as pro-human enhancement advocates like Kurzweil—obscenely wealthy. People have taken notice of the trend's disadvantages, and it's no surprise that academics greet transhumanist arguments with hesitance. Transhumanists have a reputation that clouds over the salient aspects of their ideology, namely, that HETs are almost assuredly going to play a significant role in the future of humanity. Debates over the ethics of cognitive enhancement, particularly with regards to BCIs, needs to move away from insubstantial theories and towards the seriousness of BCI enhancement. Furthermore, the debate also needs to pull away from bioconservative arguments about offending the natural order of things and human nature, as these types of arguments want to preserve the status quo, and are a slippery slope towards treating all

innovation with severe hesitance and hostility. The argument to “leave well enough alone” would suggest that any technologies that improve life are undesirable. For radical bioconservatives using artificial organs or even taking blood pressure medication may be problematic, let alone accepting emerging technologies, their ethical evaluation and regulation.

Less radical bioconservatives also muddle the debate over HETs by steering the conversation towards discussions of human nature. Philosophers have debated what constitutes being human for centuries, and no definitive conclusion can yet be given. Concepts of human nature may be helpful in informing ethical considerations, but they cannot be the primary reason to *not* pursue human enhancement, as they tend to lead towards increasingly complex notions of the human that pull further away from achieving any sort of practical consensus on how to take action. Endless philosophical debates ignore the fact that BCIs are developing *now*, and that regulation is best done prior to technologies of any kind becoming accepted. We cannot wait for a concrete definition of what constitutes human nature—whether it is wholly determined by our biology, by some religious or spiritual concept of a soul, or somewhere in between. BCIs require ethical evaluation and action sooner rather than later, as do all human enhancements.

It is clear many BCIs are developing outside of medicine, as companies like Google hold intensive BCI-development workshops, and small BCI developers are routinely funded by DARPA. Some may argue that this technology is outside of medicine, and thus outside of medical ethics and regulation, because BCIs—especially invasive implants—are merely a superficial shift from holding a device to more intimately tying it to oneself. Such an argument sees that technologies like computers have increasingly become smaller, more affordable, transportable, and commonplace, from having large mainframe computers housed in entire rooms, to exponentially more powerful handheld devices. The shift from using a computer or device by holding it and typing, to using your thoughts to do the same sorts of things, is insignificant from an ethical standpoint: people are still accessing information and communicating with others. The method by which they do these things does not matter, and does not require serious ethical discussion or regulation.

I have to wholeheartedly disagree: BCIs provide unique advantages to those who have them, and others, even with access to the same information systems and ways of communicating, cannot compete with on a level plane. Networking an individual's mind to external devices and systems undoubtedly alters social and professional relationships. It will depend on the particular type of BCI to determine in what ways these changes may occur, but there will be change nevertheless. BCIs need to be approached with precautionary measures, which for the most part they are not.

Some argue that humans have always extended their natural abilities—whether physical or cognitive—through the use of external technologies. Andy Clark holds that even writing has allowed humans to extend their memory, which would lead to suggesting that BCIs are just the next step in a long history of extending human capacities. Along with this, many argue that therapeutic technologies may be used for enhancement, and that the line between therapy and enhancement is blurry at best—if not completely nonexistent. While I agree the difference between restoring individuals to normative levels of cognition and enhancing cognition is vague, it is an important difference to make. Policy and law cannot function without at least attempting to draw lines to distinguish one from the other, so arguments that humans have always enhanced themselves or that enhancement and therapy are increasingly blurred do not help when approaching policy enactment. These are arguments to take into consideration, but ethical regulation needs to draw whatever distinctions are possible.

Because BCIs are developing outside of medicine, it appears to me that the best course of action is to firstly move the discussion of BCI-type enhancements outside of transhumanism, to stop lumping BCIs with all other forms of cognitive enhancements, and to seriously engage with BCIs on their own. These ethics need to deal with not only the problems of how BCIs should be best distributed to citizens, but also with the questions of how free-market capitalism will influence who has access to BCIs. Furthermore, these ethical discussions need to address the fact that government and military organizations are increasingly swallowing BCI development companies, effectively giving them a monopoly on BCI research, and allowing them to steer that research towards particular sets of goals, including warfare. The politics of BCIs need to

be flushed out into public discourse to best allow citizens to decide democratically how to approach cognitive enhancement. There needs to be policy that pushes for a more intimate tie between the developers of emerging technologies—engineers and computer scientists—with experts dealing with the philosophy and ethics of human enhancement, namely, academics. Literature on the ethics of cognitive enhancement needs to be moved outside of academia and focused on influencing how BCI designers approach their work—this may altogether avoid developing BCIs that threaten to worsen inequalities. By increasing communication between developers and ethicists, we can raise the social-consciousness towards how emerging technologies will have an impact on humanity, and make the transhumanist idea of a better world through human enhancement more of a possibility. While transhumanists may be at times too dramatic, they are correct in insisting that cognitive enhancement will radically shape the future. Careful ethical discussion, along with policy formulation and increased education of the public on the risks and benefits of HETs, may very well foster a better world.

Conclusion

This thesis has examined the formation and ideology of transhumanism—along with its ethical implications—with a focus on enhancing human minds through electronic devices. I have shown that the brain-computer interfacing (BCI) industry is rapidly growing, and that it's highly plausible that in the near future humans may use these technologies to enhance their normal cognitive levels. These three chapters, when taken as a whole, demonstrate that there are considerable ethical problems with BCI enhancements, which are sadly missing from discussion thus far. My attempt is to bring to light this deficiency in hopes of pulling the debate towards developing and enacting proper regulation and policy for BCI enhancements.

For the majority of the time I spent researching and writing this thesis, I tried to be as objective as I could be. Transhumanism gets a bad reputation at times, but I don't believe that many of the objections I've heard from my colleagues and in popular media are aimed at the right points. Transhumanists are optimistic, yes, but they are also cautious. Even scholarly articles I've come across make claims and assumptions about transhumanism that are simply not true, and this only exacerbates the problem: transhumanists are not seeking a "perfect human," nor do they envision a perfect world in the future. Instead they look to emerging technologies as a crucial element in perpetual improvement, both for individuals and for society at large. Many of them argue that technology requires strong policy and democracy in order to best serve the future of humanity, and I believe they are right. They are however too technologically deterministic, arguing that technology will be what leads humans to a brighter future, with social and political structures as more of a supporting than leading feature. Their bioconservative opponents point out the faults of transhumanism quite well, showing where transhumanists too readily leave behind evidence-based arguments in favor of speculation. But bioconservatives too have their weaknesses, especially when it comes to issues of enacting a global ban on enhancements—as I've shown in Chapter One, a ban just isn't possible. Human enhancement through the use of technology has in many ways been ubiquitous throughout human history, and banning development for the sake of preserving the status quo will in all likelihood not happen in all areas of the world

simultaneously—research will take place wherever it is permitted. Chapter One of this thesis should serve as a survey of the debate landscape, and demonstrate how transhumanists and bioconservatives, while not the only two groups involved in debating enhancement, are by far the most prolific. They take the discussion away from the science community and into the realm of philosophy and theory, and make emerging technologies seem relatable and realistic. These two groups play a huge part in advocating for public education and engagement with human enhancement, and should be taken very seriously.

Chapter Two was the most difficult section of this thesis to write, primarily due to the fact that the overwhelming majority of academic writing about BCIs is confined to scientific journals flooded with technical jargon that are hard to wade through for someone with a humanities background. And this is precisely part of the problem I've identified: BCIs, while often mentioned in transhumanist writing—and in human enhancement debate in general—are rarely discussed from a non-technical perspective. There is plenty of work done on how BCIs work, but very little to describe their role in culture and society. Humanities scholars examine technologies in order to understand how they shape, and are shaped by, the society that surrounds them. There are entire faculties devoted to understanding technology from a cultural and critical perspectives, yet there is little written about BCIs. With such little attention given to such a powerful technology, BCIs are avoiding all sorts of public and academic engagement. As Chapter Two demonstrates, BCI technology is progressing rapidly, in the hands of medical researchers, military-owned developers, and by relatively small technology companies looking to make commercial products. Unlike other forms of cognitive enhancement, like genetic engineering and pharmaceuticals, which develop entirely within medicine and science, BCIs are appearing in multiple areas of development at once, with each field raising different sets of ethical questions.

Chapter Three serves as an exploration of how BCI enhancements are being treated at present. My research shows that they are almost always mentioned as an after thought, or as being no different than other types of cognitive enhancement, when this is simply not the case. BCIs, and particularly those developed as commercial products, pose

serious risks to social, economic and political structures, and need to be given serious attention. If BCIs do not undergo rigorous ethical evaluations, they are liable to enhance those who can afford them, allowing the wealthy to utilize a serious competitive advantage over unenhanced people, furthering the gap between classes. As with anything, it is better to err on the side of caution and keep BCIs highly regulated until their risks can be better understood, rather than to try to regulate them once they've already gone into use.

This thesis should serve as a warning to how BCI enhancements may slip through the cracks of regulation. Transhumanists advocate for their development and use in order to elevate human cognition, with most transhumanists pushing towards at least some sort of policy. It is not altogether impossible that enhancing human minds through BCIs may result in smarter people who may be able to innovate better technologies and better policies to improve quality of life across the world, and transhumanists agree. However, this cannot happen if BCIs are allowed to continue on their current path. My hope is that this oversight into BCI development can be corrected sooner rather than later.

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Curriculum Vitae

Name: Matthew Devlin

Post-secondary Education and Degrees: The University of Western Ontario
London, Ontario, Canada
2007-2011 B.A. (Hons.)

The University of Western Ontario
London, Ontario, Canada
2012-2014 M.A.

Honours and Awards: Western Graduate Research Scholarship
2013, 2014

UWO Scholarship of Distinction
2007

Related Work Experience Teaching Assistant
The University of Western Ontario
2012-2014